PLANNING CONSULTANTS HAWAII, LLC
URBAN & REGIONAL PLANNING
Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 22, 2016

Mr. Scott Glenn, Executive Director
Office of Environmental Quality Control
Department of Health
State of Hawaii
235 South Beretania Street, Room 702
Honolulu, Hawaii 96813

Dear Mr. Glenn:

RE: Final Environmental Impact Statement (FEIS) for the Waikapu Country Town, located within and around the Maui Tropical Plantation, Wailuku, Maui, Hawaii; (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036

Planning Consultants Hawaii, LLC on behalf of Waikapu Properties, LLC (Applicant), requests the publication of the subject document in the January 8, 2017, issue of The Environmental Notice. Attached please find the required submittal documents:

- One (1) letter from the Applicant dated December 22, 2016 requesting publication of the FEIS in The Environmental Notice;
- One (1) hard copy of the OEQC Publication Form;
- One (1) copy of the FEIS in pdf format on a jump drive;
- Two (2) hardcopies of the FEIS;
- FEIS Distribution Cover Letter; and
- FEIS Distribution List.

Please note that Planning Consultants Hawaii LLC has transmitted a digital copy of the Publication Form in Microsoft Word format via e-mail. Should you have any questions, please call me at 808-244-6231.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

#17-285

Sincerely yours,

Michael J. Summers

Mr. Michael J. Summers
President

Cc: Mr. Daniel Orodenker, Executive Director, State Land Use Commission
Mr. Michael Atherton, Waikapu Properties, LLC
Mr. Albert Boyce, Waikapu Properties. LLC

Waikapu Properties, LLC
1670 Honoapiilani Highway
Wailuku, Hawaii 96793

December 22, 2016

Mr. Scott Glenn, Executive Director
Office of Environmental Quality Control
Department of Health, State of Hawaii
235 S. Beretania Street, Room 702
Honolulu, Hawaii 96813

Daniel Orodenker, Executive Officer State
Land Use Commission DBEDT, State of
Hawaii
P.O. Box 2359
Honolulu, Hawaii 96804-2359

Dear Mr. Glenn and Mr. Orodenker:

By this letter, Waikapu Properties, LLC transmits the documents package for the Final Environmental Impact Statement for the Waikapu Country Town project on properties bearing Tax Map Key Numbers (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036 in Waikapu, District of Wailuku, Island and County of Maui, for publication in the next available edition of the Environmental Notice and for evaluation for acceptability under Section 11-200-23, Hawai'i Administrative Rules.

Also enclosed is a distribution list for the verification by OEQC under Section 11-200-20, Hawai'i Administrative Rules. Upon receiving verification from OEQC (along with the bulletin proof of the notice containing the pertinent details for commenters), we will make the Final EIS and the bulletin proof available to those so indicated on the distribution list.

Finally, enclosed is a completed OEQC Publication Form, two copies of the Final EIS, an Adobe Acrobat PDF file of the same, and an electronic copy of the publication form in MS Word. Simultaneous with this letter, we have submitted the summary of the action in a text file by electronic mail to the OEQC.

If there are any questions, please contact Mr. Michael Atherton at 209-601-4187 or Mr. Michael Summers, Planning Consultants Hawaii, LLC at 808/244-6231.

Sincerely,

Waikapu Properties, LLC

By: _____

Enclosures

cc: James W. Geiger, Esq.
Michael Summers

APPLICANT
PUBLICATION FORM

Project Name:	Waikapū Country Town
Project Short Name:	(please use no more than five succinct words; count not to include document status, e.g., EA)
HRS §343-5 Trigger(s):	Section 343-5(a)(6), HRS; Section 343-5(a(1), HRS; Section 343-5(a)(9), HRS
Island(s):	Maui
Judicial District(s):	Wailuku
TMK(s):	(2) 3-6-002:001; (2) 3-6-002:003; (2) 3-6-004:003; (2) 3-6-004:006; (2) 3-6-005:007; (2) 3-6-006:036
Permit(s)/Approval(s):	State Land Use Commission District Boundary Amendment; County Community Plan Amendment; County Change in Zoning; Project District Approval, Subdivision Approval; NPDES Permits; Building Permits
Approving Agency:	State of Hawai'i, Land Use Commission
Contact Name, Email, Telephone, Address	Mr. Daniel Orodenker; Executive Officer; dbedt.luc.web@hawaii.gov; 808-587-3822; Department of Business, Economic Development and Tourism; P.O. Box 2359; Honolulu, Hawai'I 96804-2359
Applicant:	Waikapu Properties, LLC
Contact Name, Email, Telephone, Address	Mr. Michael Atherton; athtertonisland@gmail.com; 209-601-4187; 1670 Honoapiilani Highway, Wailuku, Hawaii 96793
Consultant:	Planning Consultants Hawaii, LLC
Contact Name, Email, Telephone, Address	Mr. Michael Summers, President; msummers@planningconsultantshawaii.com; 808-244-6231; 2331 W. Main Street, Wailuku, HI 96793

Status (select one)	**Submittal Requirements**
____ DEA-AFNSI	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice.
____ FEA-FONSI	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice.
____ FEA-EISPN	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice.
____ Act 172-12 EISPN ("Direct to EIS")	Submit 1) the approving agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required and a 30-day comment period follows from the date of publication in the Notice.
____ DEIS	Submit 1) a transmittal letter to the OEQC and to the approving agency, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice.
__X__ FEIS	Submit 1) a transmittal letter to the OEQC and to the approving agency, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEIS, 4) a searchable PDF of the FEIS, and 5) a searchable PDF of the distribution list; no comment period follows from publication in the Notice.
____ FEIS Acceptance Determination	The approving agency simultaneously transmits to both the OEQC and the applicant a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice.
____ FEIS Statutory Acceptance	The approving agency simultaneously transmits to both the OEQC and the applicant a notice that it did not make a timely determination on the acceptance or nonacceptance of the applicant's FEIS under Section 343-5(c), HRS, and therefore the applicant's FEIS is deemed accepted as a matter of law.
____ Supplemental EIS Determination	The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that

a supplemental EIS is or is not required; no EA is required and no comment period ensues upon publication in the Notice.

____ Withdrawal — Identify the specific document(s) to withdraw and explain in the project summary section.

____ Other — Contact the OEQC if your action is not one of the above items.

Project Summary

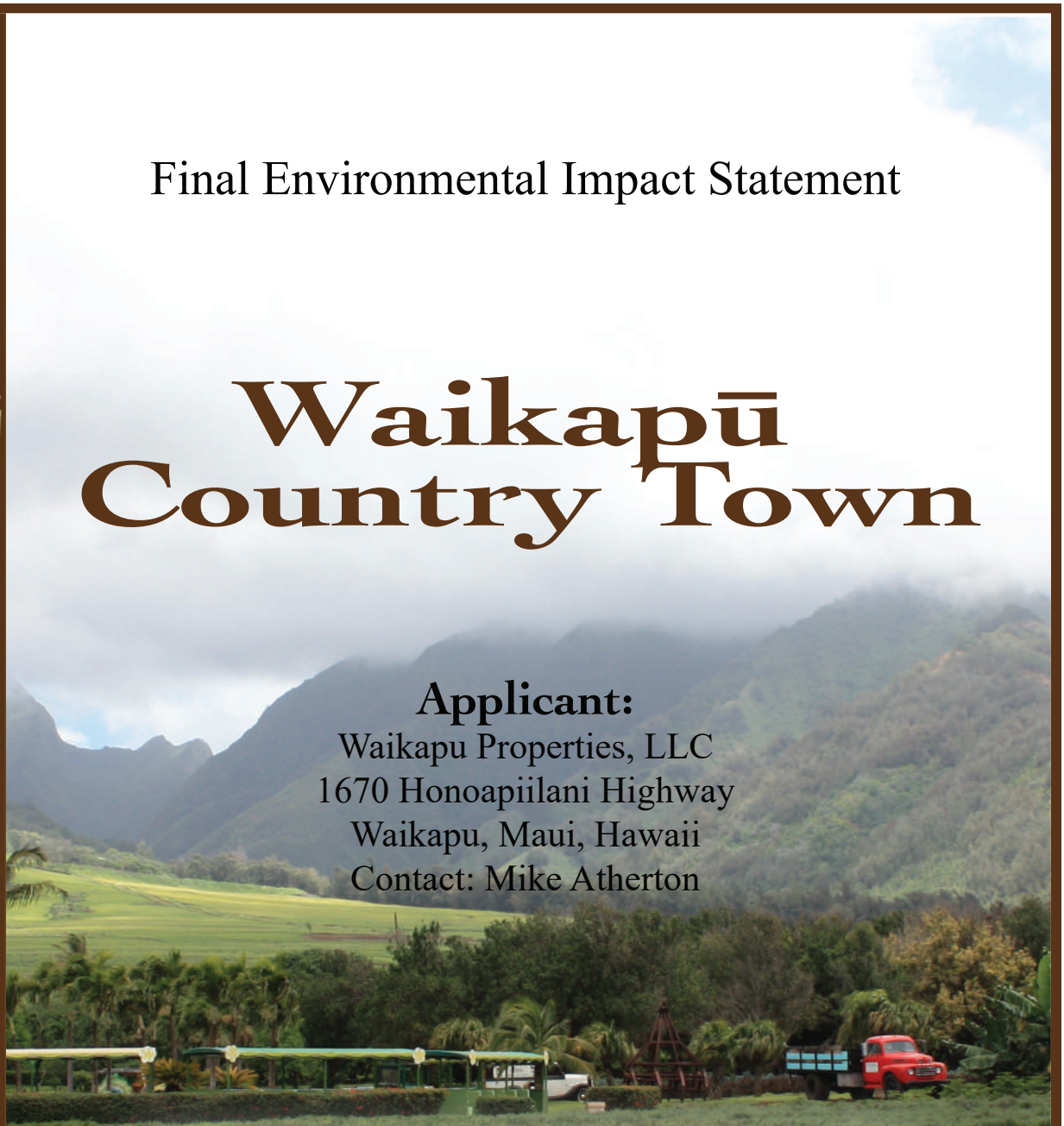
Provide a description of the proposed action and purpose and need in 200 words or less.

Waikapū Country Town is a mixed-use residential community proposed for development on approximately 499 acres within and around the Maui Tropical Plantation, Wailuku, Maui, Hawaii. The project site is about 2 miles south of Wailuku and adjacent to the southern boundary of Waikapū. Four hundred eighty five (485) of the subject acres are in the State Land Use Agricultural District. Entitlement changes will be sought to bring State Land Use and County zoning designations into appropriate State and County urban and rural designations. Waikapū Country Town is designated a "Planned Growth Area" in the Maui Island Plan (MIP), December 2012.

The project includes a diversity of housing types, neighborhood commercial, employment uses, an elementary school, private water and wastewater systems, parks and open space. The project will comprise about 1,433 residential units and nearly 200,000 square-feet of commercial. The project includes an approximate 8-mile network of pedestrian and bicycle paths. The project's agricultural component encompasses about 1,077 acres which will remain in the State Agricultural District. The bulk of the agricultural lands, approximately 800 acres, will be dedicated in perpetuity to agricultural use. The Applicant desires to establish an agricultural park, a limited amount of renewable energy production and other permissible uses on these lands.

Final Environmental Impact Statement

Waikapū Country Town



Applicant:

Waikapu Properties, LLC
1670 Honoapiilani Highway
Waikapu, Maui, Hawaii
Contact: Mike Atherton

Prepared by:

Planning Consultants Hawaii, LLC
Urban and Regional Planning
2331 W. Main Street
Wailuku, Hawaii 96793
Phone: (808) 244-6231
email: msummers@planningconsultantshawaii.com

Planning
Consultants
Hawaii, LLC

December 2016

~~Draft~~ Final Environmental Impact Statement

Waikapū Country Town

Submitted Pursuant to
Chapter 343 Hawai'i Revised Statutes
and
Title 11, Hawai'i Administrative Rules

Prepared for:
Waikapu Properties, LLC
1670 Honoapiilani Highway
Waikapu, Maui, Hawaii
Contact: Mike Atherton

Prepared by:

Planning
Consultants
Hawaii, LLC

This document was prepared under my supervision and the information submitted, to the best of my knowledge, fully addresses document content requirements as set forth in Sections 11-200-17 and 11-200-18 of the Hawai`i Administrative Rules, as appropriate

Michael J. Summers

Michael J. Summers, President
Planning Consultants Hawaii, LLC

TABLE OF CONTENTS

I. INTRODUCTION AND SUMMARY I-1

A. PURPOSE OF THE ENVIRONMENTAL IMPACT STATEMENT I-1

B. LIST OF PREPARERS I-2

C. PROJECT PROFILE I-4

1. Applicant I-4

2. Land Ownership I-5

3. Accepting Authority I-5

4. Project Overview I-5

5. Project Location I-6

6. Tax Map Keys I-6

7. Land Area I-13

8. State Land Use Districts I-13

9. State Land Use District Boundary Amendment (DBA) I-13

10. ~~9.~~ Wailuku-Kahului Community Plan Designations I-16

11. ~~10.~~ County Zoning Districts I-19

12. ~~11.~~ Status of Required State and County Approvals and Permits I-19

D. EXECUTIVE SUMMARY I-23

1. Project Description I-23

2. Purpose and Need I-24

3. Projected Market Demand I-25

4. Summary of Beneficial and Adverse Impacts and Mitigation Measures I-26

a. Flora and Fauna I-26

b. Air Quality I-27

c. Noise Quality I-27

d. Archaeological Resources I-28

e. Cultural Resources I-29

f. Visual Resources I-30

g. Population I-31

h. Housing I-31

i. Economic Impacts I-32

j. Fiscal Impacts I-33

k. Public Facilities I-33

l. Traffic I-34

m. Utilities and Energy I-36
n. Drainage I-36
o. Water I-37
p. Wastewater I-38
5. Cumulative and Secondary Impacts I-39
6. Consistency with State and County Plans and Policies I-39
a. State Land Use Law, Chapter 205,HRS I-39
b. Coastal Zone Management Act, Chapter 205A, HRS I-40
c. Hawai'i State Plan, Chapter 226, HRS I-40
d. State Functional Plans I-40
e. County of Maui General Plan I-40
1) Countywide Policy Plan I-40
2) Maui Island Plan I-41
3) Wailuku-Kahului Community Plan I-41
4) County of Maui Zoning I-41
7. Alternatives Considered I-42
8. Unresolved Issues I-42

II. PLANNING CONTEXT II-1

A. HISTORICAL LAND USE II-1
B. EXISTING LAND USE II-4
C. SITE PHOTOGRAPHS II-5
D. MAUI ISLAND PLAN DIRECTED GROWTH PLAN II-5
E. PROJECTED MARKET DEMAND II-23

III. DESCRIPTION OF THE PROJECT III-1

A. PURPOSE AND OBJECTIVES III-1
B. MASTER PLAN CONCEPT III-6
1. Land Use Plan III-6
2. Neighborhood Pattern and Urban Design Character III-7
3. Transportation Plan III-25
a. Roadway Network III-25
b. Pedestrian Network III-25
c. Bicycle Network III-28
d. Vehicular Parking III-30
e. Pedestrian and Bicycle Crossing of Honoapi'ilani Highway III-30
f. ~~d.~~ Transit Network III-32

4. Parks and Open Space Plan III-35
5. Agricultural Development Plan III-37
6. Sustainability Plan III-45
7. Phasing Plan III-50
8. Wastewater Treatment Plan III-55
9 ~~7~~. Infrastructure and Public Facility Development Plan III-63
C. AGENCY AND COMMUNITY OUTREACH III-73
D. REQUIRED ENTITLEMENTS AND APPROVALS III-75
1. State Land Use District Boundary Amendment (DBA) III-75
2. Community Plan Amendment (CPA) III-75
3. Change in Zoning (CIZ) III-76
4. Environmental Impact Statement (EIS) III-77

IV. AFFECTED NATURAL ENVIRONMENT, POTENTIAL IMPACTS AND MITIGATION MEASURES IV-1

A. PHYSICAL ENVIRONMENT IV-1
1. Climate IV-1
2. Topography and Soils IV-2
3. Natural Hazards IV-7
4. Flora and Fauna IV-15

V. AFFECTED HUMAN ENVIRONMENT, POTENTIAL IMPACTS AND MITIGATION MEASURES V-1

A. HUMAN ENVIRONMENT V-1
1. Surrounding Land Uses V-1
2. Air Quality V-2
3. Noise Quality V-5
4. Historical and Archaeological Resources V-10
5. Cultural Resources V-20
6. Visual Resources V-28
7. Agricultural Resources V-39
B. SOCIO-ECONOMIC ENVIRONMENT V-48
1. Population V-48
2. Housing V-50
3. General Economy V-55
4. Project Induced Economic Impacts V-57
5. Project Induced Fiscal Impacts V-61
C. PUBLIC SERVICES V-62

1. Recreational Resources V-62
2. Medical Facilities V-65
3. Police Protection V-66
4. Fire Protection V-68
5. Schools V-69
6. Solid Waste V-73
D. INFRASTRUCTURE V-75
1. Roadways and Traffic V-75
2. Electric, Telephone and Cable TV V-96
3. Drainage V-97
4. Water V-105
5. Wastewater V-114
6. Airports V-120

VI. CONTEXTUAL ISSUES VI-1

A. RELATIONSHIP BETWEEN SHORT-TERM USES AND MAINTENANCE OF LONG-TERM PRODUCTIVITY VI-1
B. CUMULATIVE AND SECONDARY IMPACTS VI-3
C. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES VI-11
D. OFFSETTING CONSIDERATIONS OF GOVERNMENTAL POLICIES VI-12
E. UNRESOLVED ISSUES VI-13

VII. RELATIONSHIP TO GOVERNMENTAL PLANS, POLICIES, AND CONTROLS VII-1

A. STATE LAND USE VII-1
B. HAWAIʻI STATE PLAN VII-36
C. HAWAIʻI STATE PLAN PART III. PRIORITY GUIDELINES VII-70
D. HAWAIʻI STATE FUNCTIONAL PLANS VII-84
E. COASTAL ZONE MANAGEMENT VII-96
1. Recreational Resources VII-96
2. Historical/Cultural Resources VII-97
3. Scenic and Open Space Resources VII-98
4. Coastal Ecosystems VII-99
5. Economic Use VII-100
6. Coastal Hazards VII-103
7. Managing Development VII-103
8. Public Participation VII-104

9. Beach Protection *VII-105*

10. Marine Resources *VII-105*

F. STATE ENVIRONMENTAL POLICY VII-106

G. STATE ENVIRONMENTAL IMPACT STATEMENT REQUIREMENTS SIGNIFICANCE CRITERIA VII-110

H. MAUI COUNTY GENERAL PLAN VII-117

1. County-wide Policy Plan *VII-117*

2. Maui Island Plan (MIP) *VII-166*

3. Wailuku-Kahului Community Plan *VII-286*

I. COUNTY ZONING VII-343

J. WATER AVAILABILITY POLICY VII-347

VIII. ALTERNATIVES ANALYSIS VIII-1

1. No Action Alternative *VIII-3*

2. Develop Fewer Units *VIII-8*

3. Develop More Units by Building More Workforce Housing *VIII-12*

4. Develop at a Lower Density *VIII-15*

5. Develop at an Alternative Location *VIII-17*

6. Wastewater Treatment Alternatives *VIII-19*

IX. EISPN DISTRIBUTION LIST AND COMMENT LETTERS IX-1

X. DEIS DISTRIBUTION LIST AND COMMENT LETTERS X-1

XI. REFERENCES XI-1

LIST OF FIGURES

FIGURE 1: REGIONAL LOCATION MAP I-7

FIGURE 2: AERIAL LOCATION I-8

FIGURE 3, A-D: TAX MAP KEYS I-9

FIGURE 4: PETITION AREA ILLUSTRATION I-14

FIGURE 5: STATE LAND USE DESIGNATION I-15

FIGURE 6, A-B: WAILUKU-KAHULUI COMMUNITY PLAN DESIGNATION I-17

FIGURE 7: COUNTY ZONING MAP I-22

FIGURE 8, A-N: SITE PHOTOGRAPHS II-6

FIGURE 9: MAUI ISLAND PLAN DIRECTED GROWTH MAP II-21

FIGURE 10: MAUI ISLAND PLAN WAILUKU/KAHULUI PLANNED GROWTH AREAS II-22

FIGURE 11, A-B: ILLUSTRATIVE LAND PLAN III-8
FIGURE 12: ILLUSTRATIVE BIRDSEYE PERSPECTIVE OF MAUKA VILLAGE III-10
FIGURE 13, A-E: RENDERING KEY, CONCEPTUAL ILLUSTRATIVE RENDERINGS OF VILLAGE LAGOON, MILL HOUSE RESTAURANT, AND COUNTRY MARKET III-11
FIGURE 14: ILLUSTRATIVE RENDERING OF POCKET NEIGHBORHOOD AND PEDESTRIAN PATH III-17
FIGURE 15: ILLUSTRATIVE RENDERING OF SINGLE-FAMILY NEIGHBORHOOD III-18
FIGURE 16: ILLUSTRATIVE RENDERING OF MIXED-USE NEIGHBORHOOD WITH LIVE-WORK III-19
FIGURE 17: ILLUSTRATIVE RENDERING OF VILLAGE TOWNHOMES III-20
FIGURE 18: ILLUSTRATIVE RENDERING OF MAIN STREET III-22
FIGURE 19, A-B: ILLUSTRATIVE RENDERING OF TOWNHOMES AND COTTAGE RESIDENCES ALONG GREENWAY. III-23
FIGURE 20: WCT STREET NETWORK III-26
FIGURE 21: WCT WALKABILITY DIAGRAM III-27
FIGURE 22: WCT NON-MOTORIZED PEDESTRIAN AND BICYCLE PATHS III-29
FIGURE 23: HONOAPI'ILANI AND ARTERIAL PEDESTRIAN CROSSINGS III-31
FIGURE 24, A-B: CONCEPTUAL HONOAPI'ILANI AND ARTERIAL PEDESTRIAN CROSSING CONCEPTS III-33
FIGURE 25 ~~23~~: WCT CONCEPTUAL PARKS AND OPEN SPACE PLAN III-38
FIGURE 26, A-C ~~24~~: CONCEPTUAL AGRICULTURAL MASTER PLAN III-41
FIGURE 27 ~~25~~: CONCEPTUAL PHASING PROGRAM III-54
FIGURE 28: CONCEPTUAL WWRF SITE PLAN III-56
FIGURE 29: ORGANICA PROCESS DIAGRAM OF FCR PROCESS III-57
FIGURE 30 A-B: WASTEWATER RECLAMATION FACILITY CONCEPTUAL ILLUSTRATIONS III-65
FIGURE 31 ~~26~~: CONCEPTUAL ROADWAY IMPROVEMENT PHASING DIAGRAM III-67
FIGURE 32 ~~27~~: CONCEPTUAL WASTEWATER IMPROVEMENT PHASING DIAGRAM III-68
FIGURE 33, A: CONCEPTUAL POTABLE WATER IMPROVEMENT PHASING DIAGRAM III-69
FIGURE 33, B: CONCEPTUAL NON-POTABLE WATER IMPROVEMENT PHASING DIAGRAM III-70
FIGURE 34 ~~29~~: CONCEPTUAL DRAINAGE IMPROVEMENT PHASING DIAGRAM III-71
FIGURE 35 ~~30~~: USDA SOILS MAP IV-5
FIGURE 36 ~~31~~, A-F: FLOOD HAZARD ASSESSMENT MAPS IV-9
FIGURE 37 ~~32:~~ AIS SURVEY MAP V-11
FIGURE 38 ~~33~~: HISTORIC PROPERTIES IDENTIFIED DURING AIS V-18
FIGURE 39 ~~34~~: MAUI ISLAND PLAN, CONTEXT AND CHARACTER MAP V-30
FIGURE 40 ~~35~~, A-E: ILLUSTRATIVE VISUAL SIMULATION OF PRE- AND POST PROJECT VIEWS V-34
FIGURE 41 ~~36~~: LAND STUDY BUREAU MAP V-42
FIGURE 42 ~~37~~: ALISH MAP V-43
FIGURE 43 ~~38~~: STUDY AREA AND ANALYZED INTERSECTIONS V-76

FIGURE 44 ~~39~~: STUDY AREA INTERSECTIONS V-79
FIGURE45 ~~40~~: EXISTING DRAINAGE PATTERN V-98
FIGURE 46 ~~41~~: PROPOSED DRAINAGE SYSTEM IMPROVEMENTS V-100
FIGURE47, A-B ~~42~~: PRIVATE WATER SYSTEM IMPROVEMENTS V-107
FIGURE 48 ~~43~~: PREFERRED LOCATION TO DEVELOP ADDITIONAL AFFORDABLE HOUSING VIII-13
FIGURE 49: ALTERNATIVE SITE "A" FOR WWRF VIII-42
FIGURE 50: ALTERNATIVE SITE "B" FOR WWRF VIII-43

LIST OF TABLES

TABLE 1: PRIME CONSULTANT I-2
TABLE 2: SUB-CONSULTANTS I-2
TABLE 3: PROJECT APPLICANT I-4
TABLE 4: WCT LAND OWNERSHIP I-5
TABLE 5: STATE OF HAWAIʻI, LAND USE COMMISSION I-5
TABLE 6: PROJECT TAX MAP KEY NUMBERS I-6
TABLE 7: STATE LAND USE DISTRICTS I-13
TABLE 8: TMK PARCELS REQUIRING A STATE LAND USE DISTRICT BOUNDARY AMENDMENT I-16
TABLE 9 ~~8~~: WAILUKU-KAHULUI COMMUNITY PLAN DESIGNATIONS I-16
TABLE 10 ~~9~~: COUNTY ZONING DISTRICTS I-19
TABLE 11 ~~10~~: ~~TMK PARCELS REQUIRING A CHANGE IN ZONING~~ REQUIRED STATE AND COUNTY APPROVALS AND PERMITS I-19
TABLE 12: GOVERNMENTAL APPROVALS AND PERMITS FOR WASTEWATER RECLAMATION FACILITY I-21
TABLE 13 ~~11~~: STATE AGRICULTURAL DISTRICT DESIGNATED LANDS II-4
TABLE 14 ~~12~~: ESTIMATED ANNUALIZED MID-POINT MARKET ABSORPTION OF RESIDENTIAL PRODUCT II-26
TABLE 15 ~~13~~: ESTIMATED ANNUALIZED MID-POINT MARKET ABSORPTION OF COMMERCIAL PRODUCT II-27
TABLE 16: WCT SUSTAINABILITY GOALS, OBJECTIVES AND STRATEGIES III-45
TABLE 17 ~~14~~: PHASE I CONCEPTUAL LAND USE PROGRAM FOR 2017 THROUGH 2021 III-50
TABLE 18 ~~15~~: PHASE II CONCEPTUAL LAND USE PROGRAM FOR 2022 THROUGH 2026 III-51
TABLE 19 ~~16~~: CONCEPTUAL DEVELOPMENT PROGRAM FOR 2017 - 2026 III-52
TABLE 20 ~~17~~: CONCEPTUAL ORDER OF MAGNITUDE COST ESTIMATES III-63
TABLE 21~~18~~: SCHOOL AND PARK FACILITIES AND COST ESTIMATES III-72
TABLE 22 ~~19~~: NEIGHBORHOOD AND AGENCY PRE-CONSULTATION ACTIVITIES III-73
TABLE 23 ~~20~~: TMK PARCELS REQUIRING A STATE LAND USE DISTRICT BOUNDARY AMENDMENT III-75
TABLE 24 ~~21~~: TMK PARCELS REQUIRING A COMMUNITY PLAN AMENDMENT III-76
TABLE 25 ~~22~~: TMK PARCELS REQUIRING A CHANGE IN ZONING III-76

TABLE 26 ~~23~~: WAIKAPŪ COUNTRY TOWN SOIL TYPES IV-3
TABLE 27 ~~24~~: CONSTRUCTION NOISE SOURCE CONTROL METHODS V-7
TABLE 28 ~~25~~: MINIMUM SETBACK DISTANCES TO SATISFY HUD SITE ACCEPTABILITY STANDARDS V-9
TABLE 29 ~~26~~: PROJECTED WAILUKU-KAHULUI POPULATION V-49
TABLE 30: FOR SALE RESIDENTIAL WORKFORCE HOUSING UNITS BY INCOME CATEGORY V-54
TABLE 31: FOR RENT RESIDENTIAL WORKFORCE HOUSING UNITS BY INCOME CATEGORY V-54
TABLE 32 ~~27~~: WCT PROJECTED EMPLOYMENT IMPACTS V-58
TABLE 33 ~~28~~: SUMMARY OF ECONOMIC IMPACTS V-59
TABLE 34 ~~29~~: SUB-REGIONAL PARKS WITHIN PROXIMITY OF THE WCT V-62
TABLE 35 ~~30~~: REGIONAL PARKS WITHIN PROXIMITY OF THE WCT V-63
TABLE 36 ~~31~~: CENTRAL MAUI BEACH PARKS WITHIN PROXIMITY OF THE WCT V-64
TABLE 37 ~~32~~: FULL-TIME EQUIVALENT POLICE DEPARTMENT PERSONNEL V-67
TABLE 38 ~~33~~: BALDWIN-KEKAULIKE-MAUI COMPLEX AREA SCHOOLS V-70
TABLE 39 ~~34~~: DOE SCHOOL ENROLLMENT & CAPACITY V-70
TABLE 40 ~~35~~: DOE STUDENT GENERATION RATE MULTIPLIERS V-71
TABLE 41 ~~36~~: WCT PROJECTED STUDENT GENERATION V-71
TABLE 42 ~~37~~: WCT CONSTRUCTION COST IMPACT FEE V-72
TABLE 43 ~~38~~: WCT DOE LAND DEDICATION REQUIREMENT V-72
TABLE 44 ~~39~~: EXISTING INTERSECTION LEVEL OF SERVICE V-80
TABLE 45 ~~40~~: YEAR 2022 LEVELS OF SERVICE – PHASE I V-83
TABLE 46 ~~41~~: YEAR 2026 LEVELS OF SERVICE – PHASES I AND II V-84
TABLE 47 ~~42~~: YEAR 2026 PROJECT FAIR SHARE INTERSECTIONS TRAFFIC CONTRIBUTIONS V-90
TABLE 48: TRAFFIC IMPACT WITH AND WITHOUT THE PROJECT AND WITHOUT THE WAI'ALE BYPASS V-92
TABLE 49 ~~43~~: PHASE I EXISTING RUNOFF FROM MAUKA AND MAKAI PROJECT SITES V-99
TABLE 50 ~~44~~: PHASE II EXISTING RUNOFF FROM MAUKA AND MAKAI PROJECT SITES V-99
TABLE 51 ~~45~~: PHASE I PRE- AND POST-DEVELOPMENT RUNOFF FROM MAUKA AND MAKAI PROJECT SITES V-101
TABLE 52 ~~46~~: PHASE II PRE- AND POST-DEVELOPMENT FROM MAUKA AND MAKAI PROJECT SITES V-101
TABLE 53 ~~47~~: DEPARTMENT OF WATER SUPPLY WATER SYSTEM STANDARDS, 2002 V-110
TABLE 54 ~~48~~: ESTIMATED DEMAND FOR POTABLE WATER USING A DUAL WATER SYSTEM V-110
TABLE 55: ESTIMATED DEMAND FOR NON-POTABLE WATER IRRIGATION WATER V-114
TABLE 56 ~~50~~: PLANNED URBANIZATION OF CENTRAL MAUI AGRICULTURAL LANDS VI-6
TABLE 57 ~~51~~: WCT LAND AREA SUBJECT TO STATE LAND USE DISTRICT BOUNDARY AMENDMENT VII-1
TABLE 58 ~~52~~: HAWAIʻI STATE PLAN, CHAPTER 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES VII-36
TABLE 59 ~~53~~: HAWAIʻI STATE PLAN, CHAPTER 226 – PART III. PRIORITY GUIDELINES VII-71

TABLE 60 ~~54~~: HAWAIʻI STATE FUNCTIONAL PLANS VII-84
TABLE 61 ~~55~~: STATE ENVIRONMENTAL POLICY VII-107
TABLE 62 ~~56~~: COUNTYWIDE POLICY PLAN VII-118
TABLE 63 ~~57~~: MAUI ISLAND PLAN GOALS, OBJECTIVES AND POLICIES VII-167
TABLE 64 ~~58~~: COMPARISON OF THE WCT MASTER PLAN AND MIP GUIDELINES VII-285
TABLE 65 ~~59~~: WAILUKU-KAHULUI COMMUNITY PLAN GOALS, OBJECTIVES AND POLICIES VII-286
TABLE 66: WWRF SITE SELECTION CRITERIA VIII-44
TABLE 67 ~~60~~: EISPN DISTRIBUTION LIST AND COMMENT LETTERS IX-1
TABLE 68: DEIS DISTRIBUTION LIST AND COMMENT LETTERS X-1

LIST OF APPENDICIES

APPENDIX A MARKET STUDY, ECONOMIC IMPACT ANALYSIS AND PUBLIC FISCAL ASSESSMENT
APPENDIX B BOTANICAL AND FAUNAL SURVEYS
APPENDIX C AIR QUALITY STUDY
APPENDIX D NOISE ASSESSMENT REPORT
APPENDIX E ARCHAEOLOGICAL INVENTORY SURVEY
APPENDIX F CULTURAL IMPACT ASSESSMENT
APPENDIX F, A KA PA`AKAI CULTURAL ANALYSIS
APPENDIX G AGRICULTURAL IMPACT ASSESSMENT
APPENDIX H PRELIMINARY ENGINEERING AND DRAINAGE REPORT
APPENDIX I WATER RESOURCE ASSOCIATES RESULTS OF 10-DAY PUMPING TESTS FOR WELLS 1, 2 AND 3
APPENDIX J ENVINITI PREPARED “PRELIMINARY WASTEWATER REPORT”
APPENDIX K MANA WATER PREPARED “WATER RECLAMATION AND REUSE REPORT FOR WAIKAPŪ COUNTRY TOWN
APPENDIX L ~~I~~ TRAFFIC IMPACT ANALYSIS REPORT
APPENDIX M FEHR & PEERS PREPARED “NO WAI’ALE BYPASS ANALYSIS” MEMORANDUM
APPENDIX N ~~J~~ A HISTORY REPORT OF WAIKAPŪ
APPENDIX O MCC, CHAPTER 2.96 “WORKFORCE HOUSING POLICY”
APPENDIX P ~~K~~ SEPTEMBER 14, 2009 COMMUNITY SURVEY RESULTS
APPENDIX Q ~~L~~ EISPN AGENCY COMMENT AND RESPONSE LETTERS
APPENDIX R ~~M~~ DISTRICT BOUNDARY AMENDMENT PETITION MAPS
APPENDIX S DEIS AGENCY AND COMMUNITY COMMENT AND RESPONSE LETTERS

ACRONYMS AND ABBREVIATIONS

AAQS	Ambient Air Quality Standards
Ac	acre
ADF	Average Daily Flow
ADT	Average Daily Traffic
ALISH	Agricultural Lands of Importance to the State of Hawai‘i
AMI	Area Median Income
AMLS	Above Mean Sea Level
BMP	Best Management Practices
BWS	Board of Water Supply (County of Maui)
CDP	Census Defined Place
CFS	Cubic Feet per Second
CIA	Cultural Impact Assessment
CIP	Capital Improvement Program
CIZ	Change in Zoning
CML	Central Maui Landfill
CPA	Community Plan Amendment
CSD	Conservation Subdivision Design
CWB	Clean Water Branch
CWRM	Commission on Water Resource Management
CZM	Coastal Zone Management
DBA	District Boundary Amendment
DBEDT	Department of Business, Economic Development and Tourism (State of Hawai‘i)
DBL	Decibel Level
DEM	Department of Environmental Management (County of Maui)
DEIS	Draft Environmental Impact Statement
DHHC	Department of Housing & Human Concerns (County of Maui)
DLNR	Department of Land and Natural Resources (State of Hawai‘i)
DOE	Department of Education (State of Hawai‘i)
DOFAW	State of Hawai‘i Division of Forestry and Wildlife
DOH	Department of Health (State of Hawai‘i)
DPR	Department of Parks and Recreation (County of Maui)
DOT	Department of Transportation (State of Hawai‘i)
DPW	Department of Public Works (County of Maui)
DU	Dwelling Units
DWS	Department of Water Supply (County of Maui)
EA/EISPN	Environmental Assessment/Environmental Impact Statement Preparation Notice
EIS	Environmental Impact Statement
ESP	Endangered Species Act

ESCP	Erosion and Sediment Control Plan
FEIS	Final Environmental Impact Statement
EISPN	Environment Impact Statement Preparation Notice
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
GPAC	General Plan Advisory Committee
GPD	Gallons per day
GPM	Gallons per minute
HAR	Hawai‘i Administrative Rules
HC&S	Hawai‘i Commercial & Sugar Company
HCZMP	Hawai‘i Coastal Zone Management Program
HDOT	Hawai‘i Department of Transportation
HRS	Hawai‘i Revised Statutes
HTCO	Hawaiian Telcom
HUD	U.S. Department of Housing and Urban Development
IcB	‘Īao Clay, 3 to 7 percent slopes
ISWMP	Integrated Solid Waste Management Plan
KWWTF	Kahului Wastewater Treatment Facility
KPWR	Keālia Pond Wildlife Refuge
KV	Kilovolt
LCA	Land Commission Award
LEED-ND	Leadership in Energy and Environmental Design – New Development
LID	Low Impact Development
LOS	Level of Service
LSB	Land Study Bureau
LUC	Land Use Commission (State of Hawai‘i)
MCC	Maui County Code
MECO	Maui Electric Company
MG	Million gallons
MGD	Million gallons per day
MIP	Maui Island Plan
MMA	Maui Market Area
MPC	Maui Planning Commission
MPD	Maui Police Department
MSL	Mean Sea Level
MVA	Megavolt Amperes
NAAQS	National Ambient Air Quality Standards
NPDES	National Pollutant Discharge Elimination System
NFIP	National Flood Insurance Program

NRCS	Natural Resources Conservation Service
OEQC	Office of Environmental Quality Control (State of Hawai‘i)
OHA	Office of Hawaiian Affairs
OP	Office of Planning
PCB	Polychlorinated biphenyls
PD	Project District
PDER	Preliminary Drainage & Engineering Report
PpA	Pulehu silt loam, 0 to 3 percent slopes
PtB	Pulehu cobbly clay loam, 3 to 7 percent slopes
PV	Photovoltaic
RGB	Rural Growth Boundary
ROW	Right-of-Way
SCS	Soil Conservation Service
SF	Square Feet
SFHAD	Special Flood Hazard Area Development
SGR	Student Generation Rate
SHPD	State Historic Preservation Division (Hawai‘i)
SLUC	State Land Use Commission
SMA	Special Management Area
STIP	State Transportation Improvement Program
STB	Small Town Boundaries
State	State of Hawai‘i
TIAR	Traffic Impact Analysis Report
TMK	Tax Map Key
UBC	Uniform Building Code
UGB	Urban Growth Boundary
USDA	United States Department of Agriculture
USDW	Underground Sources of Drinking Water
USGS	United States Geological Survey
W	Water>40 acres
WCT	Waikapū Country Town
WKCP	Wailuku-Kahului Community Plan
WvB	Wailuku silty clay, 3 to 7 percent slopes
WvC	Wailuku silty clay, 7 to 15 percent slopes
WUDP	Water Use and Development Plan
WWPS	Wastewater Pump Station
WWRF	Wastewater Reclamation Facility
WWTP	Wastewater Treatment Plant

CHAPTER I

Introduction & Summary

I. INTRODUCTION AND SUMMARY

A. PURPOSE OF THE ENVIRONMENTAL IMPACT STATEMENT

This ~~Draft~~ Final Environmental Impact Statement ~~(DEIS)~~ (FEIS) is being prepared for the Proposed Action in accordance with the State of Hawai'i requirements in Chapter 343 of Hawai'i Revised Statutes (HRS) and Chapter 200 of Hawai'i Administrative Rules (HAR) from the Department of Health describing the contents of an EIS (HAR 11-200-17).

The purpose of HRS Chapter 343 is to establish a system of environmental review to ensure that environmental concerns are given appropriate consideration in decision making along with economic and technical considerations. Within the law are nine 'triggers' or uses that necessitate environmental review. Environmental review is required for any program or project that contains specified land uses or administrative acts, including use of State or County lands or funds other than for feasibility studies, the use of any land classified as Conservation District by State law, proposed amendments to existing county general plans where the amendment would result in designations other than agriculture, conservation or preservation, development of a wastewater treatment facility serving more than 50 dwellings, among other actions.

The Proposed Action is subject to review under HRS Chapter 343 because an amendment to the Wailuku-Kahului Community Plan is required to re-designate land currently designated for agricultural use to urban and rural uses. Other applicable triggers for the Proposed Action include the possible use of State and County lands or funds related to infrastructure improvements, including but not limited to roadway, traffic, water, sewer, drainage, utility or other related facilities. The Proposed Action may also include development of an on-site wastewater treatment facility to service all or a portion of the development.

This ~~DEIS~~ FEIS was prepared in accordance with HRS Chapter 343 and HAR Chapter 11-200, to provide sufficient information, evidence and analysis to decision makers for determining the environmental and socio-economic impacts of the Proposed Action.

B. LIST OF PREPARERS

This EIS was prepared by a qualified team of urban planning, landscape architectural, engineering, socio-economic, archaeological, cultural, and environmental professionals.

Table 1: Prime Consultant

Firm	Expertise	Contact Information
Planning Consultants Hawai'i, LLC	Urban Planning	Michael J. Summers President 2331 W. Main Street Wailuku, HI 96793 Telephone: 808-244-6231 Email: msummers@planningconsultantsHawaii.com

Table 2: Sub-Consultants

Firm	Expertise	Contact Information
Hawai'i Land Design	Landscape Architecture; Urban Design	Bill Mitchell President 2331 W. Main Street Wailuku, HI 96793 Telephone: 808-385-2859 Email: bmitchell@Hawaiilanddesign.com
Otomo Engineering	Civil Engineering	Stacy Otomo President 305 South High Street Wailuku, HI 96793 Telephone: 908-242-0032 Email: stacy@otomoengineering.com
Fehr & Peers	Traffic Engineering	Sohrab Rashid Principal 7 Waterfront Plaza 500 Ala Moana Blvd., Suite 7-4000 Honolulu, Hawai'i 96813 Telephone: 619-758-3002 Email: s.rashid@fehrandpeers.com
The Hallstrom Group | CBRE, Inc.	Market Studies; Fiscal	Thomas Holliday ~~Charter Member~~

Firm	Expertise	Contact Information
~~The Hallstrom Group~~	and Economic Impact Studies	Vice President ~~1003 Bishop Street~~ ~~Pauahi Tower, Suite 1350~~ ~~Honolulu, Hawai'i 96813~~ ~~Telephone: 808-526-0444~~ ~~Email: tws@hallstromgroup.com~~ 1003 Bishop Street, Ste. 1800 Honolulu, Hawai'i 96813 Telephone: 808-541-5120 Email: Tom.Holliday@cbre.com
Archaeological Services Hawai'i	Archaeology	Lisa Rotunno-Hazuka 1930 East Vineyard Street, #A Wailuku, HI 96793 Telephone: 808-244-2012 Email: lisa@ashmaui.com
DL Adams & Associates	Acoustic Studies	~~Dana Dorsch~~ John Garreston 970 N. Kalaheo Avenue, Suite A311 Kailua, HI 96734 Telephone: 808-254-3318 Email: ddorsch@dlaa.com
Planning Consultants Hawai'i, LLC	Agricultural Impact Assessment; Sustainability Plan	Michael J. Summers President 2331 W. Main Street Wailuku, HI 96793 Telephone: 808-269-6220 Email: msummers@planningconsultantsHawaii.com
B.D. Neal & Associates	Air Quality	Barry Neal President P.O. Box 1808 Kailua-Kona, Hawai'i 96745 Telephone: 808-329-1627 Email: bdneal@bdneal.com
Robert Hobdy	Flora and Fauna	Robert Hobdy President 2560-B Pololei Place Ha`ikū, HI 96708 Telephone: 808-573-8029 Email: Hobdyroo1@Hawaii.rr.com
Hana Pono, LLC	Cultural Impact Assessment	Kimokeo P.O. Box 2039 Wailuku, HI 96793 Telephone: 808-573-1643

Firm	Expertise	Contact Information
		Email: hanapono@gmail.com
Jill Engledow	Historian; Writer	Jill Engledow jill@mauiislandpress.com
Enviniti, LLC	Wastewater Engineering	Jonathan Nagato Managing Member P.O. Box 256659 Honolulu, HI 96825 Telephone: 808-596-2378 Email: jon@enviniti.com
Mana Water LLC	Wastewater Engineering	Zoltan Milaskey Vice President Operations 2010 Honoapi'ilani Highway C-1 Lahaina, HI 96791 Telephone: 808-280-1395 Email: zoltan@mana-water.com
Newcomber-Lee Land Surveyors	Land Surveying	Bruce Lee President 1498 Lower Main Street, Suite E Wailuku, HI 96793 Telephone: 808-244-8889 Email: new.lee@Hawai'iantel.net
Warren S. Unemori Engineering Inc.	Land Surveying	Darren Unemori President Wells Street Professional Center 2145 Wells Street, Suite 403 Wailuku, HI 96793

C. PROJECT PROFILE

1. Applicant

The Project Applicant is Waikapū Properties LLC.

Table 3: Project Applicant

Contact	Telephone/Email	Address
Mike Atherton	209-601-4187 ~~athertonisland@aol.com~~ athertonisland@gmail.com	Maui Tropical Plantation 1670 Honoapi'ilani Highway Waikapū, HI 96793
Albert Boyce	209-239-4014 albertboyce@gmail.com	Waikapū Properties, LLC P.O. Box 1780

Contact	Telephone/Email	Address
		Manteca, CA 95336

2. Land Ownership

Waikapū Country Town (WCT) or (the Project) land is owned in fee simple by various ownership entities.

Table 4: WCT Land Ownership

Ownership Group	Parcel(s)	Acres
Waikapū Properties LLC	(2) 3-6-004:003 (2) 3-6-006:036 (2) 3-6-004:006	657.195 0.72 52.976
MTP Land Partners LLC and the Filios, William Separate Property Trust	(2) 3-6-005:007	59.054
Wai'ale 905 Partners LLC	(2) 3-6-002:003 (2) 3-6-002:001	521.40 284.826
TOTAL		1576.171

3. Accepting Authority

The Accepting Authority for the EIS is the State of Hawai'i, Land Use Commission.

Table 5: State of Hawai'i, Land Use Commission

Contact(s)	Telephone/Email	Address
Daniel E. Orodenker Executive Director Scott Derrickson, AICP Planner	Telephone: 808-587-3822 Fax: (808) 587-3827 Email: luc@dbedt.Hawai'i.gov	State of Hawai`i Land Use Commission Department of Business, Economic Development & Tourism P.O. Box 2359 Honolulu, Hawai`i 96804-2359

4. Project Overview

The Applicant is proposing to develop a new residential mixed-use community on lands within and around the Maui Tropical Plantation (MTP), which is just south of the small town of Waikapū, Maui. The Project will encompass approximately 499.003 acres of lands to be used for urban and rural development. Approximately 1,077.168 acres will remain in agricultural use and

about 800 acres of this agricultural land will be placed into an agricultural conservation easement. The project area is within the Maui Island Plan's (MIPs) Small Town Growth Boundary and is identified as the "Tropical Plantation Town Planned Growth Area". The MIP allocates 1,433 residential units and supporting commercial and civic uses to the Planned Growth Area.

The WCT will include 1,433 residential units, plus about 146 'Ohana units, together with neighborhood retail, commercial, employment uses, a school, parks and open space. The project will be developed in accordance with the goals, objectives and policies of the MIP and Wailuku-Kahului Community Plan. The project will be developed in two five-year phases, once all State and County approvals have been granted.

5. Project Location

The Project is located in Central Maui at the Maui Tropical Plantation (MTP), 1670 Honoapi'ilani Highway, Wailuku, Maui, Hawai'i. The boundaries of the project include lands that are makai (east) and mauka (west) of the Honoapi'ilani Highway and extending north and south of the existing MTP. (**See**: Figure 1, "Regional Location Map" and Figure 2, "Aerial Photograph").

6. Tax Map Keys

The entire property, including the lands that are to remain in agricultural use, is identified by the following six Tax Map Key Numbers (**See**: Figure 3, a-d: "TMK Maps"):

Table 6: Project Tax Map Key Numbers

Project Tax Map Key Numbers	
(2) 3-6-005:007	(2) 3-6-002:001
(2) 3-6-002:003	(2) 3-6-006:036
(2) 3-6-004:003	(2) 3-6-004:006

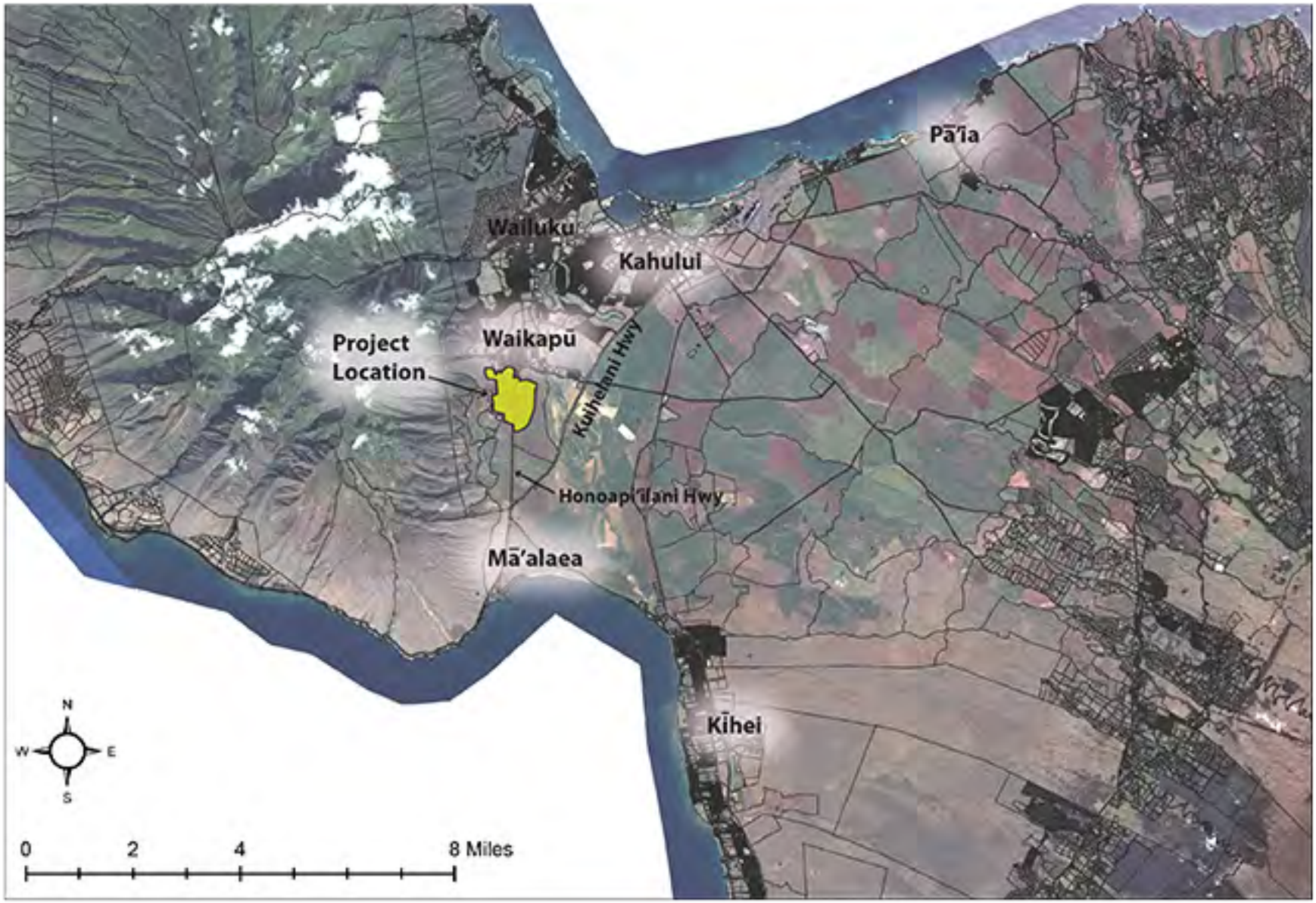


Figure 1
Regional Location

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

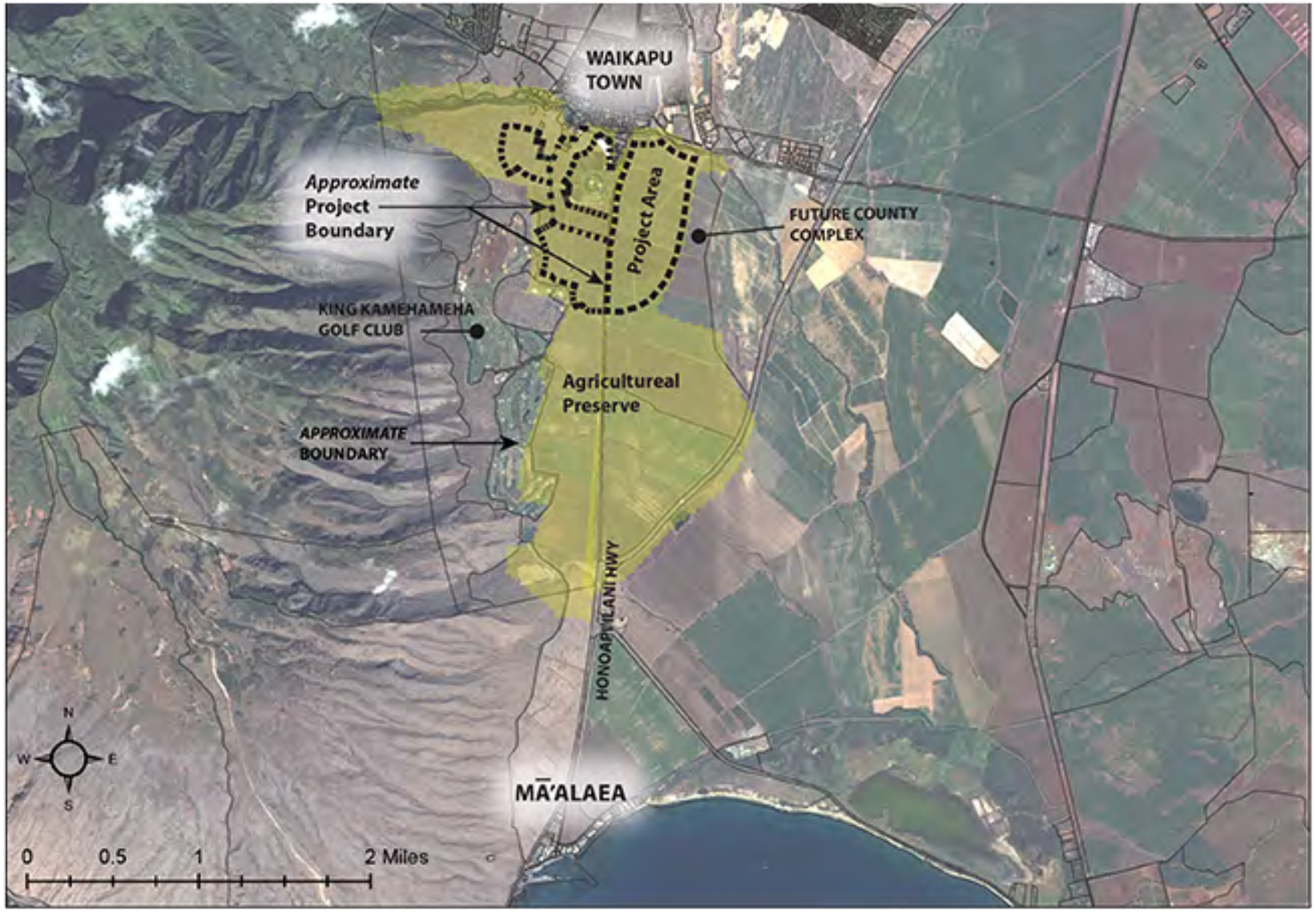


FIGURE 2
AERIAL LOCATION

WAIKAPŪ COUNTRY TOWN

PLANNING
CONSULTANTS
HAWAII, LLC

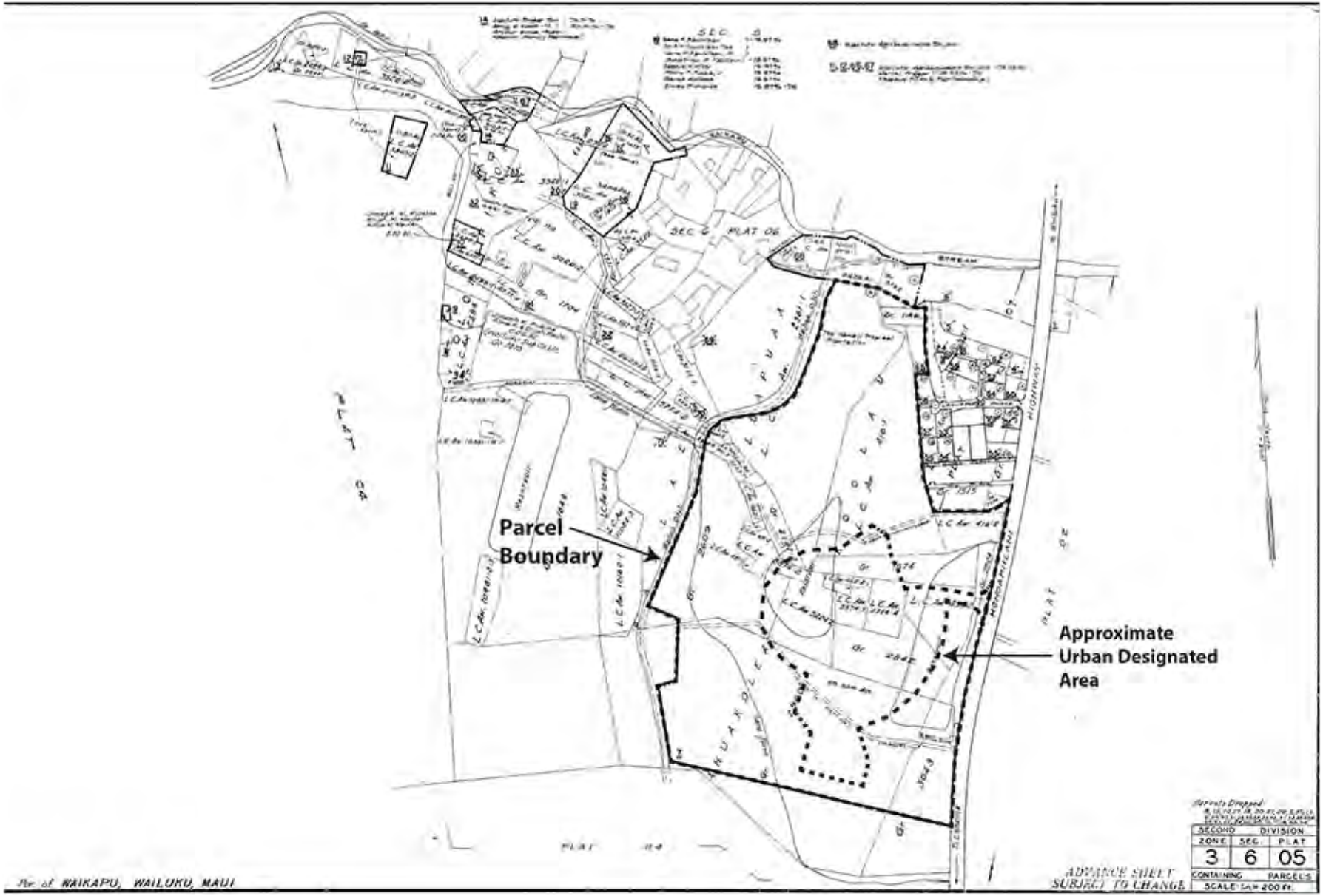


Figure 3a

TMK MAP

TMK No. (2) 3-6-005:007

Not to Scale

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

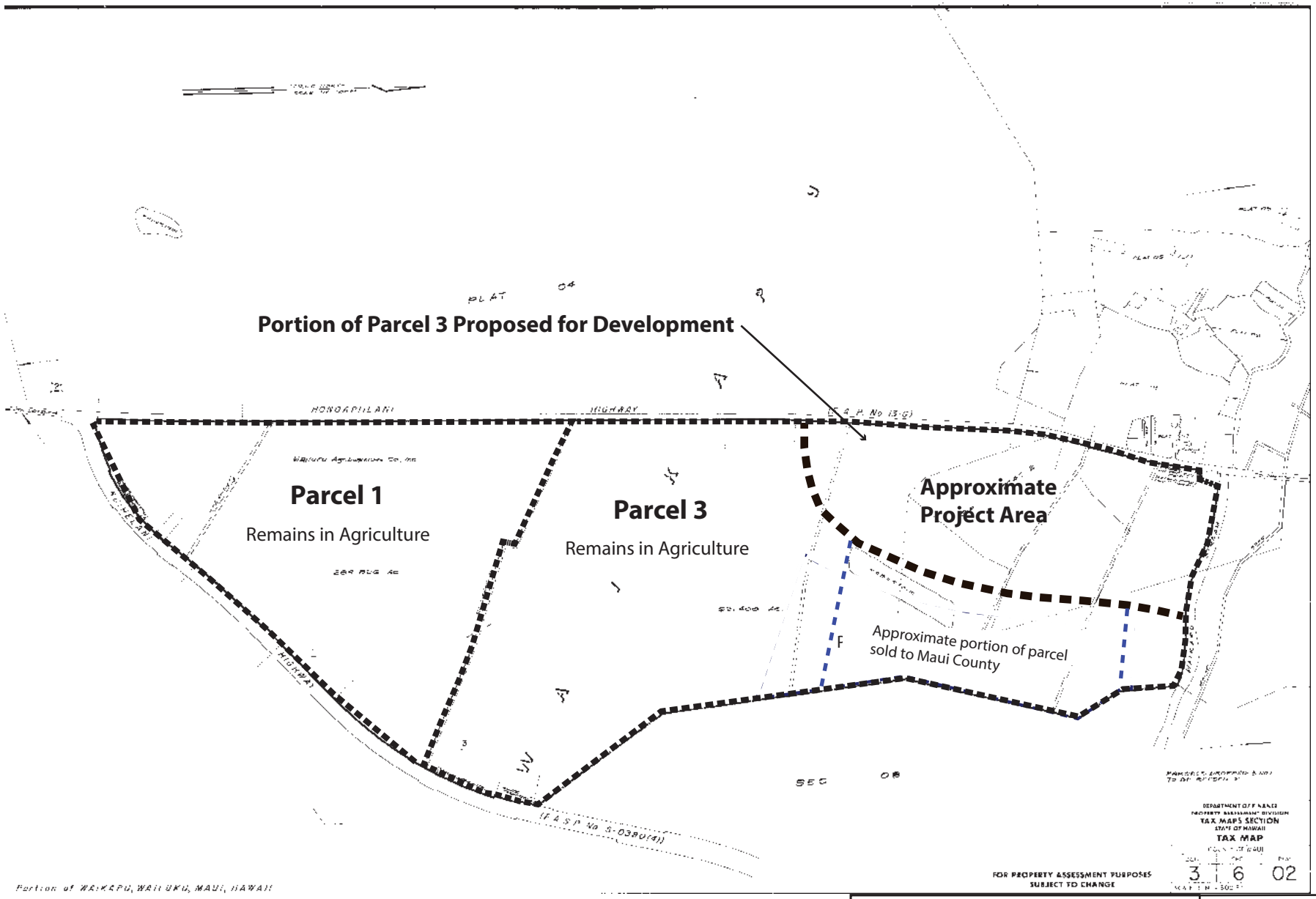


Figure 3b

TMK MAP

TMK No. (2) 3-6-002: 001 and 003

Not to Scale

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

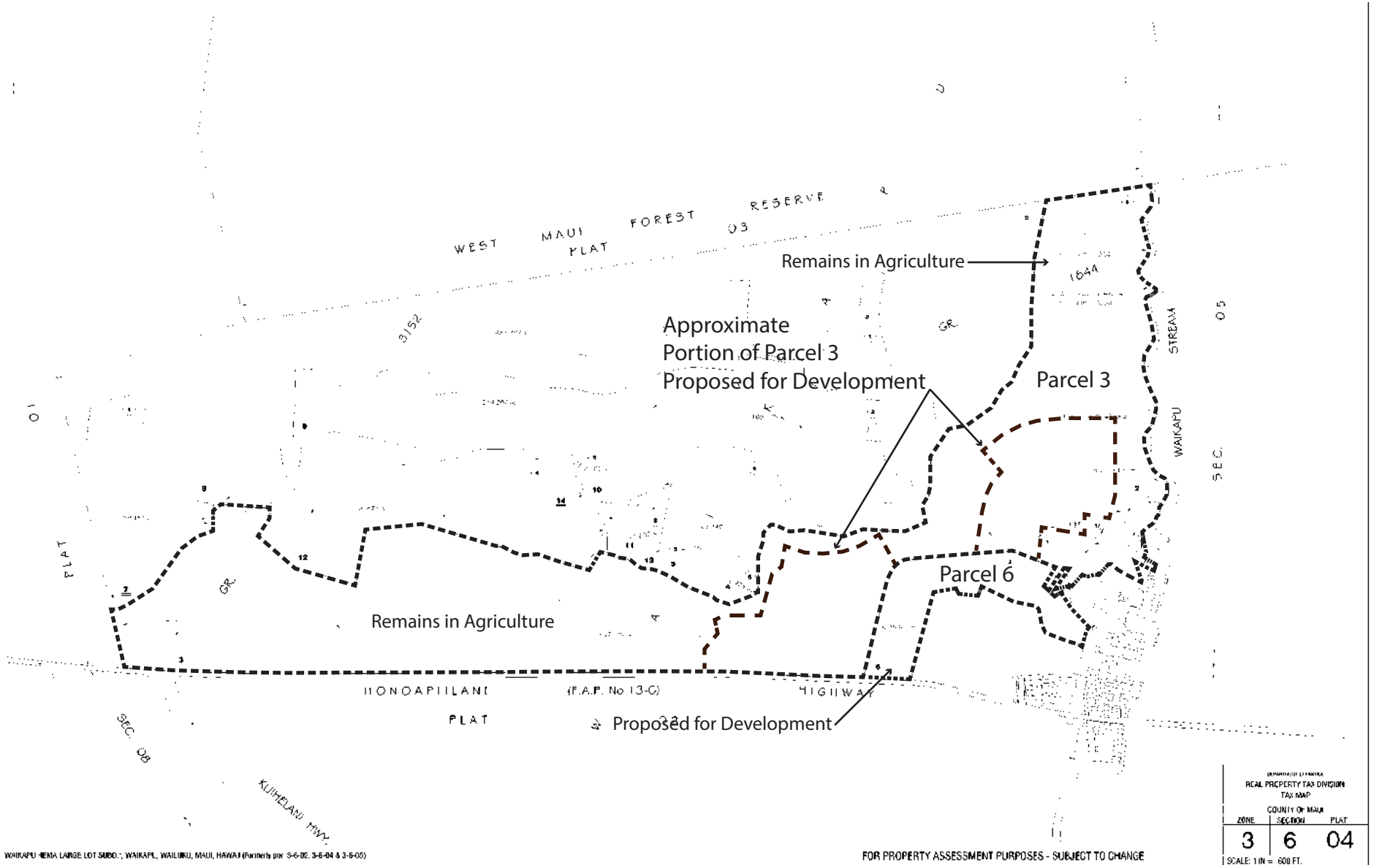


Figure 3c
TMK MAP
TMK No. (2) 3-6-004: 003 and 6

Not to Scale

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

Figure 3d

TMK MAP

TMK No. (2) 3-6-006:036

Not to Scale

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

7. Land Area

The land area owned by the various ownership entities comprises 1,576.171 acres. The property proposed for urban and rural development encompasses approximately 499.003 acres. Lands not proposed for urban or rural development will remain within the State Agricultural District (**See**: Figure No. 4, "Petition Area Illustration" and Appendix M ~~N~~, District Boundary Amendment Petition Maps).

8. State Land Use Districts

Of the 1,576.171 acres under ownership, 1,562.171 acres are located within the State Land Use Agricultural District and 14 acres are located within the State Land Use Urban District (**See**: Figure No. 5, "State Land Use Designation").

Table 7: State Land Use Districts

Ownership Group	Parcel(s)	Acres	State Land Use
Waikapū Properties LLC	(2) 3-6-004:003 (2) 3-6-006:036 (2) 3-6-004:006	657.195 0.72 52.976	Agricultural Agricultural Agricultural
MTP Land Partners LLC and the Filios, William Separate Property Trust	(2) 3-6-005:007	59.054	Agricultural (45.054 acres) Urban (14 acres)
Wai'ale 905 Partners LLC	(2) 3-6-002:003 (2) 3-6-002:001	521.40 284.826	Agricultural Agricultural
TOTAL		**1576.171**	

9. State Land Use District Boundary Amendment (DBA)

The WCT Master Plan will require a State Land Use District Boundary Amendment in order to bring 485 acres of State Agricultural District land into the State Land Use Urban and Rural districts. Table No. 8 identifies the parcels requiring a State Land Use Commission District Boundary Amendment for all or a portion of the property (**See**: Figure No. 5, State Land Use Designation"). See Appendix R ~~M~~ for the proposed District Boundary Petition Area Maps.

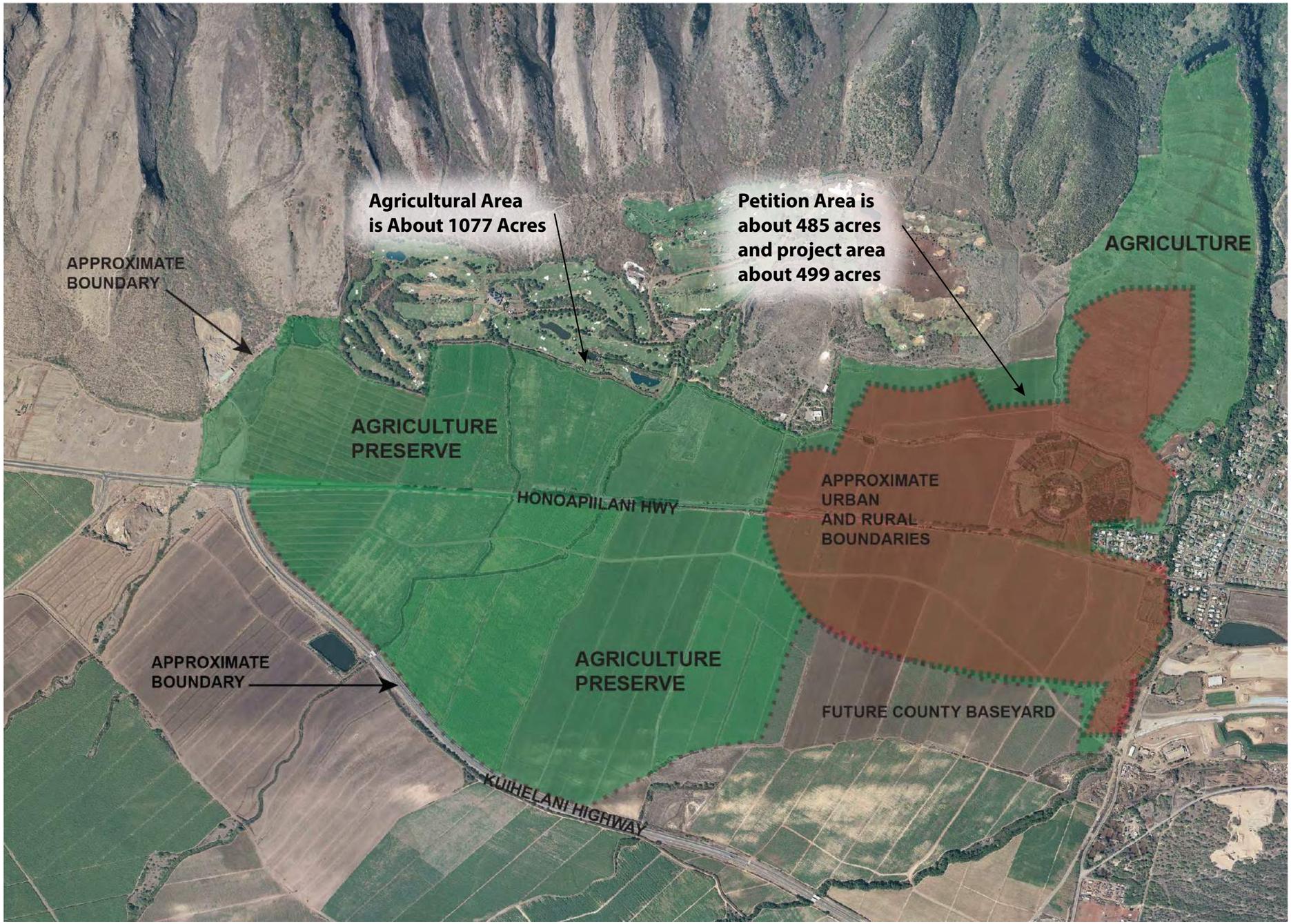


Figure 4
Petition Area Illustration

WAIKAPŪ COUNTRY TOWN

PLANNING
CONSULTANTS
HAWAII, LLC

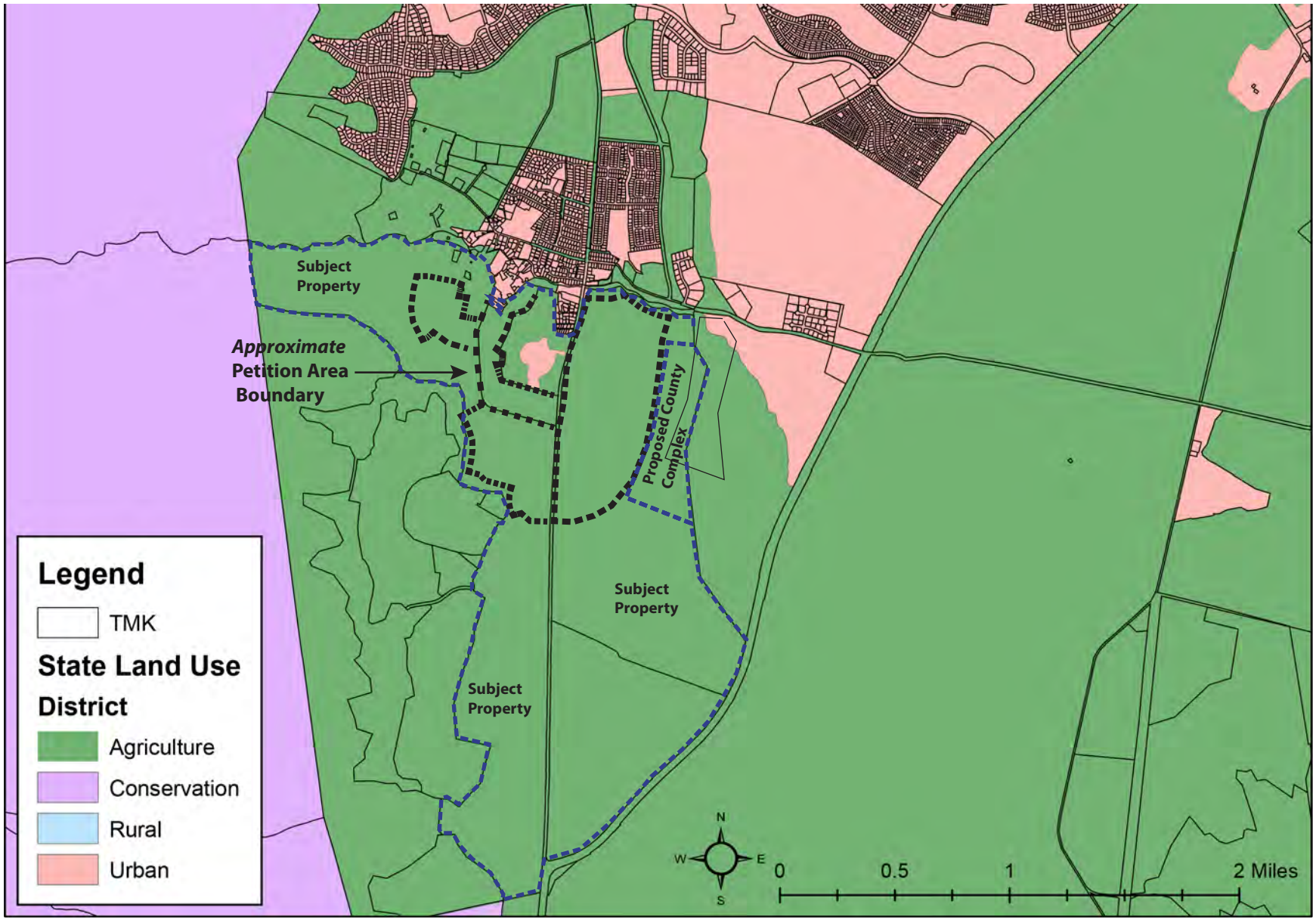


FIGURE 5
STATE LAND USE
DISTRICT BOUNDARIES

Not to Scale

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

Table 8: TMK Parcels Requiring a State Land Use District Boundary Amendment

Ownership	Parcel	Acres	Existing State Land Use	Acres Subject to DBA	Proposed State Land Use
Waikapū Properties LLC	(2) 3-6-004:003 (2) 3-6-004:006	657.195 52.976[1]	Agriculture Agriculture	149.848 53.775[2]	Rural Urban
MTP Land Partners LLC and the Filios, William Separate Property Trust	(2) 3-6-005:007	59.054	Agriculture	45.054	Urban
Wai`ale 905 Partners LLC	(2) 3-6-002:003	521.40	Agriculture	236.326	Urban

10. ~~9.~~ Wailuku-Kahului Community Plan Designations

Of the 1,576.171 acres under ownership, 1,464.141 acres are designated Agriculture by the Wailuku-Kahului Community Plan and 112.03 acres are designated Project District (**See**: Figure No. 6, A-B: "Wailuku-Kahului Community Plan Designations").

Table 9 ~~8~~: Wailuku-Kahului Community Plan Designations

Ownership Group	Parcel(s)	Acres	Community Plan
Waikapū Properties LLC	(2) 3-6-004:003 (2) 3-6-006:036 (2) 3-6-004:006	657.195 0.72 52.976	Agriculture Agriculture Project District
MTP Land Partners LLC and the Filios, William Separate Property Trust	(2) 3-6-005:007	59.054	Project District
Wai'ale 905 Partners LLC	(2) 3-6-002:003 (2) 3-6-002:001	521.40 284.826	Agriculture Agriculture
TOTAL		**1576.171**	

[1] Acreage identified on TMK Map.

[2] Acreage identified by survey.

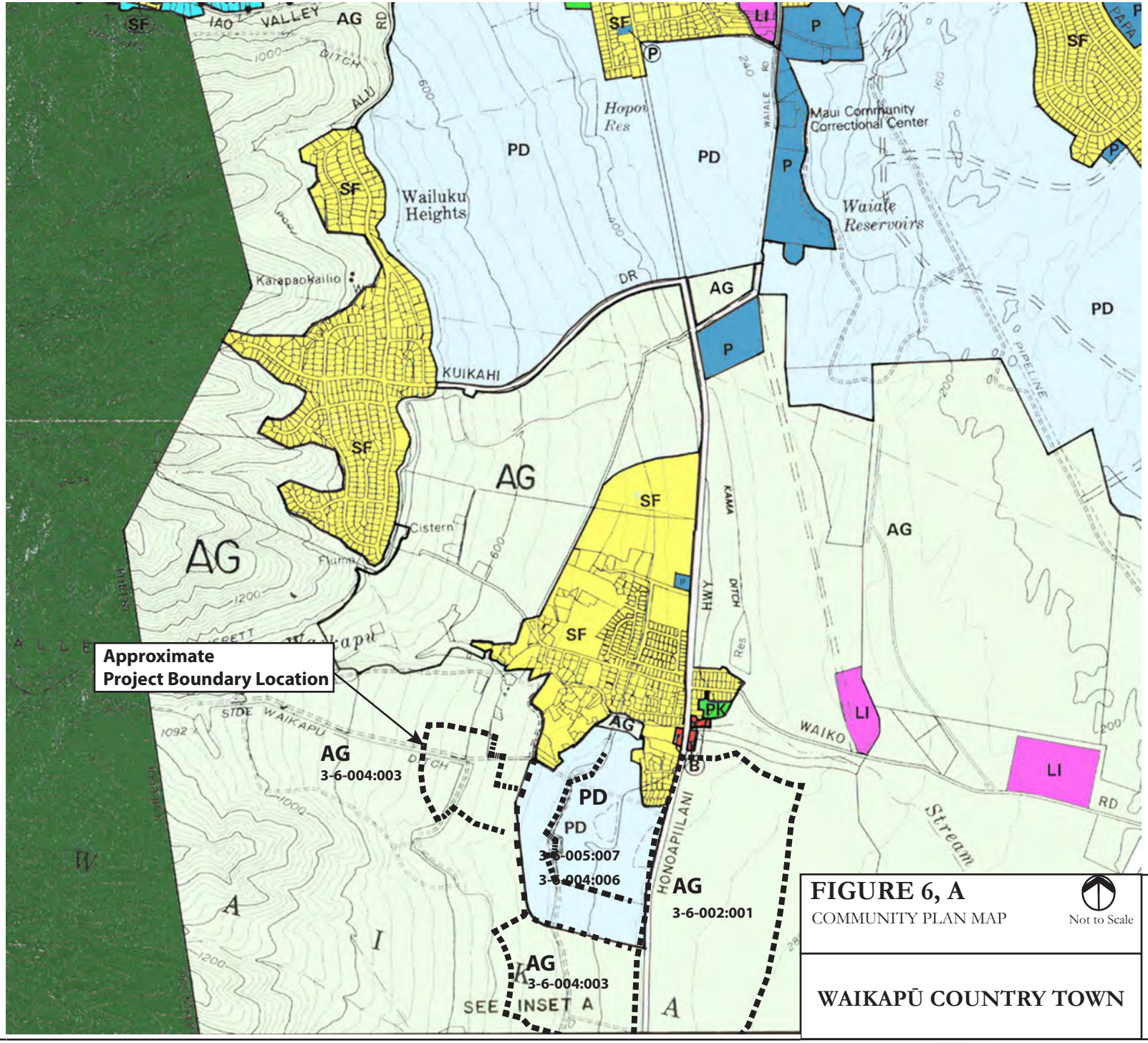


FIGURE 6, A
COMMUNITY PLAN MAP

Not to Scale

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

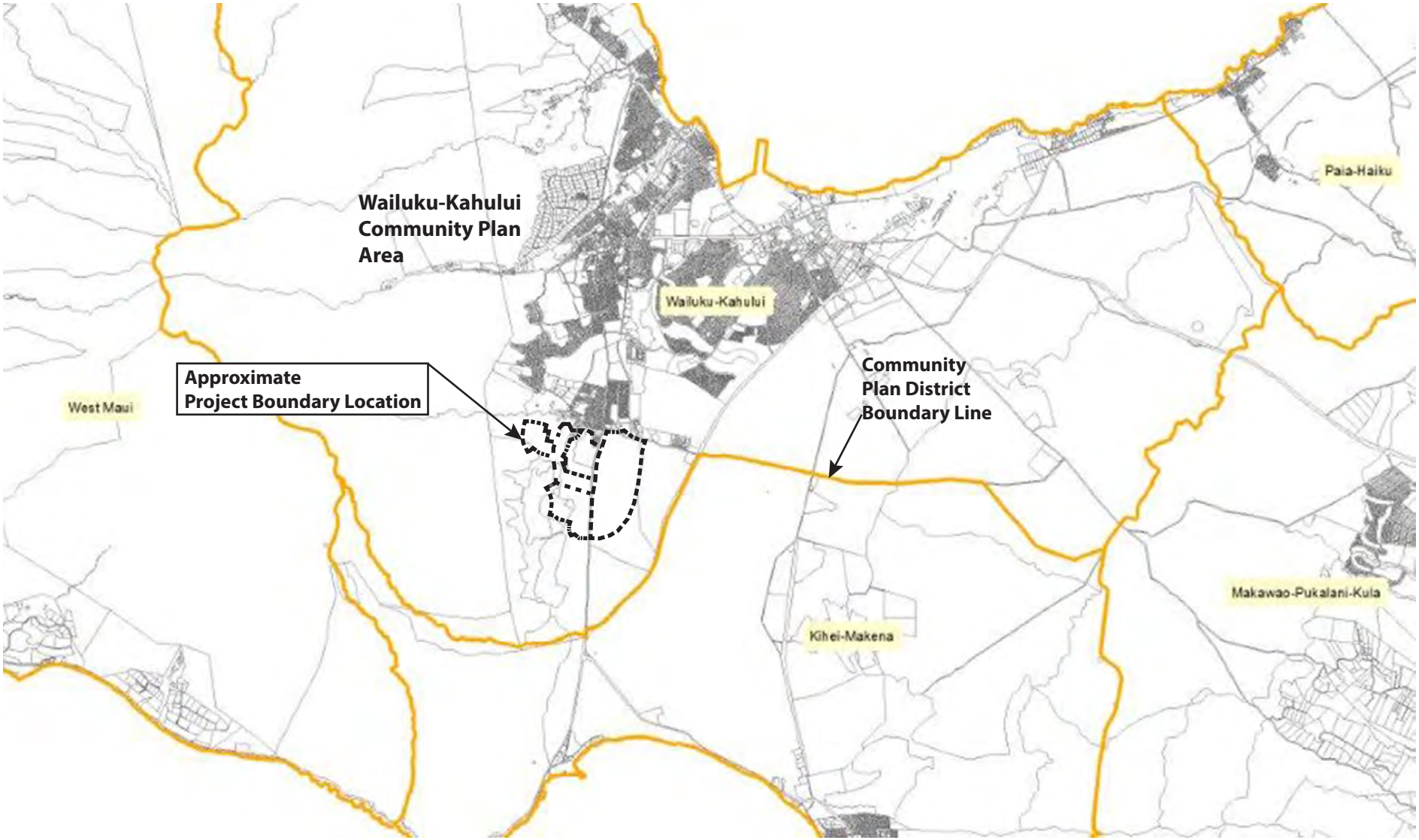


FIGURE 6, B
COMMUNITY PLAN MAP

Not to Scale

WAIKAPŪ COUNTRY TOWN

PLANNING
CONSULTANTS
HAWAII, LLC

11. ~~10.~~ County Zoning Districts

Of the 1,576.171 acres under ownership, 1,517.177 acres are located within the County's Agricultural District and 59.054 acres are located within the County's Project District PD-Wk/5 (**See**: Figure No. 7, "County Zoning Map"). Of the 59.054 acres within PD-Wk/5, 14.00 acres are zoned Commercial and 49.054 acres are zoned Agricultural.

Table 10 ~~9~~: County Zoning Districts

Ownership Group	Parcel(s)	Acres	County Zoning
Waikapū Properties LLC	(2) 3-6-004:003 (2) 3-6-006:036 (2) 3-6-004:006	657.195 0.72 52.976	Agricultural Agricultural Agricultural
MTP Land Partners LLC and the Filios, William Separate Property Trust	(2) 3-6-005:007	59.054	Project District (PD-WK/5)
Wai'ale 905 Partners LLC	(2) 3-6-002:003 (2) 3-6-002:001	521.40 284.826	Agricultural Agricultural
TOTAL		**1576.171**	

12. ~~11.~~ Status of Required State and County Approvals and Permits

The following is a summary of major approvals and permits required for implementation of the proposed action. Table 11 ~~10~~ documents permits and approvals specific to the residential and commercial development and Table 12 documents approvals specific to the development of the Project's wastewater reclamation facility. Additional approvals and permits may be necessary.

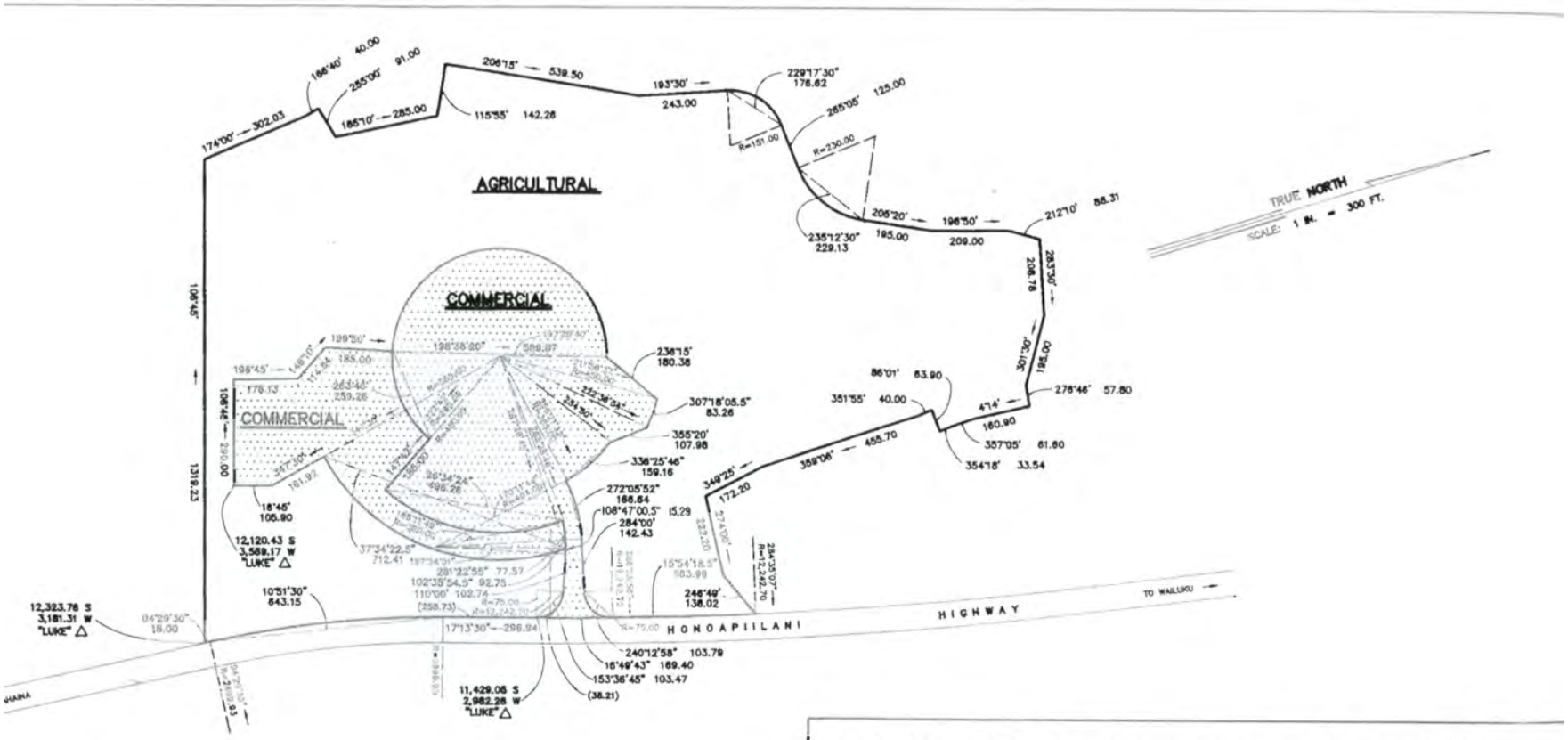
Table 11 ~~10~~: ~~TMK Parcels Requiring a Change in Zoning~~ Required State and County Approvals and Permits

Permit/Approval	Responsible Agency	Status
Chapter 343 Compliance	State Land Use Commission	~~Pending public comments on DEIS and acceptance of FEIS~~ Pending Acceptance of FEIS and a Finding of No Significant Impact (FONSI) determination.
State Land Use District Boundary Amendment	State Land Use Commission	Petition has been filed. Processing is on hold until the

Permit/Approval	Responsible Agency	Status
		EIS (Chapter 343, HRS) process has been completed.
Community Plan Amendment	Maui Department of Planning	Application to be processed concurrently with State Land Use District Boundary Amendment. Final approval will be issued if the DBA is granted.
Change in Zoning / Project District Phase I Approval	Maui Department of Planning	Application to be processed concurrently with State Land Use District Boundary Amendment. Final approval will be issued if the DBA is granted.
Project District Phase II	Maui Department of Planning	Application to be submitted after Project District Phase I Approval.
Project District Phase III	Maui Department of Planning	Application to be submitted after Project District Phase II Approval.
Chapter 6E, HRS Compliance	State Historic Preservation Division	Archaeological Inventory Survey has been filed. Archaeological Monitory Plan to be prepared and filed. Reports are pending approval of the SHPD.
Chapter 343 HRS Compliance for Wastewater Treatment Plant	Department of Public Works	Application to be filed if entitlement requests are granted
National Pollutant Discharge Elimination System Permit	State Department of Health	Application to be filed prior to Grading/Building permits.
Subdivision Approval	Maui Department of Public Works	Application to be submitted after Project District Phase II Approval.
Grading Permit	Maui Department of Public Works	Application to be filed after Project District Phase II approval.
Building Permit	Maui Department of Public Works	Application to be filed after Project District Phase II approval.

Table 12: Governmental Approvals and Permits for Wastewater Reclamation Facility

Permit/Approval	Responsible Agency	Status
National Pollutant Discharge Elimination System Permit	State Department of Health	Applications to be filed for the following: • Stormwater Associated with Construction Activity • Dewatering; and • Hydrotesting.
Noise Permit	State Department of Health	Application to be filed prior to issuance of building permit.
Air Quality Permit	State Department of Health	Application to be filed prior to issuance of building permit.
Underground Injection Control (UIC) Permit	State Department of Health	Application to be filed prior to issuance of building permit.
Wastewater Management Plan Permit	State Department of Health	Application to be filed prior to issuance of building permit.
Use of Recycled Water for Irrigation Permit	State Department of Health	Application to be filed prior to issuance of building permit.
Chapter 6E, HRS Compliance	State Historic Preservation Division	Archaeological Inventory Survey has been filed. Archaeological Monitory Plan to be prepared and filed. Reports are pending approval of the SHPD.
Coastal Zone Management (CZM) Program Consistency Review	Office of Planning	Application to be filed prior to issuance of building permit.
State Land Use Commission Special Use Permit	Maui Planning Commission	Application to be submitted after Project District Phase II Approval.
Driveway Permit Grading/Grubbing Permit Building Permit Excavation Permit Drainage Plan Approval	Maui Department of Public Works	Application to be filed after Project District Phase II approval.



LAND ZONING MAP NO. 412

CHANGE IN ZONING – WAILUKU, MAUI

FROM COUNTY AGRICULTURAL DISTRICT TO WAILUKU /KAHULUI PROJECT DISTRICT PD-WK/5

APPROVAL: County Clerk	PUBLIC HEARING DATE: 11-05-91 ADOPTED BY COUNTY COUNCIL: 10-2-92 ADOPTED BY MAYOR: 10-5-92 ORDINANCE NO.: 2159 (BILL No 69 (1992
APPROVAL: Planning Director	DATE: SCALE: 1" = 300'

OFFICE OF THE COUNTY CLERK
200 SO. HIGH ST., WAILUKU, MAUI, HAWAII, 96793

L – 412

LAND:	AREA:
AGRICULTURAL	45.054 ACRES
COMMERCIAL	14.000 ACRES
TOTAL =	59.054 ACRES

TAX MAP KEY: 3-6-05 : PORTION OF 7

FIGURE 7
MTP LAND ZONING MAP NO. 412 Not to Scale
(2) 3-6-005:007

WAIKAPU COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

D. EXECUTIVE SUMMARY

1. Project Description

Waikapū Country Town (hereafter "WCT" or the "Project") is located in Central Maui at Waikapū, which is approximately two (2) miles south of Wailuku, Maui, Hawai'i (**See**: Figure 1, "Regional Location Map" and Figure 2, "Aerial Photograph"). The urbanized portion of the property, which is the site of the existing Maui Tropical Plantation (MTP), is approximately 2,000 feet south of the intersection of Waiko Road and Honoapi'ilani Highway. The Project will be built on each side of Honoapi'ilani Highway. The entire property, including the land to remain in agricultural use, is identified by Tax Map Key Numbers (TMKs) (2) 3-6-005:007; (2) 3-6-002:001 and 003; (2) 3-6-006:036; (2) 3-6-004:003 and 006 (**See**: Figure 3a-d, "TMK Maps"). This area encompasses approximately 1,576 acres, of which 1562 acres is within the State Agricultural District and 14 acres is within the State Urban District.

The Applicant is proposing to redistrict approximately 485 acres of State Agricultural District land to the State Urban and Rural Districts. Approximately 1,077 acres of the Applicant's holdings will remain within the State Agricultural District. About 800 acres of the agricultural land will be permanently protected by the Applicant through an agricultural easement, or similar mechanism, to facilitate long-term farming on these lands.

The Project, which will be situated on approximately 499 acres, is intended to be developed as a "complete community". A complete community is a settlement pattern in which jobs, housing, private and public facilities and services come together to provide the basic needs of a community, without having to be dependent upon long vehicular commutes.

The Project area was placed into the MIPs Small Town Growth Boundary in December 2012. The purpose for placing the lands within the growth boundary is so that the land can provide additional housing and services to accommodate projected population growth through 2030. In accordance with the MIP's Planned Growth Guidelines, the WCT will comprise 1,433 residential units, plus about 146 'Ohana units, together with neighborhood retail, commercial, employment uses, a school, parks and open space. The Project will be bound by agricultural land that will be

preserved in perpetuity through a conservation easement. The utilization of conservation subdivision design (CSD) practices will preserve additional rural land for farming, open space, and open land recreation uses.

The WCT will be built in two five year phases, both mauka and makai of Honoapi'ilani Highway. Development mauka of the highway will focus inwards onto a "village center," incorporating the existing buildings and tropical grounds of the MTP. The WCT Master Plan calls for a mixture of affordable and market priced housing, along with commercial, entertainment, and civic uses within and around the village center. Development makai of the highway will focus onto a pedestrian-oriented "main street," a nearby elementary school, and neighborhood and community parks. The makai development is bound to the east by the planned extension of the Wai'ale Road, which will intersect with Honoapi'ilani Highway.

2. Purpose and Need

Like the rest of Hawai'i, housing affordability on Maui is a pressing problem, especially for lower and middle income families and young adults. It is generally recommended that no more than 30% of monthly income be spent on rent. However, in 2011 60% of Maui residents exceeded this threshold. According to the US Census Bureau, 2007-2011 American Community Survey 5-Year Estimates, 65% of renters in Wailuku spend over 30% of their income on gross rent and 44% spend over 50% of their income on gross rent.[i] Spending such a high percentage of a family's income on rent takes away from other needed spending and investments, such as saving for a child's education or for retirement.

While housing affordability is a significant concern, demand for housing is projected to increase, placing further pressure on housing prices. According to the MIP (December 2012), there will be a demand for an additional 29,589 housing units on Maui through 2030. Of these units, approximately 10,845 are expected to be built on lands not currently entitled for urban development.[ii] Therefore, about 18,744 units are to be built on lands already zoned for residential use. The majority of the future demand for housing will be in Central Maui. According to the County's Land Use Forecast (November 2006), there will be a demand for an additional 16,549 residential units within the Central Maui region by 2030. This demand will have to be met by new housing developments on both entitled and non-entitled lands.

However, a critical constraint to the development of future housing in Central Maui is the availability of potable water. Due to a current shortage of County water to support future Central and South Maui development, the County is not approving new subdivisions unless those subdivisions develop their own sources of water. This has stopped many projects from proceeding.

In December 2012 the County of Maui adopted the MIP, which set forth the County's first comprehensive island-wide managed and directed growth strategy to address housing demand through 2030. The MIP identifies several "Planned Growth Areas" where future growth will be directed. The subject property is one of these Planned Growth Areas, receiving an allocation of approximately 1,433 residential units. Additional housing may be built, but it must be affordable workforce housing that exceeds County requirements.

It should be expected that as demand outpaces supply at an accelerating rate, housing prices will continue to escalate, which will further exacerbate Maui's affordable housing problems. The proposed project is addressing a critical community need by supplying an additional supply of housing to an underserved market.

3. Projected Market Demand

A market study and economic and fiscal impact assessment was conducted by the Hallstrom Appraisal Group | CBRE, Inc. and is included in the ~~DEIS~~ FEIS as Appendix A (**See**: Appendix A, "Market Study, Economic Impact Analysis, and Public Fiscal Assessment").

The purpose of the market study was to determine if there will be sufficient market demand to absorb the proposed residential and commercial development during a reasonable exposure period given competing developments and projected statewide/regional market trends.

According to the Hallstrom | CRBE study, it is estimated the demand for new residential units in the Wailuku-Kahului study area will be from 9,647 to 16,814 units over the next 21 years (through 2035); including allowances for non-resident purchasers and vacancies, with a mid-point demand of 13,230 units. The number of existing unsold and planned resident housing units within the regional "Directed Growth Boundary", excluding the proposed WCT product,

totals some 7,296 units. This indicates there will be a shortfall in the sector of from 2,351 to 9,518 new residential units; with a mid- point under-supply of 5,935 units. Thus, sufficient unmet demand should exist to readily absorb the 1,433 units of subject inventory during the projection period.

The Hallstrom | CRBE study estimates that the 1,433 proposed residential units of WCT will require about 10 years to be fully absorbed following anticipated commencement of sales in 2017, or at an average rate approaching 150 units annually. It is estimated the demand for neighborhood commercial space by WCT residents and day workers at build-out will be some 85,100 square feet, with patronage by guests in the community, other Waikapū households, and passer-byes contributing an additional 34,000 square feet of demand on a stabilized basis. The remaining 50,500 square feet (of the total 169,600 square feet proposed) will be modestly absorbed over-time with specialized/niche businesses, many with cross-over appeal to residents and visitors, and keeping with the small town context. It is estimated that it will require about 12 years for the WCT commercial space to be fully absorbed.

4. Summary of Beneficial and Adverse Impacts and Mitigation Measures

a. Flora and Fauna

Botanical and Faunal Surveys were conducted by Robert W. Hobdy, Environmental Consultant, in February 2013 for the area proposed for development (**See**: Appendix B, "Botanical and Faunal Surveys"). The study determined that there is little of botanical concern on the property and that the proposed project is not expected to have a significant negative impact on botanical resources. No recommendations with regard to plants were deemed necessary. The study also found that all mammals recorded were common non-native species of no particular concern. However, the study did find two mature Blackburn's sphinx moth eggs on the leaves of one of two Tree Tobacco plants found on the property. The Blackburn's sphinx moth is an endangered species and is of special concern. In response to the findings, the U.S. Fish and Wildlife Service was consulted and appropriate mitigation measures, as described in Section IV.A.4 of the ~~DEIS~~ FEIS, will be taken to mitigate impacts to the Blackburn's sphinx moth. Implementation of these measures will not constrain development of the site.

b. Air Quality

An Air Quality Study was conducted by B.D Neal & Associates to examine the potential short- and long-term air quality impacts that could occur as a result of the construction and operation phases of the development and suggests mitigation measures to reduce any potential air quality impacts where possible and appropriate (**See**: Appendix C, "Air Quality Study").

Except for periodic impacts from volcanic emissions (vog) and possibly occasional localized impacts from traffic congestion and local agricultural sources, the present air quality of the project area is believed to be relatively good. There may be some short- and/or long-term impacts on air quality that may occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust could occur during the project construction phases. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean and covering of open-bodied trucks.

To assess the potential long-term impact of emissions from project-related motor vehicle traffic operating on roadways in the project area after construction is completed, a computerized air quality modeling study was undertaken. With the project in the year 2026 and with proposed roadway improvements, estimated worst-case carbon monoxide concentrations indicated only minimal or no impact compared to the without project case. Concentrations would remain well within standards. Moreover, the Project's wastewater reclamation facility will be designed and operated to keep any emissions of odorous gases at the facility boundary below the odor threshold. Thus, offsite odor nuisance is not expected to be an issue.

c. Noise Quality

A Noise Assessment Report was prepared by D.L. Adams & Associates to describe the existing and future traffic noise levels in the environs of the project site. (**See:** Appendix D, "Noise Assessment Report"). The construction phases of the project will generate significant amounts of noise. In cases where construction noise is expected to exceed the Hawai'i Department of Health (HDOH) "maximum permissible" property line noise levels, a permit must be obtained to allow the operation of construction equipment. HDOH may require additional noise mitigation,

such as temporary noise barriers, or time of day usage limits for certain kinds of construction activities.

During the operations phase, residences within the WCT that are located along Honoapi'ilani Highway, and the major perimeter roadways, will be exposed to elevated traffic noise. Housing and Urban Development (HUD) site acceptability standards must be satisfied by providing minimum setback distances or other traffic noise mitigation measures in order to reduce the noise impact to these homes. The recommended setback for residences located along Honoapi'ilani Highway is 60-feet.

Regarding the proposed on-site wastewater reclamation facility, based on data collected of similar facilities and operations, the wastewater reclamation facility is not expected to produce high noise levels at or beyond property lines adjacent to it.

d. Archaeological Resources

Archaeological Services Hawai'i, LLC conducted an Archaeological Inventory Survey (AIS) of the subject parcels to be developed (TMK's 3-6-002:003; 3-6-004:003, 006; and 3-6-005:007) (**See**: Appendix E, "Archaeological Inventory Survey").

During the AIS investigation, no evidence of traditional Hawaiian activities, with the possible exception of Site 7882 (remnant retaining wall or terrace) was recorded. These negative results are primarily due to the compounded disturbances from sugarcane cultivation, historic habitation and modern land use; and possibly the inherent bias of random sampling during the inventory survey testing. Based on the proposed development plan, Site 7884 Features 2-3 (historic trash scatter and refuse pit); a section of Site 5197 (Waihe`e Ditch) and possibly Site 7883 (WWII bunker) may be adversely affected during the development activities. The AIS notes that these historic properties have been properly recorded and may be removed and or altered during construction. Archaeological monitoring is recommended for those areas that contain former LCA's and Grants. Prior to the commencement of construction, an Archaeological Monitoring Plan (AMP) detailing the localities to undergo monitoring procedures will be prepared and submitted to SHPD for review and approval. The project is not expected to have

an adverse impact upon archaeological or historical resources with implementation of the proposed mitigation measures.

e. Cultural Resources

A Cultural Impact Assessment (CIA) was prepared by Hana Pono, LLC to describe existing Native Hawaiian cultural activities, practices and resources that occur on the property, potential impacts from the project, and mitigation, if necessary, to address these impacts (**See**: Appendix F, "Cultural Impact Assessment"). The cultural practices and beliefs that are documented in the CIA include Hawaiian subsistence and residential agriculture on kuleana lands. These lands utilize the Waikapū Stream, which is a valuable cultural resource. Intricate irrigation systems built prior to western contact continue to be maintained and utilized. There are also on-going projects in the mauka portion of the Applicant's land that are being utilized for cultural site and native habitat restoration, while providing a traditional access point into the Waikapū Valley for gathering of lāʻau lapaʻau (medicinal plants) and native seed gathering.

There are two kuleana lots privately owned by the Mahi family (LCAw: 2499, R.P. 4070 AP 1 &2 to Ehunui) and (Grant 1153 to Ehunui) that are situated within TMK: (2) 3-6-004:003 on lands that the Applicant proposes to keep in agricultural use. The WCT Master Plan has these properties located within the Project's agricultural lands. The Mahi family would like to preserve the subject properties. The CIA also notes that there is a community desire to protect and restore the Waikapū Stream. There is an established 100-foot riparian buffer along the stream as it traverses mauka to makai along the eastern edge of the project boundary. The WCT proposes agricultural, park and open space land uses along the entire stream corridor abutting the WCT. The closest abutting urban land use is located approximately 100-feet away from the stream.

Kuleana farmers have expressed concerns about sedimentation entering Waikapū Stream during high rainfall events and from maintenance and management needs related to the plantation irrigation infrastructure, some of which traverses through WCT agricultural lands. The Applicant is committed to working with neighboring kuleana farmers to help resolve these issues. Concern has also been raised about the potential degradation of native plant species and habitats within the Waikapū Ahupua'a from the potential increase in access to the watershed

from future WCT residents. The Applicant is committed to working with the kama'āina of Waikapū and other concerned residents to develop proper access management programs to protect the Ahupua'a for future generations. Regarding ground water withdrawals from the Waikapū aquifer, these will be done within the strict guidelines established by the Commission on Water Resources Management (CWRM), which should address concerns expressed that ground water withdrawals might impact the health of the aquifer and reduce stream flows.

f. Visual Resources

The WCT will change the character of the existing open space, Haleakalā and West Maui Mountain views along the frontage of the Highway where the urban and rural development is being proposed. The frontage that will be impacted stretches approximately 4,700 linear feet just south of Waikapū in the direction of Mā'alaea, from the northern boundary of the MTP. The views from this area, where not impacted by existing vegetation within the right-of-way, are of agricultural lands and the West Maui Mountains in the background looking in a mauka direction. Looking in a makai direction, where existing vegetation does not obstruct the views, Haleakalā is prominent and views of the Pacific Ocean can also be seen when the sugarcane has been harvested (See Section V.A.6 and Figure 40 ~~35~~, A-E of the ~~DEIS~~ FEIS).

While the existing character of the open space, Haleakalā and West Maui Mountain views will be impacted by the WCT, setbacks of at least 60-feet, and in some areas up to 100-feet or more, will be utilized along each side of the Honoapi'ilani Highway to separate the development from the public right-of-way. In order to mitigate the obstruction of views from the highway to the West Maui Mountains, buildings will be setback at least 75-feet from the highway and building heights will be limited to a maximum of 30-feet along the highway frontage. Buildings will also be separated, placed and oriented in a manner that will establish view corridors from the highway to the West Maui Mountains. Building setbacks and placement will help to mitigate the WCTs overall impact upon the existing views of Haleakalā and the West Maui Mountains.

While the development will produce an impact upon the character of views fronting the urban lands, it is important to note that the Applicant is also proposing to create a permanent 800-acre agricultural preserve that will exist on both the mauka and makai sides of Honoapi'ilani Highway. The preserves frontage is approximately 7,550 linear feet along the highway from the

southern boundary of the project towards Mā‘alaea. The approximate 800-acres of agricultural land will create a permanent open space buffer and permanent separation between Waikapū Town and Mā‘alaea. Along this section of the highway, largely unobstructed views of Haleakalā, the West Maui Mountains and partial views of the Pacific Ocean will exist in perpetuity.

g. Population[3]

In 2010 the population of Wailuku-Kahului was approximately 53,456, which was about 37% of the island's 2010 population of 144,444. As of mid-year 2015, there were approximately 57,616 residents in the Wailuku-Kahului region and projections of the resident population by 2035, based on County and State Forecasts range from circa 78,800 to 97,100. It is estimated that at buildout of the WCT the de facto population of the Project will be approximately ~~3,511~~ 4,085 persons, comprised of ~~3,362~~ 3,921 full-time residents and some ~~148~~ 163 part-time residents and second home owners.[4] The Project's resident population represents from approximately ~~8.40%~~ 9.93% to ~~15.40%~~ 18.51% of the region's projected resident population growth to 2035. It is not expected there will be meaningful in-migration to Maui as a direct result of the operating components of the project.

h. Housing

According to the MIP (December 2012), there will be a demand for an additional 29,589 housing units on Maui through 2030. Of these units, approximately 10,845 are expected to be built on lands not currently entitled for urban development.[iii] The WCT proposes the development of approximately 1,433 residential dwelling units, plus the potential for up to 146 Ohana units, in accordance with the MIP's allocation to the Planned Growth Area. The WCT will offer a mix of single and multi-family housing types to address the diverse housing needs of Maui residents. Due to the Project's Central Maui location and the expected lot and unit size configurations, the Applicant expects that the majority of the Project's market priced housing will be sold at prices considered affordable to Maui County residents earning between 100 and 140 percent of the County's median income as determined by the United States Department of Housing and Urban

[3] See Chapter V.B.1. and Appendix A, Exhibit III-Table 5 of the Market Study, Economic Impact Analysis and Public Fiscal Assessment for the methodology used to calculate the Project's population

[4] Source: Market Study, Economic Impact Analysis, and Public Fiscal Assessment of the Proposed Waikapū Country Town, July 2015; Prepared by the Hallstrom Group | CBRE, Inc.; Addendum C, Table III-5 (Appendix A)

Development. The WCT will also include workforce housing units pursuant to Chapter 2.96, MCC, "Residential Workforce Housing Policy". These homes will be subject to price controls and resale restrictions to ensure that affordable homes remain available for full-time Maui residents. Housing types within the WCT may include multi-family condominiums, small cottage homes on small lots with common open spaces, traditional single-family lots within a variety of home and lot size configurations, rental apartments, townhomes and larger estate rural lots. The goal is to serve the demands of all Maui residents.

i. Economic Impacts

A market study and economic and fiscal impact assessment (FIA) was conducted by the Hallstrom Appraisal Group | CBRE, Inc. and is included as Appendix A in the ~~DEIS~~ FEIS.

The WCT is expected to indirectly support Maui's existing economic base activities by providing much needed housing to serve the island's workforce. The WCT is intended to provide housing along with supporting commercial, employment and institutional uses that will allow for Maui's economic base industries to grow, diversify and become more sustainable, including the island's agricultural industry.

The project will also create direct, indirect and induced short- and long-term positive economic impacts. During the construction phase, the WCT components will directly create an estimated ~~2,320~~ 2,476 "worker-years" of employment (the equivalent of 52 work weeks at 40 hours per week) in the trades and associated businesses during build-out, averaging about ~~193~~ 165 worker years annually, with an estimated ~~$188.3~~ $201 million in wages (averaging about ~~$15.7~~ $13.4 million per year). Moreover, the on-going operations and maintenance of the business commercial, and residential components will directly provide an estimated 4,251 worker-years and $151.6 million in total wages over the 13-year period from opening of the first businesses until full absorption and stabilization are achieved (2018 to 2030). The operating businesses and maintenance of the housing units will support a projected ~~597~~ 531 "full-time equivalent" positions following stabilization (many of which are anticipated to be held by WCT residents) with annual wages of ~~$19.5~~ $2.2 million. Associated secondary/off-site employment during the overall development and absorption time-frame will total ~~1,750~~ 1,789 worker-years with wages

of ~~$89.3~~ $91.3 million. After "stabilization" the community will contribute to the support of some 149 secondary/off-site positions with $7.6 million in yearly wages off-site.

j. Fiscal Impacts

It is projected that the County of Maui will realize new Real Property Taxes (~~$28.3~~ $27.7 million), other secondary receipts, and impact fees of ~~$48.8~~ $47.9 million during the 15-year projection period (2016-2030), and ~~$5~~ $4.9 million annually on a stabilized basis thereafter. The WCT will also be providing approximately 32.5 acres of public park land within the project, of which at least 16.5 acres will be dedicated to the County. After new per capita costs for services are considered the County will earn a net "profit" of $42.2 million during build-out and $4.2 million annually after stabilization. The State of Hawai'i will receive Gross Excise and Income taxes, secondary revenues, and impact fees of ~~$228.0~~ $95.4 million during the 2016-2030 period, and ~~$20.0~~ $4.4 million per year thereafter. The State of Hawai'i will also receive a 12-acre elementary school site. Overall, after new per capita governmental costs are deducted, the State will generate net benefits of $82.6 million during build-out and $2.9 million annually on a stabilized basis.

~~As is typical of a residential-focused master planned community, with limited commercial components, and having a significant percentage of affordably-priced housing units for local families, the expense to the State and County from a "per capita basis" of all governmental operating costs perspective may exceed the specific on-site tax/fee revenue benefits. However, given~~ Given the existing emergency services and social services infrastructure available in nearby Wailuku and Kahului, the provision of a school site within WCT, payment of impact fees, and young age of the project components, it is unlikely the "actual" public cost burden associated with the project would be greater than the per capita assessment or independently require the need for major new public facilities. ~~exceed the revenues generated.~~

k. Public Facilities

Development of the project will increase demand for public facilities, including police, fire, schools, parks, libraries, and solid waste services. The ~~DEIS~~ FEIS documents the direct demand placed upon these facilities and proposed mitigation measures. The following summarizes proposed mitigation measures:

- ***Schools.*** The WCT will contribute 12-acres for the development of an elementary school. The school site is conveniently located next to the regional park and residential housing. The WCT will also pay to the DOE approximately $2,600,000 in impact fees for construction costs.
- ***Parks.*** In order to comply with the County's park land dedication requirement of 500 square feet of land per unit, the project would be required to dedicate approximately 16.5-acres of land for park use. The WCT proposes to dedicate approximately 32.5 acres of sub-regional park land. This land will comprise a variety of park types including mini-parks, neighborhood parks and a community park. The parks are strategically located to provide easy pedestrian and bicycle access from the project's single- and multi-family residential neighborhoods and the elementary school. The project also provides approximately 50-acres of greenways and open-space, which will include pedestrian and bicycle paths and will create additional opportunities for passive recreation. Moreover, within the abutting 1,077-acres of agricultural lands owned by the Applicant, opportunities for various forms of open-land recreation such as horseback riding, mountain biking, trail running, hiking and community gardening may also be provided.
- ***Police and Fire.*** The WCT will increase demand for police and fire facilities, equipment and personal. The Police and Fire Departments receive over ninety percent of their funding from the County General Fund, which is funding primarily by property taxes. Owners of the developed lots will pay property taxes to the County.
- ***Solid Waste.*** The WCT will increase demand for solid waste facilities, equipment and personal. The Department of Environmental Management receives most of its funding for solid waste collection and disposal from the collection of solid waste fees. Owners of the developed lots will pay monthly solid waste collection fees to the County.

I. Traffic

A Traffic Impact Analysis Report was prepared by Fehr & Peers in December 2014 to document the impact of the project and propose mitigation measures (**See**: Appendix L ~~I~~, "Traffic Impact Analysis Report"). The Traffic Impact Analysis Report (TIAR) analyzed the typical weekday AM and PM traffic conditions under existing conditions and potential project-related traffic impacts at partial buildout in 2022 and at full buildout in 2026. The analysis evaluated the operations at eight existing and six future intersections (a total of 14 study intersections) in the vicinity of the

proposed project. The project will increase traffic within the immediate area as project residents, customers and employees commute to and from the project site. The WCT will contribute to cumulative impacts (LOS E or F conditions) during one or both peak hours and the project will contribute to cumulative impacts (LOS E or F conditions) during one or both peak hours at six of the eighteen intersections. The projects will also have project-specific impacts at two of these intersections where the addition of project-generated traffic would cause the overall intersection operations to degrade below LOS D in the peak hours.

In response to the DEIS, the DPW informed the Applicant by letter dated May 23, 2016 (**See**: Appendix S, DEIS Agency and Community Comment and Response Letters) that the timing of the Wai'ale Bypass is uncertain and that the Applicant should assume that the roadway may not be constructed. In response, the Applicant contracted with Fehr and Peers to conduct an analysis of the Project's traffic impacts at full buildout in 2026 without the Wai'ale Bypass Road. Fehr & Peers completed the analysis in October 2016 (**See**: Appendix M, Fehr & Peers Prepared "No Wai'ale Bypass" Memorandum). While three more study intersections would be significantly impacted under this scenario than in the "with Bypass" scenario analyzed in the December 2014 TIAR, LOS D can be achieved at the impacted locations with an expanded program of roadway improvements as mitigation.

In the past, projects would make a fair share financial contribution for each mitigation measure to the appropriate governing agency (i.e., the County or Hawai'i State Department of Transportation (HDOT). However, providing just partial funds for a variety of different improvements does not ensure construction of any individual improvement. More recently, HDOT has indicated a preference for development projects to fully design and build improvements at a select set of locations to ensure their implementation. The WCT proposes a mitigation planning program in the amount of its fair share requirements that would fund improvements at intersections closer to the project site where the project contributes to, but does not directly cause a significant impact. The project proposes to fully fund mitigation measures that would return operations to pre-project levels at those intersections.

During the construction phase, the Applicant will implement a traffic control plan to mitigate impacts to operating conditions along Honoapi'ilani Highway from construction vehicles ingressing and egressing from the Project site.

m. Utilities and Energy

There are existing power, telephone, and cable television transmission facilities along Honoapi'ilani Highway. If approved by MECO, It is anticipated that the power poles will be relocated underground fronting the project site along Honoapi'ilani Highway. Within the WCT, utility poles will be placed underground within the road right-of-way. It is expected that the project will create a total demand of about 10 megawatts of electricity. The WCT intends to promote the use of renewable energy. The installation of photovoltaic systems will be encouraged on residential and commercial buildings. If forty percent of residential and commercial buildings install photovoltaic systems (generating approximately 11.9 GWh per year), demand for carbon-based fuels could be reduced by roughly 50 percent. Moreover, the WCT desires to install a limited number of solar farms in appropriate locations within the agricultural lands. If two solar farms of approximately 5-acres (0.75 MW each) each are developed, the electricity generated would be about 2.6 GWh per year, which could service approximately 236 residential units. Thus, the WCT could potentially generate about 70 percent of its energy consumption through renewables. However, the installation of such systems will depend upon the technical and financial viability of such systems at the time the project is being constructed.

n. Drainage

A Preliminary Drainage Report was prepared by Otomo Engineering. The report analyzes current conditions, including drainage patterns, existing improvements, and runoff totals (**See**: Appendix H, "Preliminary Engineering and Drainage Report).

The WCT will produce an increase in impervious surfaces and will therefore be required to capture and treat the increase in runoff from the project. It is estimated that the WCT will be required to mitigate an increase in runoff of 516 cubic feet per second (cfs) and provide a minimum storage volume of 1,528, 233 cubic feet. With the drainage improvements, there will be no increase in runoff from the project site. The design of the stormwater system will include

water quality treatment to reduce the discharge of pollutants to the maximum extent practicable. Some examples of stormwater best management practices (BMPs) are grass swales, open space and parks and stormwater detention. With stormwater detention the stored runoff will infiltrate into the underlying soils and recharge groundwater. Temporary erosion control measures will be incorporated during the construction period to minimize dust and soil erosion. Additional controls will be implemented to protect the Waikapū Stream. Temporary BMPs include the construction of diversion berms and swales, dust fences, silt fences, stabilized construction entrances, truck wash down areas, inlet protection, temporary grassing of graded areas, and slope protection.

o. Water

The Preliminary Engineering Report documents existing sources of water and infrastructure improvements that service the property (**See**: Appendix H, "Preliminary Engineering and Drainage Report). Water and fire protection for the project will be provided from a private onsite water system. Six (6) wells have been drilled on the site. One of these wells is a monitoring well. ~~Three (3) wells have been designated for potable use and two (2) for non-potable purposes.~~ Water quality testing has been conducted on three of these wells and the testing concluded that these wells are capable of producing potable water of excellent quality. The pump test results demonstrated that the three wells can produce sufficient water to service the Project's potable water demand (**See**: Appendix I, "Water Resources Associates Results of 10-Day Pumping Tests for Wells 1, 2, and 3". All of the wells are located within the Waikapū Aquifer. A dual water system is proposed to service the development. The non-potable water will provide irrigation to the parks, open space and commercial and residential landscape planting of individual lots. It is estimated that the dual system will reduce potable water demand by at least 33 percent. The projected non-potable water demand for the Project's agricultural lands as well as irrigation of parks and open space is estimated to be 3,420,000 gallons per day (gpd). Sources for the non-potable water are proposed to include surface water from the Iao Stream via the Iao-Waikapū Ditch and Waikapū Stream via the South Waikapū Ditch and Waihee Ditch, agricultural well water and reclaimed water from the Project's wastewater reclamation facility. Based on the water usage, the projected average daily potable water demand for the Project is 655,508 gallons per day (gpd). Water conservation measures,

such as low-flow toilets and shower heads will be utilized throughout and efficient water conserving irrigation practices will also be adopted.

p. Wastewater

A Preliminary Engineering Report was prepared for the Draft EIS that assesses current wastewater system capacity and existing infrastructure to support the project (**See**: Appendix, H, "Preliminary Engineering and Drainage Report").

The Project will produce an increase in demand for wastewater treatment. Based on the *"Preliminary Wastewater Report",* prepared by Enviniti LLC, dated March 2013 (**See**: Appendix J), the average wastewater flow estimate for the project is 698,000 gpd and the design maximum flow estimate is 2,449,819 gpd. ~~It is projected that the average daily demand of wastewater generation for the project will be 529,709 gpd.~~ According to the Wastewater Reclamation Division, County of Maui, as of July 31, 2014, the Kahului Wastewater Reclamation Facility (KWRF) has a capacity of 7.9 million gallons per day (mgd). The average flow into the KWRF is 4.7 mgd and the allocated capacity is 6.33 mgd. The remaining wastewater capacity at the KWRF is approximately 1.57 mgd. During pre-consultation for the DEIS, the Department of Environmental Management (DEM) ~~has~~ had noted that in order for the existing collection system to accept flows from the WCT, transmission improvements ~~will~~ would be required along Lower Main Street, Waiko Road, and the Wailuku Pump Station. However, the DEM in their October 13, 2016 letter in response to the DEIS informed the Applicant that the Project would not be allowed to connect to the existing County wastewater collection system and treatment system (**See**: Appendix S, DEIS Agency and Community Comment and Response Letters). After analyzing various alternatives for treating the Project's wastewater, the Applicant has determined that the preferred alternative is to construct a standalone private wastewater treatment facility. The facility will be designed using the most sustainable technologies available based upon Organica's Food Chain Reactor (FCR) configuration, which consists of biological treatment in successive reactor zones utilizing fixed biomass on a combination of natural plant roots and Organica's engineered biofiber media, along with a limited amount of suspended biomass. This system will also serve the dual purpose of reclaiming the Project's wastewater so that at full buildout it will be able to provide approximately 650,000 gpd of recycled water that can be used for irrigation of the WCT's agricultural lands and urban open spaces. ~~The~~

~~Developer is consulting with the Department regarding the opportunity of making such improvements in order to have some of the initial demand generated by the project serviced at the KWRF. However, the WCT will need to construct a stand-alone private wastewater treatment facility, or partner with other projects in the Waikapū area, such as A&B's Wai`ale project or the County of Maui to construct a regional wastewater treatment facility. The Applicant is analyzing several package wastewater treatment options, including a conventional wastewater treatment facility and a facility using a Food Chain Reactor (FCR) configuration.~~

5. Cumulative and Secondary Impacts

Cumulative impacts are defined as the impact on the environment which results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Secondary impacts are those that have the potential to occur later in time or farther in the future, but which are reasonably foreseeable. They can be viewed as actions of others that are taken because of the presence of the project.

The gradual build-out of the WCT will produce a range of impacts that are described in the ~~DEIS~~ FEIS. These are the same types of impacts that are projected for the region overtime as population increases and land is developed to accommodate population growth. Cumulative and Secondary impacts resulting from the Project, together with other development planned for Central Maui, will include increased demand upon public infrastructure and facility systems such as traffic, schools, police, fire, wastewater and water. Cumulative and Secondary impacts can also have an effect upon air and water quality, sensitive environmental habitats and natural resources if not property monitored and mitigated. Section VI.B of the ~~DEIS~~ FEIS discusses cumulative and secondary impacts in greater detail.

6. Consistency with State and County Plans and Policies

a. State Land Use Law, Chapter 205,HRS

The State Land Use Law (Chapter 205, HRS), establishes the Land Use Commission (LUC) and authorizes the body to designate all lands in the State into one of four districts: Urban, Rural, Agricultural or Conservation. The WCT comprises about 1,576 acres of which 14 acres are

located within the State Urban District and the remaining lands are within the State Agricultural District. To develop the property as proposed, approximately 335.155 acres will need to be redesignated to the Urban District and 149.848 acres to the Rural District. Section VII.A of the ~~DEIS~~ FEIS discusses the Project's consistency with the State Land Use Law in greater detail.

b. Coastal Zone Management Act, Chapter 205A, HRS

The Coastal Zone Management (CZM) Area as defined in Chapter 205A includes all of the lands in the State. As such, the property is within the CZM area. Section VII.E of the ~~DEIS~~ FEIS contains a detailed discussion of the Project's compliance with the objectives and policies of the CZM Act.

c. Hawai'i State Plan, Chapter 226, HRS

The Hawai'i State Plan (Chapter 226, HRS), establishes a set of goals, objectives and policies that serve as long-range guidelines for the growth and development of the State. Section VII.A-B of the ~~DEIS~~ FEIS discusses how the project is either supportive or not supportive of these goals, objectives and policies.

d. State Functional Plans

The Hawai'i State Plan directs State agencies to prepare functional plans for their respective program areas. There are 14 state functional plans. These plans direct State policy in areas that range from agriculture to the natural environment and economic development. Section VII.D of the ~~DEIS~~ FEIS discusses how the project is either supportive or not supportive of these goals, objectives and policies.

e. County of Maui General Plan

The General Plan of the County of Maui refers to a hierarchy of planning documents that together set forth future growth and policy direction in the County. The General Plan is comprised of the following documents: 1) County-wide Policy Plan; 2) Maui Island Plan; and 3) nine community plans.

1) Countywide Policy Plan

The County-wide Policy Plan was adopted in March 2010 and is a broad policy document that identifies a vision for the future of Maui County. It establishes a set of guiding

principles and provides comprehensive goals, objectives, policies and implementing actions that portray the desired direction of the County's future. The County-wide Policy Plan provides the policy framework for the development of the MIP and nine Community Plans. Section VII.H.1 discusses how the project is either supportive or not supportive of these goals, objectives and policies.

2) Maui Island Plan

The MIP functions as a regional plan and addresses the policies and issued that are not confined to just one community plan area, including regional systems such as transportation, utilities and growth management, for the Island of Maui. Together, the Island and Community Plans develop strategies with respect to population density, land use maps, land use regulations, transportation systems, public and community facility locations, water and sewage systems, visitor destinations, urban design and other matters related to development. The MIP was adopted on December 28, 2012. The MIP designates as a "Planned Growth Area" the land area comprising the proposed urban and rural areas that comprise the WCT. Section VII.H.2 of the ~~DEIS~~ FEIS discusses how the project is either supportive or not supportive of these goals, objectives, policies and implementing actions.

3) Wailuku-Kahului Community Plan

The Wailuku-Kahului Community Plan designates the urban and rural land proposed for development Agriculture and Wailuku-Kahului Project District No. 5 (Maui Tropical Plantation). Community Plan Amendments are required for the approximate 499 acres of land that are proposed for development. Section VII.H.3 of the ~~DEIS~~ FEIS discusses how the project is either supportive or not supportive of these goals, objectives and policies.

4) County of Maui Zoning

The WCT Master Plan will similarly require a Change in Zoning for all lands proposed for development. A new project district zoning ordinance will be created to implement the vision and mix of uses proposed in the WCT Master Plan.

7. Alternatives Considered

The Project alternatives that have been considered are:

- No Action Alternative;
- Develop Fewer Units;
- Develop More Units by Building More Workforce Housing
- Develop at a Lower Density; and
- Develop at an Alternative Location.

The Applicant has also evaluated several alternatives for the treatment of the Project's wastewater. The alternatives analyzed included following:

1. Connect to the KWWRF to treat the entire Project;
2. Temporarily connect to the KWWRF for the first 650 residential units and then construct a private on-site and/or regional Waikapū wastewater reclamation facility;
3. Construct a regional Waikapū wastewater reclamation treatment facility in association with the County of Maui and adjoining property owners;
4. Construct a private wastewater reclamation facility on property owned by the Applicant;
5. Construct a conventional wastewater treatment plan within the subject property;
6. Construct an Organica Food Chain Reactor (FCR) facility within the subject property; and
7. No action, which is to not proceed with the Project.

Chapter VIII of the ~~DEIS~~ FEIS contains a discussion of the alternatives.

8. Unresolved Issues

The following issues remain unresolved at the time this document is being prepared:

~~**Wastewater Treatment**~~

~~The WCT proposes to complete off-site upgrades to the County's wastewater transmission system in order to temporarily connect to the KWRF for the initial 650 units, or development producing an equivalent amount of wastewater, in the Phase I development. It is unclear at this~~

~~time if the County will agree to this proposal. In any event, the Applicant will need to construct a stand-alone private wastewater treatment facility, or partner with the County and other projects in the Waikapū area, to construct a combined wastewater treatment plant.~~

Wai`ale By-pass Road Improvements

The Wai`ale Bypass Road is identified in the County's Fiscal Year 2016 Capital Improvement Program for funding between 2017 and 2021. The precise schedule for funding and development of this roadway is uncertain at this time.

Elementary School Timing

The FEIS assumes that the Project's elementary school will be built within the first phase of the development. Thus, the impacts of the facility are addressed during this phase. However, the precise schedule for development of this State facility will be dependent upon funding from the State Legislature, which the Applicant has no control over. Moreover, the Educational Contribution Agreement (ECA) between the Applicant and the State Department of Education has not yet been executed.

Final Water Quality Testing

Pump tests and water quality testing for compliance with State DOH water quality standards is being conducted on the Project's three potable wells.

Renewable Energy Development

Development of renewable on-site photovoltaic energy will be dependent upon many factors including financial viability and securing any necessary agreements from MECO.

Amendments to Maui County Code (MCC) Chapter 19.33

Implementation of the Master Plan will require the adoption of a Project District Ordinance, pursuant to MCC Chapter 19.58. It is not yet known whether the ordinance will be adopted through the legislative process. Should the ordinance not be adopted, or be revised significantly, then the ultimate mix of land uses and character of development may be affected.

CHAPTER II

Planning Context

II. PLANNING CONTEXT

A. HISTORICAL LAND USE

A history report prepared by Jill Engledow for Mike Atherton (August, 2009) describes the history of Waikapū, including the Applicant's property (**See**: Appendix N ~~J~~, "A History of Waikapū"). Engledow's report is briefly summarized here.

The Waikapū land division originates from the valley created by the Waikapū Stream, which is one of four streams that comprise what is known as the Nā Wai 'Ehā. The other three valleys are called 'Īao, Waiehu and Waihe'e. The Nā Wai 'Ehā streams are culturally and economically significant. For generations these streams have provided a fresh water source vital for the cultivation of crops throughout the Central Maui isthmus. From the base of each of these valleys, native Hawaiian settlements arose to take advantage of the abundant natural resources that formed the traditional Hawaiian ahupua'a from mountain to sea.

According to early censuses conducted by Christian missionaries in 1832 and 1836, there were 733 persons living in Waikapū in 1832 and 709 persons in 1836. A report from 1834 counts students attending two schools in Waikapū, one with 170 boys and 155 girls and the other with 84 boys and 54 girls. Thus, prior to the large-scale cultivation of sugarcane in Central Maui, there was a sizable native Hawaiian population in and around Waikapū.

Prior to land extensive sugarcane cultivation, kalo was cultivated along the Waikapū stream along with other vegetable crops. As documented by Engledow, E.S.C. Handy wrote the following in 1934:

> *"Spreading north and south from the base of Waikapū to a considerable distance below the valley are the vestiges of extensive wet plantations, now almost obliterated by sugarcane cultivation . . . Far on the north side, just above the main road and at least half a mile below the entrance to the canyon, an extensive truck garden on old terrace ground showed the large area and the distance below and away from the valley that was anciently developed in terraced taro culture. On the south side there are likewise several sizable kuleana where, in 1934, old terraces were used for truck gardening. . . There were probably once a few small terraces on the narrow level strips of valley bottom in the lower canyon."* [iv]

Engledow further documents that small scale sugarcane growing was occurring in Waikapū by the 1840s. However, it wasn't until 1862, when James Louzada founded Waikapū Plantation, that larger scale sugar cultivation took root in the area. An early depiction of the plantation is provided in an article from the April 9, 1864, edition of the *Pacific Commercial Advisor.*[v]

> *"The capacity of the mill is about four thousand pounds of sugar per day, though, by working nights, which is sometimes done, five thousand pounds can be got off. To obtain this product, Messrs. Louzada and Cornwell employ about seventy field and mill laborers, of whom forty are females, who are engaged on account of the scarcity of men. . . .The land at Waikapū consisting of a gentle slope from the base of the mountain to the road, irrigated by the Waikapū river, is admirably adapted to sugar culture, producing, when well cared for, very heavy crops. The extent of land suitable for cane is limited only by the amount of water obtainable for irrigation. The proprietors of the mill have purchased land largely since they began operations and have now some 200 acres. They purchase cane from the natives, paying generally about one hundred dollars an acre for the standing crop, taking it off at their own expense."*

By the mid-1870s, sugar cane production in the Central Valley was thriving. Between 1867 and 1880, land in cane cultivation on Maui increased by 136%, from 5,080 acres to 12,000 acres.[vi] In 1889 and 1890, Wailuku Sugar Company, owned by famed sugar baron Claus Spreckels,

purchased all of the shares of the Waikapū Plantation from James Louzada and Henry Cornwell. Wailuku Sugar Company, under different ownership groups, continued sugar cultivation on the Waikapū lands until 1988. Thereafter, the Maui Land & Pineapple Company leased land for pineapple production and HC&S leased land both mauka and makai of Honoapi'ilani Highway to supplement its sugar production. Pineapple ceased to be farmed on Waikapū lands in about 1997. HC&S continues to lease approximately 938 acres for sugarcane cultivation from the Project Applicant.

In 1982, Wailuku Sugar Company petitioned the State Land Use Commission for a Special Use Permit to develop the "Hawai'i Tropical Plantation" on 8.92 acres of the approximate 59 acres that comprise TMK: (2) 3-6-5:007. The purpose of the project, as described in 1982, was to develop a visitor-oriented destination where a variety of tropical agricultural products could be showcased. The agricultural component of the project included the growing, harvesting and processing of tropical fruits, plants and flowers. In addition, tours were offered so that visitors could experience the agricultural activities. Of the 8.92 acres subject to the Special Use Permit, 5.25 acres was proposed for a plantation center, 2.64 acres for parking, and 1.03 acres for an agricultural tour route. Agricultural activities were to occur on the remaining agricultural lands that encircle the facilities. On July 21, 1982, the Maui Planning Commission granted the Special Use Permit, subject to conditions. The Tropical Plantation Market was constructed in 1984 and the restaurant in 1986. By 1988, the Plantation was expected to draw approximately 450,000 visitors.

By the late 1980s the Maui Tropical Plantation's management determined that greater regulatory flexibility was needed so that the facility could be expanded to better serve its customers. In 1988, Maui Tropical Plantation filed a Hawai'i Revised Statutes (HRS) Chapter 343 Environmental Assessment to support a State Land Use Commission District Boundary Amendment from Agricultural to Urban and a Change in Zoning and Community Plan Amendment from Agriculture to Wailuku/Kahului Project District 5. In October 1992, the Maui County Council granted the request. The Project District Zoning Ordinance zoned 14 acres for commercial uses and approximately 45 acres for agricultural uses (**See**: Figure Nos. 6 and 7, "Community Plan Map" and "Zoning Map").

B. EXISTING LAND USE

The Applicant purchased the bulk of the property from Wailuku Agribusiness Company between 2004 and 2006. Today, the Applicant's 1,562.171 acres of State Agricultural District lands are used for sugarcane cultivation, cattle grazing, and diversified agriculture. These include the following TMK's:

Table 13 ~~11~~: State Agricultural District Designated Lands

TMK Number	Acres
(2) 3-6-005:007 (Portion)	45.054
(2) 3-6-004:003	657.195
(2) 3-6-004:006	52.976
(2) 3-6-006:036	0.72
(2) 3-6-002:003	521.40
(2) 3-6-002:001	284.826
TOTAL	**1,562.171**

The commercial component of the MTP, located on a 14-acre portion of TMK (2) 3-6-005:007, continues to be a visitor destination that is based on a tropical agricultural theme. As in previous years, the facility integrates ongoing agricultural activities with daily tours, restaurants, gift shops, farm stands, and adventure tours. Surrounding the MTP is sugarcane stretching to the south and east and the diversified farming operations of Kumu Farms and Hawaiian Taro to the west and north. The existing town of Waikapū, Census Designated Place population of 2,965 (Maui County Data Book, 2012), abuts the northern boundary. MTP facilities include a 9,389 square feet country store/gift shop and a 15,821 square feet restaurant/special events hall with seating for up to 500. There are also a number of smaller structures that serve as artist studios and gift shops. The most popular attraction at the MTP is a daily tram ride, which offers a guided tour of the abutting agricultural fields and tropical lagoon and gardens. The special events hall is popular for weddings, fund raising campaigns, parties and performances. In recent years the facility has attracted approximately 100,000 visitors per year.

Kumu Farms and Hoaloa Farms ~~Hawaiian Taro~~ farm along the northern and western perimeter of the MTP. Kumu Farms specializes in organically grown fruits, vegetables and herbs and is well-known for its Moloka`i farm, which sells organic strawberry papayas throughout Hawai'i and on the U.S. Mainland. Hoaloa Farms ~~Hawaiian Taro~~ is owned by farmer and University of Hawai'i taro researcher Bobby Pahia. Hawaiian Taro grows dry land taro, banana and sweet potato. Makani Olu Ranch is raising a herd of Texas Longhorn cattle and Beef and Bloom Black Angus cattle on the higher elevation agricultural lands. In July 2016 HC&S announced it will no longer lease WCT lands for agriculture. Kumu Farms, Hoaloa Farms, Makani Olu Ranch and Beef and Bloom will expand their production to these lands. These lands may also be leased to other viable farming operations. ~~MTP owner, Mike Atherton, is raising a small herd of Texas Longhorn cattle on the mauka fields at the base of the West Maui Mountains. HC&S is leasing approximately 938 acres for sugarcane on parcels to the south and east.~~

C. SITE PHOTOGRAPHS

Site photographs were taken of the entire 1,576 acres between September 2013 and October 2014. Figure Nos. 7a and 7b show the approximate location of the photos taken. The site photographs document existing site conditions at the MTP, the agricultural lands mauka and to the south of the MTP and the existing agricultural lands makai of Honoapi'ilani Highway in the area proposed for development. The site photographs also document existing conditions along the boundaries of the project, including conditions along Waiko Road**. (See:** Figure No. 8 A-N, "Site Photographs").

D. MAUI ISLAND PLAN DIRECTED GROWTH PLAN

In December, 2012, the County of Maui adopted the MIP. The MIP establishes goals, objectives, policies and actions to direct growth and development on Maui through the year 2030. The MIP was based upon a comprehensive analysis of population growth, economic conditions, development capacity of existing entitled lands, and extensive community outreach.

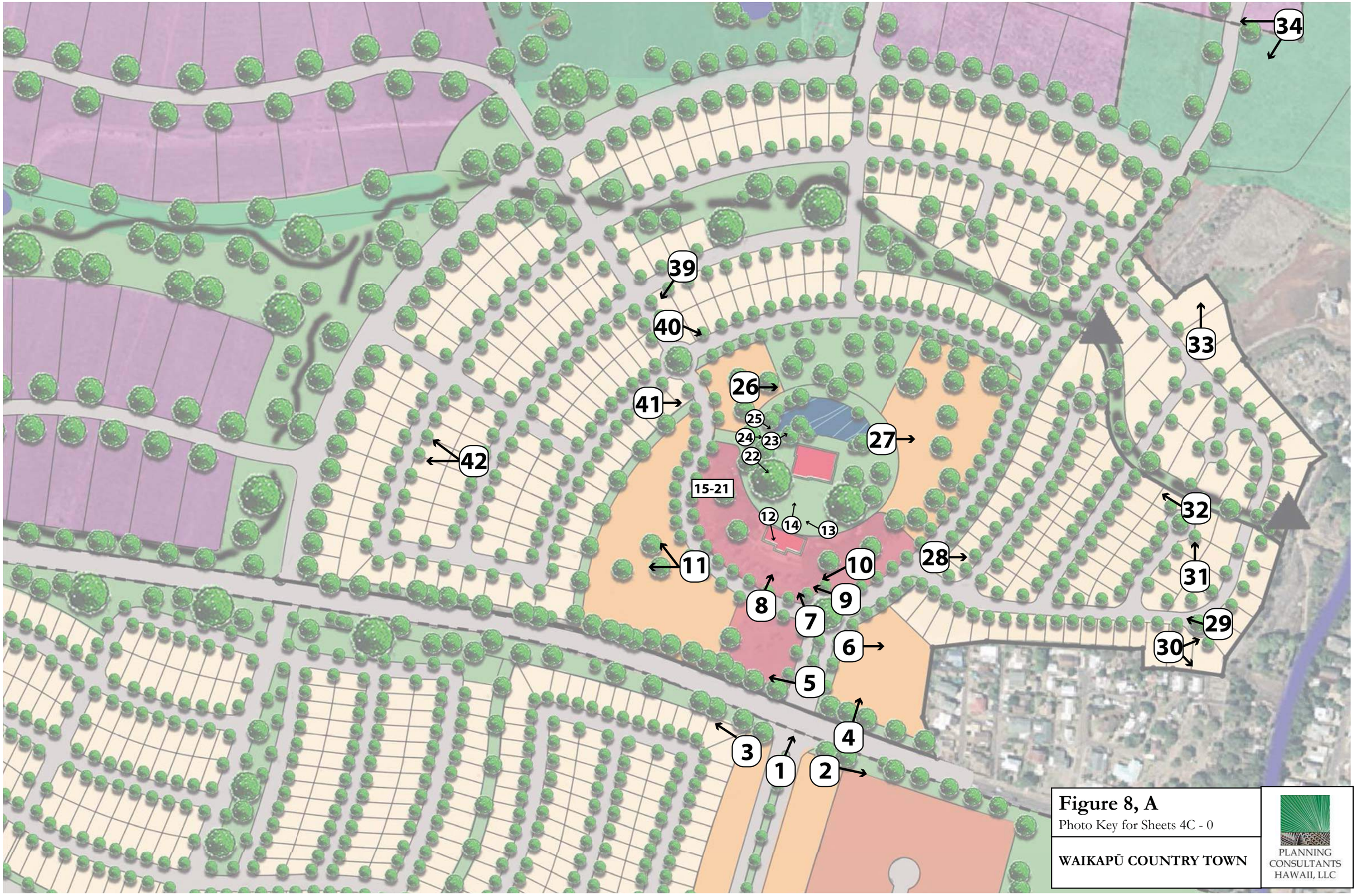


Figure 8, A

Photo Key for Sheets 4C - 0

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

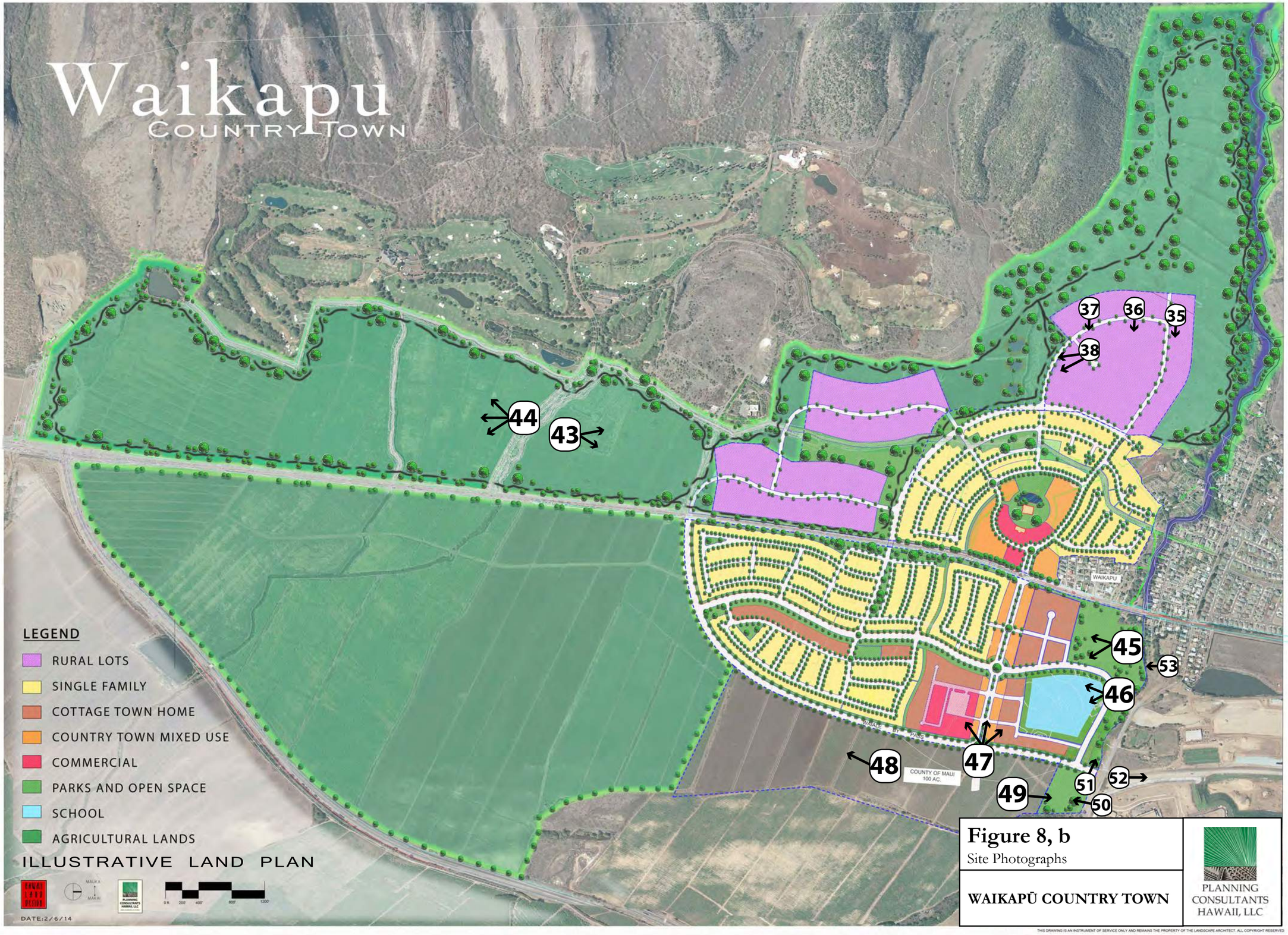


Figure 8, b
Site Photographs

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

1. Looking west (mauka) from Honoapi'ilani Highway into the project site.

2. Looking north along Honoapi'ilani Highway towards Waikapū Town fronting the project.

3. Looking south along Honoapi'ilani Highway fronting the project site.

4. Looking northwest across the subject property from Honoapi'ilani Highway.

5. Looking south from the project driveway across the subject property.

6. The existing Kumu Farms agricultural products stand.

Figure 8, C
Site Photographs

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

7. Existing electric vehicle recharging stations installed by JumpSmart Maui.

8. Looking west at the entrance to the existing Maui Tropical Plantation Visitor Store.

9. Looking south at the frontage of the Maui Tropical Plantation Visitor Store.

10. Panning from the southeast to the south across the existing Maui Tropical Plantation parking lot.

Figure 8, D
Site Photographs

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

11. Looking from south to west across the project site.

12. Looking east (makai) at the rear of the Maui Tropical Plantation Visitor Store from the village green.

13. Looking across the existing village green.

14. Looking west (mauka) at the restaurant / special events hall from the village green.

Figure 8, E
Site Photographs

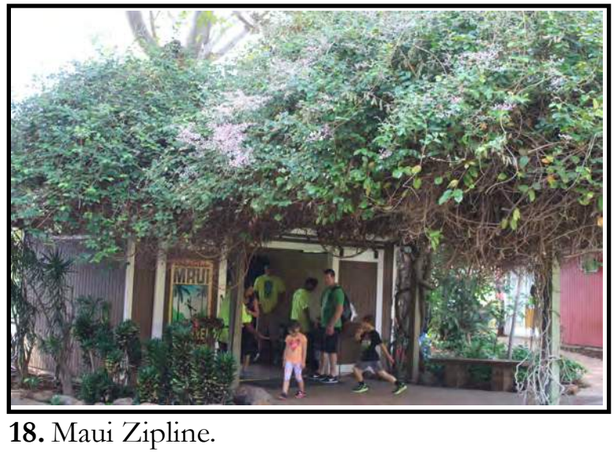
WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

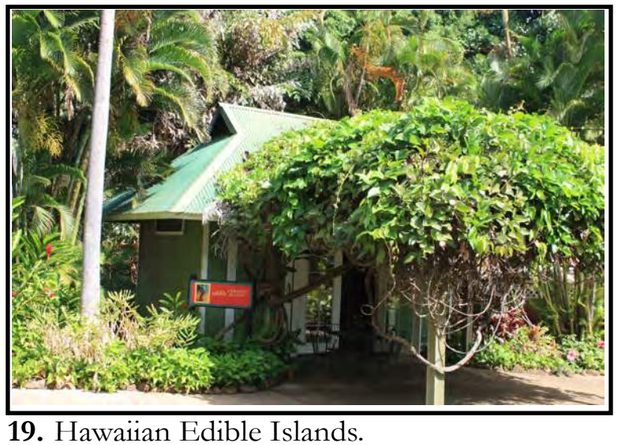
15. Ron L. Designs Jewlery Manufacturing Company.

16. History of Waikapu pavilion.

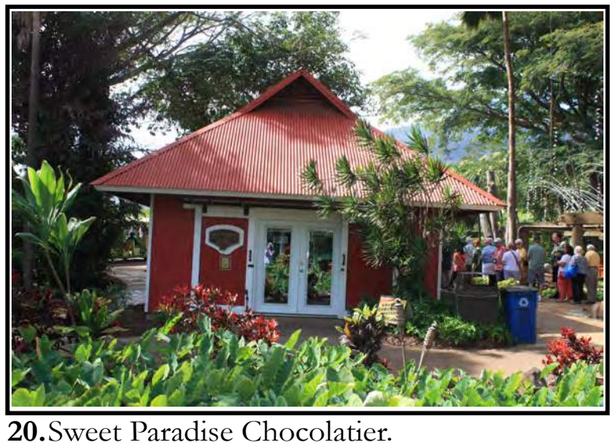
17. Flyin Hawaiian Zipline.



18. Maui Zipline.



19. Hawaiian Edible Islands.



20. Sweet Paradise Chocolatier.

Figure 8, F
Site Photographs

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

21. Typical retail shop at the Maui Tropical Plantation.

22. Current improvements to the lagoon to recognize Waikapu's sugar legacy.

23. Looking across the lagoon towards areas proposed for future multi-family residential.

24. View of the lagoon with new improvements.

25. Looking across the lagoon at the renovated restaurant and bar.

26. Looking north across the village green behind the lagoon.

Figure 8, G
Site Photographs

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

27. Wedding gazebo at the northern end of the lagoon.

28. Looking north at Kumu Farm's farming operation.

29. Looking south across Kumu Farm's farming operations.

30. Looking along the northern and eastern property lines from the northeast corner of the property.

Figure 8, H
Site Photographs

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

31. Looking west (mauka) towards proposed rural and agricultural lands.

32. Looking southwest at the existing Waihe`e irrigation ditch that lies north to south across the property.

33. Looking west (mauka) towards the proposed rural and agricultural lands.

34. Looking east (makai) towards proposed rural and residential lands.

Figure 8, I
Site Photographs

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

35. Looking east (makai) at Kumu Farms agricultural lands.

36. Looking east (makai) at Kumu Farms agricultural lands towards the MTP.

37. Looking east (makai) at Kumu Farms agricultural lands towards the MTP.

38. Panning southeast towards lands being farmed by Hawaii Taro, LLC.

Figure 8, J
Site Photographs

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

39. Looking northeast at agricultural lands near the MTP.

40. The existing Maui Zipline within the MTP.

41. Looking north across the MTP.

42. Looking south across proposed single-family and rural lands and agricultural lands beyond.

Figure 8, K
Site Photographs

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

43. Looking north across the proposed agricultural park in the agricultural preserve.

44. Looking southwest across the agricultural preserve.

45. Looking east at lands proposed for urban development, (makai) at lands makai of Honoapi'ilani Highway.

Figure 8, L
Site Photographs

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

46. Looking south across agricultural lands makai of Honoapi'ilani Highway.

47. Looking west (mauka) from the location of the proposed Wai'ale Bypass Road across lands proposed for urban development.

Figure 8, M
Site Photographs

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

48. Looking south along an existing cane haul road in the vicinity of proposed Wai'ale Bypass.

49. Looking north along existing cane haul road in the vicinity of the proposed Wai'ale Bypass.

50. Looking in the direction of the cane haul road from Waiko Road.

51. Looking northwest up Waiko Road.

52. Looking north along Wai'ale Road from Waiko Road.

53. Looking at the existing Waikapū Stream bed.

Figure 8, N
Site Photographs

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

To guide development of future urban lands, the MIP sets forth policies requiring higher urban densities, a greater balance between single- and multi-family housing types, mixed-use development, vehicular and pedestrian connectivity between land uses, and the incorporation of parks, schools, open space and affordable housing into future developments.

The MIPs Directed Growth Plan places approximately 502 acres of WCTs 1,576 acres into urban (small town) and rural growth boundaries. The MIP keeps the remaining 1,074 acres within the State's Agricultural District. Of the Project's agricultural lands, approximately 800 acres extending south of the Project's Small Town Boundary are preserved in perpetuity for agricultural use through a conservation easement. The remaining lands may be subdivided in the future into several large agricultural lots (**See**: Figure Nos. 9 and 10, "Maui Island Plan Directed Growth Map" and "Maui Island Plan Wailuku/Kahului Planned Growth Areas").

The MIP describes the purpose and intent of the WCT "Planned Growth Area" as follows:

> *The Waikapū Tropical Plantation Town planned growth area is situated in the vicinity of the Maui Tropical Plantation, and includes lands on both the mauka and makai sides of Honoapi'ilani Highway. Providing the urban character of a traditional small town, this area will have a mix of single-family and multifamily rural residences, park land, open space, commercial uses, and an elementary or intermediate school developed in coordination with the Wai'ale project. The area is located south of Waikapū along Honoapi'ilani Highway, and it will incorporate the integrated agricultural and commercial uses of the existing tropical plantation complex. This area is proximate to the Wai'ale planned growth area, providing additional housing in central Maui within the Wailuku-Kahului Community plan region. As part of this project, parcels to the south of the project (identified as Agricultural Preserve on Figure 8-1) shall be protected in perpetuity for agricultural use through a conservation easement. A portion of this area may be dedicated to the County as an agricultural park administered pursuant to County regulations. Alternatively, this area can be developed as a private agricultural park available to Maui farmers, and executed through a unilateral agreement between the landowner and Maui County. The*

Maui Island - Directed Growth Map C3

County of Maui

Wailuku

Waikapu

WCT Rural

WCT Urban Boundary

WCT Rural

Central Maui Baseyard

Figure 9: Maui Island Plan Directed Growth Map

Maui Island Plan Directed Growth Map

Waikapu / Kahului
C3

Legend

Growth Boundaries

- Urban
- Small Town
- Rural

Reference

- 2011 Parcels
- Primary Roads

Feet
0 500 1,000 2,000 3,000 4,000

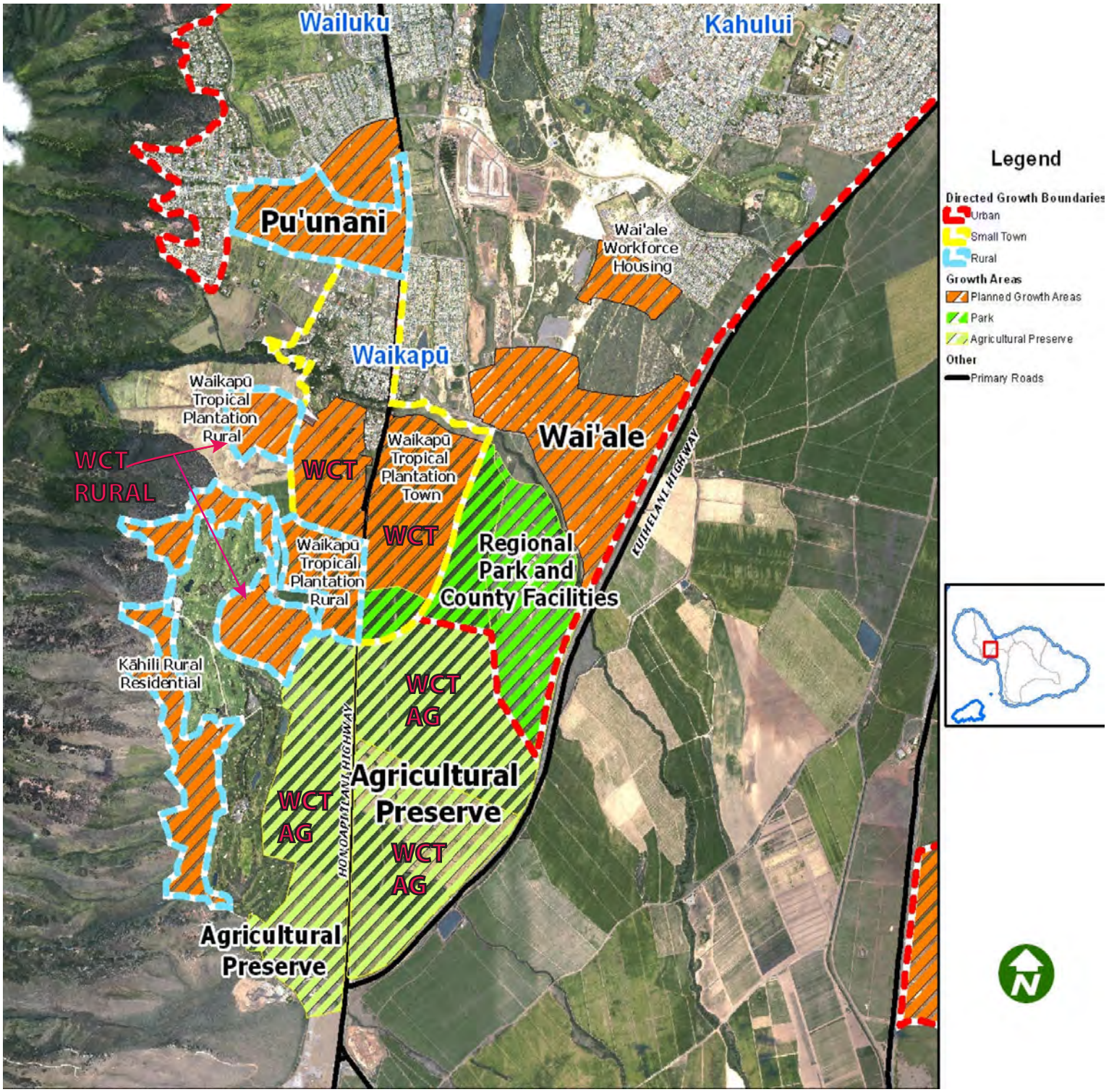
Product Code: M-DET_20121210-D2
Copyright © December 10, 2012

Background Image: Worldview 2 - 2010

This is not a zoning map. Please contact the Planning Department for Zoning confirmation.

PREPARED BY:

Long Range Planning Division
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793



Source: Maui Island Plan, Department of Planning, Long-range Planning Division, December 2012

Figure 10

Maui Island Plan
Wailuku-Kahului Planned Growth Areas

Not to Scale

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

rural lots mauka of Honoapi'ilani Highway are intended to be developed using a CSD plan. The CSD plan shall provide access to uninterrupted walking and bicycling trails and will preserve mauka and makai views while protecting environmentally sensitive lands both along Waikapū stream and mauka of the subdivision.

Planned Growth Area Rationale:

Keeping the Waikapū Tropical Plantation as its town core, this area will become a self-sufficient small town with a mix of single-family and multifamily housing units in a walkable community that includes affordable housing in close proximity to Wailuku's employment centers. Schools, parks, police and fire facilities, transit infrastructure, wastewater, water supply resources, and other infrastructure should be developed efficiently, in coordination with neighboring developments including Maui Lani, Kehalani, Pu'unani and Wai'ale. The Waikapū Tropical Plantation Town planned growth area is located on Directed Growth Map #C3. [vii]

E. PROJECTED MARKET DEMAND

A market study and economic and fiscal impact assessment was conducted by the Hallstrom Appraisal Group | CBRE, Inc. and is included as Appendix A.

The purpose of the market study was to determine if there will be sufficient market demand to absorb the proposed residential and commercial development during a reasonable exposure period given competing developments and projected statewide/regional market trends. The study also assessed if the project is an appropriate use of the underlying site relative to market needs.

Wailuku-Kahului, or "Central Maui", is the center for government, transportation and non-visitor economic activity on the island, and its most populous district. In addition to its historic standing as the location of a significant share of urban uses, it has been a focal point for light industrial,

commercial and residential development for the past two decades, with numerous major projects actively adding inventory, in construction or proposed. The region's proximity to services, goods, transportation facilities, and business/employment opportunities, ready access to the island's highway system, and a desirable climate will facilitate continuing demand for real estate into the long- term; although it will "lose" some of its market dominance as development continues in South (primarily) and West Maui.

There are an estimated 19,200 housing units in Central Maui of which some twelve-plus percent are owned by non-residents as second/vacation homes. The average resident household size is just under 3.50 persons and is forecast to decline meaningfully in coming decades as a result of family/household trends and a changing mix of unit types from new development.

There are an estimated twelve million square feet of gross leasable light industrial and commercial floor space in Central Maui, about three-quarters of the island-wide total, but a limited visitor-oriented component with only 462 total transient units (just 2.3 percent of the island total) and limited tourist-dominated retail.

Waikapū is potentially a highly competitive location within the Maui housing market. It is considered to have distinctive, unique characteristics relative to nearby Wailuku and Kahului, although it represents the southerly boundary of their greater urban sphere. All of the just over 900 units of residential inventory built in the Waikapū Village area to date (less than five percent of the regional total) have been successfully absorbed, and the number of units available for resale is typically limited with only six active house listings at the report date, or just 0.66% of the total units in the community. Waikapū is considered desirable for its relative ease of access to the Wailuku/Kahului commercial and service centers as well as the resort employment areas in West and South Maui; for its cooler climate; panoramas across the isthmus to Haleakalā; and, small town ambience.

The subject property is a superior location for the proposed development in regards to access, views, topography, shape, consistency with nearby uses and land planning objectives, climate, and ability to provide a quality lifestyle and business opportunities for a wide-range of

owners and end-users. It will have the attributes necessary to be highly competitive in all its product sectors, and will capture a reasonable market share during its offering period.

It is estimated the demand for new residential units in the Wailuku-Kahului study area will be from 9,647 to 16,814 units over the next 21 years (through 2035); including allowances for non-resident purchasers and vacancies, with a mid-point demand of 13,230 units. The number of existing unsold and planned resident housing units within the regional "Directed Growth Boundary", excluding the proposed WCT product, totals some 7,296 units. This indicates there will be a shortfall in the sector of from 2,351 to 9,518 new residential units; with a mid- point under-supply of 5,935 units. Thus, sufficient unmet demand should exist to readily absorb the 1,433 units of subject inventory during the projection period.

The median price for a single family home in Central Maui (which includes many smaller, older homes/units) during the first half of 2015 was $507,300 and at $308,750 for a multifamily unit. Both indicators show meaningful appreciation since prices reached a post-recessionary nadir in 2011. Median prices are anticipated to increase into the long-term as thousands of higher priced new units manifesting the higher costs of land, construction, impact fees and entitlement, are added to the inventory, and appreciation (though cyclical) continues.

It is estimated that approximately 75 percent of the demand for resident housing in the Wailuku-Kahului Study Area will be for units with a current price of $660,000 or less; the upper-price threshold for meeting County affordability standards (160 percent of median household income), with 30 percent of demand for units having a current price of less than $330,000 (the 80 percent of median household income threshold).

Multifamily units are expected to comprise an increasing proportion of the total regional inventory, moving from the current 25 percent level to 45 percent over the coming two decades. Based on the limited availability of alternative Central Maui supply relative to demand and the favorable competitive characteristics of the subject location/community, it is estimated that the 1,433 proposed residential units of WCT will require about 10 years to be fully absorbed following anticipated commencement of sales in 2017, or at an average rate approaching 150 units annually. This represents only some 20 percent of total regional mid-point demand during

the sales period; a moderate perspective which could readily be swifter if some proposed projects fail to reach fruition and the market standing of WCT achieves expectations.

It is estimated the demand for neighborhood commercial space by WCT residents and day workers at build-out will be some 85,100 square feet, with patronage by guests in the community, other Waikapū households, and passer-byes contributing an additional 34,000 square feet of demand on a stabilized basis. The remaining 50,500 square feet (of the total 169,600 square feet proposed) will be modestly absorbed over-time with specialized/niche businesses, many with cross-over appeal to residents and visitors, and keeping with the small town context. The developer is hopeful the existing on-site Tropical Plantation shops will remain at WCT. It is estimated that it will require about 12 years for the WCT commercial space to be fully absorbed. The annualized mid-point subject residential unit absorption estimates are summarized in Table 14 ~~12~~ below.

Table 14 ~~12~~: Estimated Annualized Mid-Point Market Absorption of Residential Product

Calendar	Year of Development	Construction, Sale and Absorption Timing	Residential Units
2016	1	Infrastructure Emplacement Commences	
2017	2	Infrastructure Completed, Vertical Construction and Pre-Sales Begin	150
2018	3	Initial Buildings Completed and Occupied	120
2019	4	Vertical Construction, Absorption and Sales On-Going	130
2020	5	Construction, Absorption and Sales On-Going	140
2021	6	Construction Absorption and Sales On-Going	150
2022	7	Construction Absorption and Sales On-Going	150
2023	8	Construction Absorption and Sales On-Going	150
2024	9	Construction Absorption and Sales On-Going	150
2025	10	Construction Absorption and Sales On-Going	150
2026	11	Construction Absorption and Sales On-Going	143
	TOTAL		**1,433**

~~Note: Total excludes potential 'Ohana units which may be permitted within the community. The number and location of possible 'Ohana units are unknown at this time, with some developer materials discussing totals of about 150 units. For purposes of the analysis it is assumed only the 1,433 proposed non 'Ohana units will be built and reflected this figure throughout our analysis.~~

Note: Plus construction of 146 Ohana units which is assumed to occur with maximum build-out.

Source: The Hallstrom Group/CBRE

The forecasted absorption of the commercial component is shown below in Table 15 ~~13~~.

Table 15 ~~13~~: Estimated Annualized Mid-Point Market Absorption of Commercial Product

PROJECTED SUBJECT COMMERCIAL SPACE ABSORPTION BY PERIOD Gross Leasable Area in Square Feet			
2016-2020	2021-2025	2026-2030	Total
42,399	110,238	16,960	169,597
Source: The Hallstrom Group/CBRE			

CHAPTER III

Description of the Project

III. DESCRIPTION OF THE PROJECT

A. PURPOSE AND OBJECTIVES

The primary purpose of the WCT is to create a new mixed-use residential community that embodies the principles and policies of the MIP and that respects and implements the Statement of Values of the Waikapū Community Association. Key guiding principles embodied in the MIP that have guided the development of the WCT Master Plan include:

1. ***Respect and encourage island lifestyles, cultures, and Hawaiian traditions:*** *The culture and lifestyle of Maui's residents is closely tied to the island's beauty and natural resources. Maintaining access to shoreline and mountain resources and protecting culturally significant sites and regions perpetuates the island lifestyle and protects Maui's unique identity. One of the most vital components of the island lifestyle and culture is Maui's people. In an island environment where resources are finite, future growth must give priority to the needs of residents in a way that perpetuates island lifestyles.*

2. ***Promote sustainable land use planning and livable communities:*** *Managing and directing future growth on Maui should promote the concept of sustainability, and the establishment of livable communities. Sustainable practices include: 1) Focusing growth into existing communities; 2) Taking advantage of infill and redevelopment opportunities; 3) Promoting compact, walkable,*

mixed-use development; 4) Revitalizing urban and town centers; 5) Providing transportation connectivity and multimodal opportunities; 6) Protecting and enhancing natural and environmental resources; 7) Protecting, enhancing, and expanding communities and small towns, where appropriate; and 8) Encouraging energy and water-efficient design and renewable energy technology.

3. ***Keep "urban-urban" and keep "country-country":*** *Given the high cost of developing public infrastructure and facilities to service remote areas, the significant environmental and social impacts associated with long vehicle commutes, and the desire to "keep the country-side country" it is preferable to develop compact communities and to locate development within or as close as possible to existing urban areas and employment centers.*

4. ***Protect traditional small towns:*** *Development within and adjacent to Maui's traditional towns should be compatible with and perpetuate their unique character. Hard edges should be maintained around new and existing communities through the use of greenbelts and significant open space.*

5. ***Protect open space and working agricultural landscapes:*** *In light of continuing urbanization, the protection of agricultural and open-space resources will depend on a healthy agricultural industry and progressive planning and regulation. Planning should utilize agricultural lands as a tool to define the edges of existing and planned urban communities, apply innovative site design, create buffers along roadways, provide visual relief, and preserve scenic views.*

6. ***Protect environmentally sensitive lands and natural resources:*** *Environmentally sensitive lands, natural areas, and valued open*

spaces should be preserved. Native habitat, floodways, and steep slopes should be identified so future growth can be directed away from these areas. It will be important to plan growth on Maui in a manner that preserves habitat connectivity, watersheds, undeveloped shoreline areas, and other environmentally sensitive lands.

7. ***Promote equitable development that meets the needs of each community:*** *Each region of the island should have a mix of housing types, convenient public transit, and employment centers. Where appropriate, all neighborhoods should have adequate parks, community centers, greenways, libraries, and other public facilities. No community should have a disproportionate share of noxious activities. Additionally, a fair, efficient, and predictable planning and regulatory process must be provided. A cornerstone of equitable development should reflect a focus on providing affordable housing for all of Maui's residents over developing nonresident housing.*

8. ***Plan for and provide efficient and effective public facilities and infrastructure:*** *Many of Maui's public infrastructure systems and facilities were constructed decades ago and are in need of repairs and upgrades to meet current and future demand. Growth should be planned for areas with existing infrastructure, or where infrastructure can be expanded with minimal financial burden to the public. Transportation infrastructure should be designed to be in harmony with the surrounding area.*

9. ***Support sustainable economic development and the needs of small business:*** *Land use decisions should promote and support sustainable business activities.*

10. ***Promote community responsibility, empowerment, and uniqueness:*** *The development of community plans should be a broad-based, inclusive process. The community plans shall be reviewed by the Community Plan Advisory Committees, the planning commissions, and approved by the Council. The MIP shall provide a framework for the updated community plans. Subsequent proposed community plan amendments should be subject, as much as possible, to local community input.*[viii]

The WCT Master Plan also seeks to embody the values of the existing residents of Waikapū. Waikapū Community Association Statement of Values and Supplemental Statements that have helped shape the WCT Master Plan include:

- *"Respect the principals and values of traditional Maui rural towns and sustainable communities.*
- *Incorporate employment uses into the project to reduce commuting.*
- *Maintain a physical and visual separation between communities.*
- *Prohibit gated neighborhoods.*
- *Preserve prime and productive agricultural lands in perpetuity.*
- *Establish an identifiable public town center.*
- *Preserve and enhance the property's natural and ecological systems, especially Waikapū Stream.*
- *Encourage mixed use development within a defined commercial/business core. Establish opportunities for easily accessible 'mom and pop' stores.*
- *Protect public view corridors of Waikapū Valley, the West Maui Mountains, the ocean, and the plains of Central Maui through the careful placement and massing of buildings and creative use of open space throughout the project.*
- *Incorporate 'green' and 'sustainable' development practices.*
- *Identify, evaluate and preserve historic and cultural landmarks on the property.*

- *Create a tiered and separated transportation network comprised of various modes, including vehicular, transit, walking and biking.*
- *Create pedestrian-friendly neighborhood roadways.*
- *Preserve the integrity of the Waikapū Ahupua'a by working with knowledgeable Kūpuna and Waikapū residents to ensure the conservation and sustainable use of the upland watershed, Waikapū stream and fertile kula agricultural lands.*
- *Provide a variety of recreational opportunities to facilitate good physical health.*
- *Encourage community input and participation in the formulation and execution of the Plan in accordance with the Plan's guiding principles and Statement of Values.*
- *Create a 'Garden Town' by dedicating a permanent agricultural buffer around the town, protecting view corridors, and incorporating a mixture of greenways, parks, open space, and tree-lined streets and landscaped public spaces throughout the project."*

In addition to the above-referenced guiding principles from the MIP and Waikapū Community Association Statement of Values, the desire of the Applicant, Waikapū Properties LLC, is to accomplish the following objectives:

- Be a profitable development for the project's entrepreneurial developers, the County and State;
- Provide a diverse range of market and affordably priced housing in order to address projected housing demand through 2030;
- Develop a "complete community" with a diversity of housing, retail, and civic uses to support residents;
- Protect the environment by directing development away from sensitive lands and by incorporating sustainability practices into the design, development and operation of the project;
- Reduce automobile dependence;
- Provide a jobs and housing balance within the development;

- Create the opportunity for more active and healthy lifestyles through the creation of "complete streets", greenways, and a diversity of parks spaces;
- Reduce the project's energy demand through conservation, energy efficient design and development of on-site renewables;
- Respect traditional Hawaiian lifestyles and existing cultural practices;
- Facilitate agricultural development within the project's protected agricultural lands;
- Maintain a sense of community where Maui residents feel comfortable visiting, living, working and playing.

B. MASTER PLAN CONCEPT

1. Land Use Plan

The project area encompasses approximately 14 acres of State Urban District land and approximately 1,562 acres of State Agricultural District land (**See**: Figure No. 5, "State Land Use Designation"). The existing MTP retail shops, restaurant, convention hall, tropical gardens and lagoon are on the State Land Use Urban designated land, which is a portion of TMK No. (2) 3-6-005:007.

The Applicant is proposing to redistrict approximately 485 acres of State Agricultural District land to the State Urban and Rural Districts. Approximately 1,077 acres of the Applicant's holdings will remain within the State Agricultural District. Approximately 800 of these acres will be permanently protected by the Applicant through an agricultural easement, or similar mechanism, to facilitate diversified agricultural development. These lands are located to the south of the Project's Small Town and Rural Growth Boundaries and extend in the direction of Māʻalaea.

The Project, which will be situated on approximately 499 acres, is envisioned to become a "complete community," encompassing a mixture of single- and multi-family residential units, commercial, and civic uses. In accordance with the MIP's Directed Growth Area Guidelines, the WCT will include 1,433 residential units, plus ~~about~~ up to 146 ʻOhana units, together with neighborhood retail, commercial, an elementary school, parks and open space. The Project will

be bound by the Applicant's agricultural land holdings. The establishment of a firm agricultural boundary abutting the Project's urban and rural boundaries will help to create a "country town" ambiance that will be unique but also similar to Maui's other small towns such as Pā'ia, Makawao and Ha`ikū. The WCT will be built in two five year phases, both mauka and makai of Honoapi'ilani Highway. Development mauka of the highway will focus inward onto a "village center," incorporating the existing buildings and grounds of the MTP. The WCT Master Plan calls for a mixture of affordable and market priced housing, along with commercial, entertainment, parks and civic uses within and around the village center.

Development makai of the highway will focus onto a pedestrian-oriented "main street," a nearby elementary school, and a community park. The makai development is bound to the east by the planned extension of the Wai'ale Road, which will intersect with Honoapi'ilani Highway at the Project's southern boundary (**See**: Figure No. 11, A-B: "Illustrative Land Plan" and Figure No. 12, "Birdseye Illustrative Perspective of the Mauka Village and Agricultural Lands"). For the purpose of assessing the Project's development impacts, the WCT Master Plan and development program is consistent with the MIP's allocation of 1,433 units, plus 'Ohana units. The Applicant understands that local market conditions will ultimately determine the types of units sold and density of development within the project. It is intended that at full build-out the overall character of development, mix of uses and development pattern will be consistent with the master plan vision, design guidelines, and zoning ordinances.

2. Neighborhood Pattern and Urban Design Character

The WCT is envisioned to have two distinct, but interconnected neighborhoods, located mauka and makai of Honoapi'ilani Highway. The community's commercial and social core will be the Village Center at the existing MTP. Here, it is envisioned that residents will be able to enjoy restaurants, go to a farmers market, or bank and shop for daily needs. The defining feature of the Village Center is the Village Green and its dramatic tropical lagoon, which gives the community a distinctly Hawaiian ambiance and will invite residents to gather and relax under a shade tree or at one of the Green's several restaurants/cafés (**See**: Figure Nos. 13, A-E: Rendering Key, Illustrative Rendering of Village Lagoon Looking Mauka (**1**), Illustrative Rendering of Village Lagoon Looking Makai (**2**), Mill House Restaurant (**3**) and the Plantation Store (**4**)".

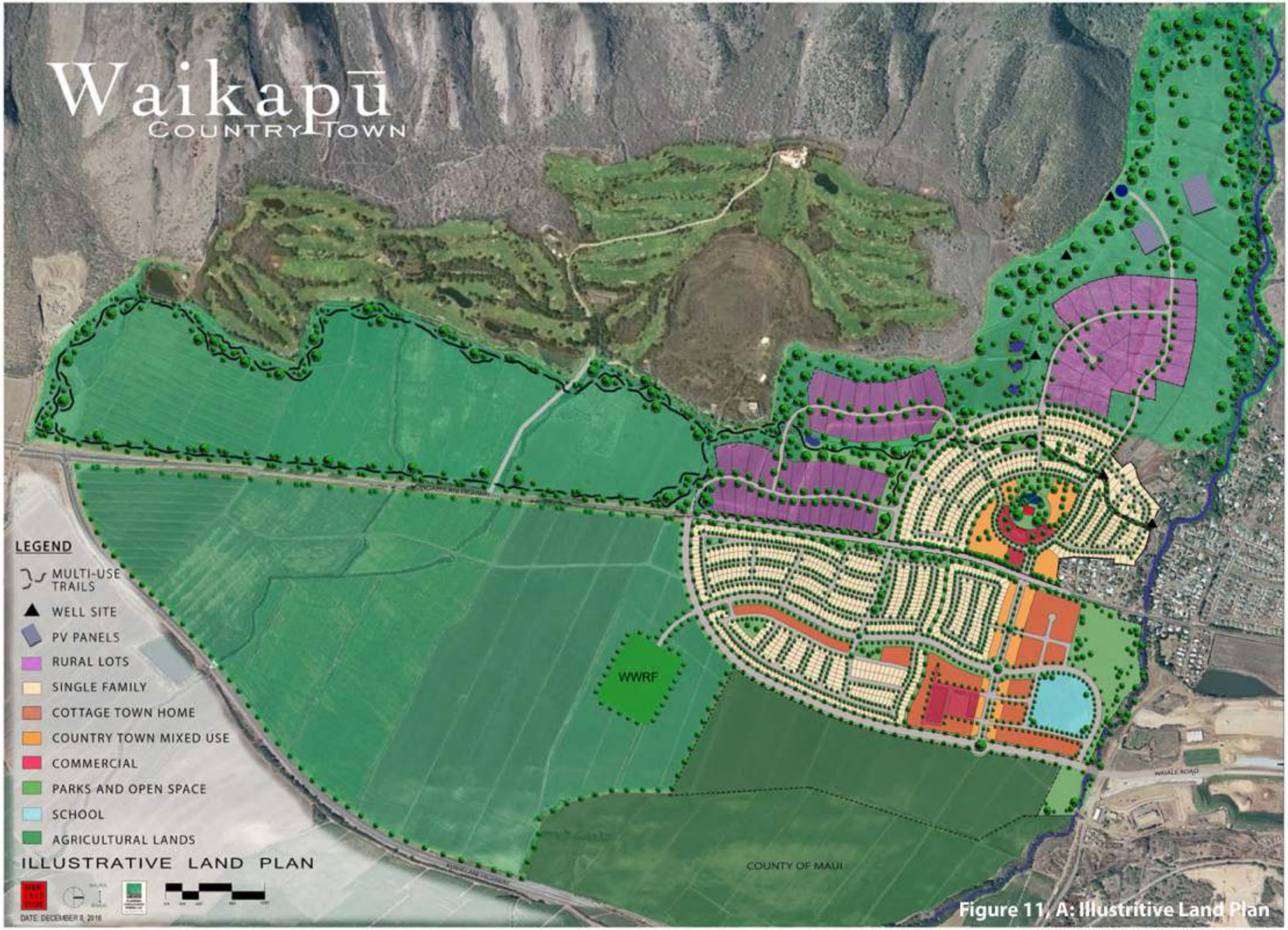


Figure 11, A: Illustritive Land Plan

Figure 12, B
ILLUSTRATIVE LAND PLAN

Figure 12: Illustrative Birdseye Perspective of Mauika Village

FIGURE 13, A

Rendering Key

Not to Scale

WAIKAPU COUNTRY TOWN

PLANNING CONSULTANTS HAWAII LLC

Figure 13 B: Village Lagoon Looking Mauka

Figure 13 C: Village Lagoon Looking Makai

Figure 13 D: Mill House Restaurant

Figure 13 E: Plantation Store

A range of housing types will be provided within easy walking distance of the Village Center. Traditional single-family residential, together with garden cottage residences of varying sizes and configurations will be carefully sited throughout traditional grid and pocket designed neighborhoods. Each neighborhood will have its own special identify but will be connected to one another and the Village Center by complete streets and pedestrian paths (**See**: Figure No. 14, "Conceptual Illustrative Rendering of Pocket Neighborhoods with Pedestrian Path (**5**)" and Figure No. 15, "Conceptual Illustrative Rendering of Single-Family Residential Neighborhood (**6)**".

Each pocket neighborhood will form a cluster of detached island-style cottage residences or duplexes with shared common areas. Traditional single-family residences may be developed as R-O Lot Line or with side-yard setbacks and garages that may be setback from the sidewalks to strengthen the character of the streets.

The clustering of residences will offer a uniquely plantation-town ambiance and will help to ensure affordability. Also, a neighborhood of two- and three-story townhomes, live-work residences and courtyard and garden apartments will complete the residential fabric, which will offer a diversity of housing choices. These buildings will be orientated to capture dramatic Pacific Ocean, Haleakalā, and West Maui Mountain views (**See**: Figure No. 16, Illustrative Rendering of Mixed-Use Neighborhood with Live-Work (**7**)" and Figure No. 17, Illustrative Conceptual Rendering of Lagoon with Village Townhomes (**1**)".

Rural lots of one-half to approximately two acres will be clustered mauka of the cottage residences to serve as a soft transition to working farms and production agriculture. These lots will provide residents with a more rural lifestyle. Through Conservation Subdivision Design (CSD) the lots will be clustered in a manner that preserves important mauka and makai view corridors, drainage ways, and large contiguous tracts of productive agricultural land.

Plantation Makai Neighborhood

The WCTs Plantation Makai Neighborhood will be defined by Main Street, which will developed in the format of a small country town similar to other small towns on Maui, but emphasizing more mixed-use and opportunities for higher density live-work and townhome development.

Figure 14: Pedestrian Path

Figure 15: Single Family Residential Neighborhood

Figure 16: Mixed-Use with Live-Work

Figure 17: Village Lagoon with Townhomes

Main Street is envisioned to provide the urban character of a traditional country town, with businesses fronting onto wide sidewalks, conveniently located on-street parking, canopy shade trees, and a mix of activity-generating land uses. Traffic along Main Street will be calmed by a large planted roundabout that is framed by a greenway, which connects the community park to the north with the commercial district, and multi- and single-family residential neighborhoods to the south. (**See**: Figure No. 18, "Illustrative Conceptual Rendering of Main Street (**8)**").

The Plantation Makai Neighborhood will be home to many of Waikapū Country Town's civic uses. An elementary school is located on twelve acres to the north of Main Street. Adjacent to the school, and in close proximity to residential neighborhoods, is a community park that will provide active and passive recreation opportunities. The County's proposed Central Maui Baseyard and regional park complex are planned within close proximity of the project and will provide community services, employment and regional recreation opportunities within walking or biking distance.

Like Plantation Mauka Village, a full range of housing choices will be provided. Neighborhoods that may comprise garden cottage residences, single-family, R-O Lot Line homes, and a mix of townhouses, live-work, courtyard, and garden apartments will provide diverse housing opportunities for all age and income categories (**See**: Figure No. 14, "Conceptual Illustrative Rendering of Pocket Neighborhoods with Pedestrian Path (**5**)" and Figure No. 19, A-B: "Illustrative Conceptual Rendering of Town Homes (**9**) and Cottage Residences (**10**) along Greenway"). The unique and historic architectural character and materials palette that collectively defines Maui's country towns, including the existing historic communities of Waikapū, Wailuku and Pāʻia will provide guidance for residential, commercial and civic buildings developed within the Project.

Figure 18: Makai Village Main Street

Figure 19 A: Greenway fronting Townhomes

Figure 19 B: Cottage Residences along Greenway

3. Transportation Plan

The following section provides a summary of the WCTs site access and circulation plan for bicycle, pedestrian, and transit facilities.

a. Roadway Network

The WCT incorporates an extensive internal roadway system that allows community residents and visitors to have multiple options for accessing neighborhoods, employment centers, and commercial and institutional uses. At full buildout of the project, access to mauka and makai land uses are provided along Honoapi'ilani Highway at four-legged, controlled intersections with Main Street, East-West Residential Street, and the Wai`ale Road. Additional access to the makai land uses are provided along the Wai`ale Bypass at a roundabout with Main Street and a three-legged intersection with the major North-South Residential Street. Overall, the proposed WCT will provide sufficient vehicular connectivity to varying project uses and the multiple site access points help to better distribute traffic entering and exiting the community (**See**: Figure No. 20, "WCT Street Network"). Once developed, the Applicant intends to dedicate the Project's roadway network to the County and so the proposed system of roads will meet, or exceed, the County's roadway design standards.

b. Pedestrian Network

The WCT follows new urbanist design principles that include compact, higher-density, mixed-uses and an emphasis on walkability and connectivity through extensive pedestrian and bicycle networks on the project site. Figure No. 21 shows the distances between the Village Center and the Main Street core at 1/8 mile, ¼ mile and ½ mile. A ½ mile walk requires about 10 minutes, which is an easy walk for most pedestrians. These characteristics by nature reduce vehicle trip making and promote use of non-motorized modes. Consistent with State of Hawai'i and the draft County of Maui policies on Complete Streets, the transportation facilities for the residential and commercial districts will be developed to form a balanced multi-modal network designed to provide mobility choices and to meet the needs of the community and all roadway users.

A primary objective of the project is to develop a community where walking and biking are the

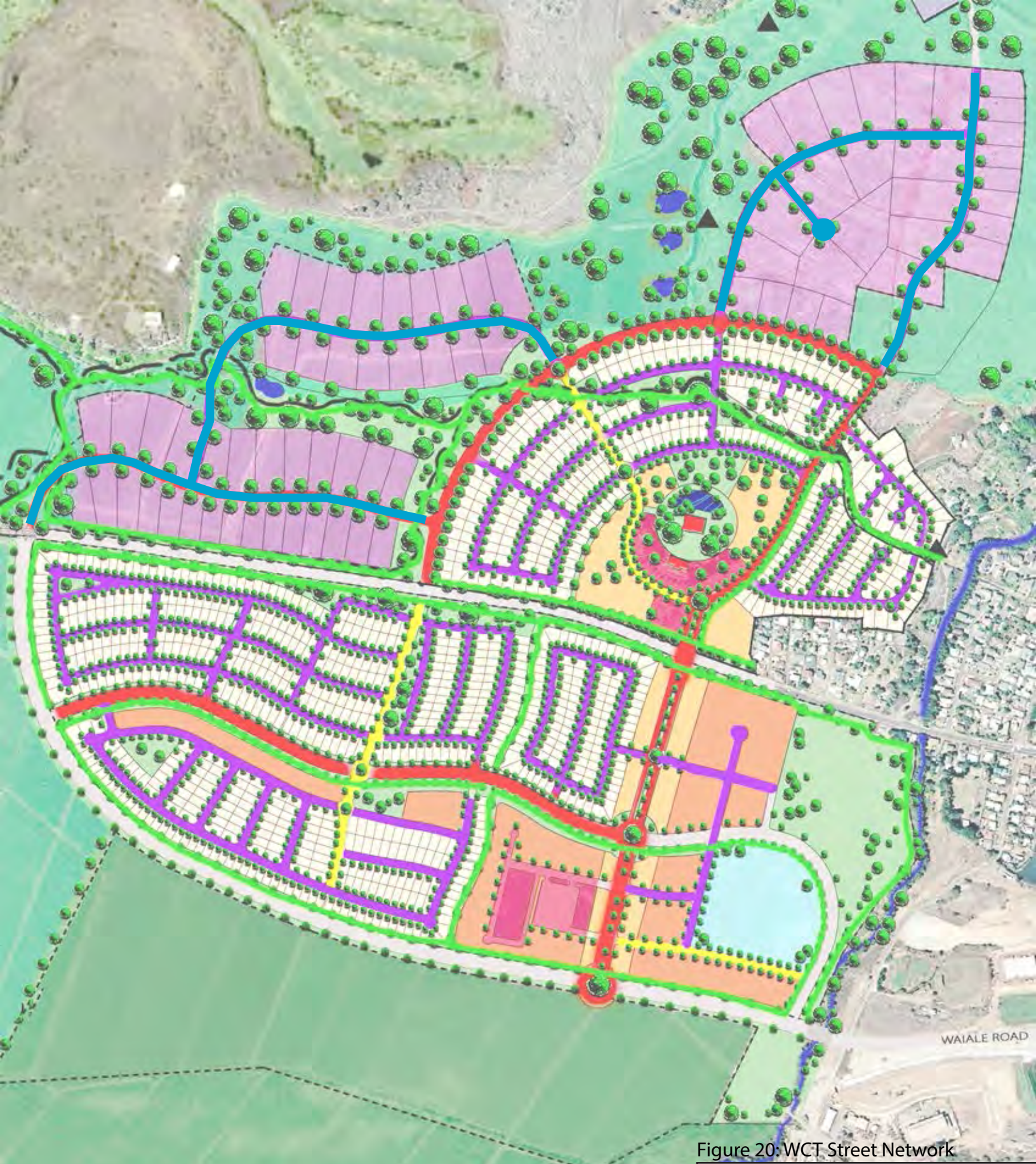
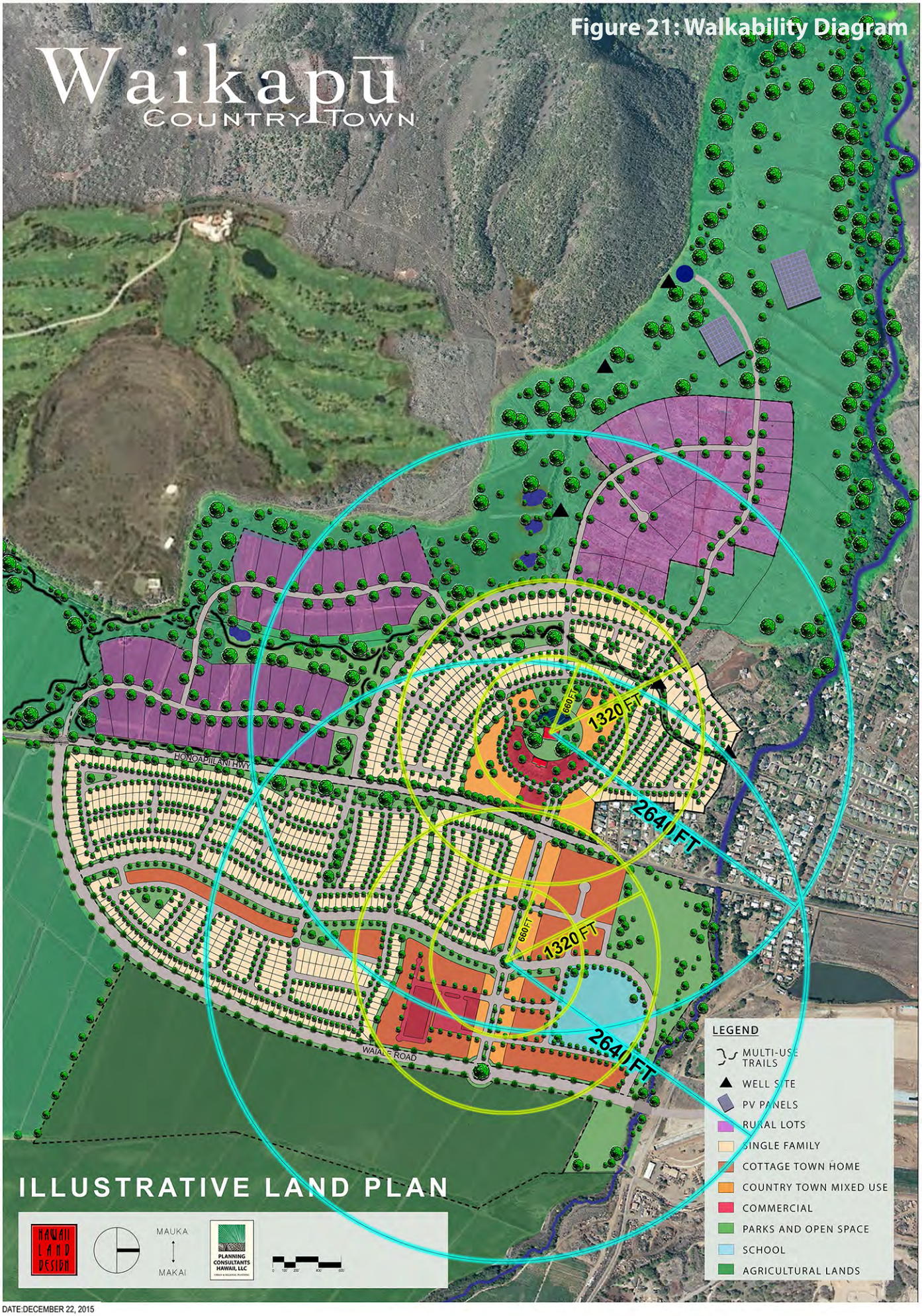


Figure 20: WCT Street Network

Date: December 21, 2015

Figure 21: Walkability Diagram



DATE:DECEMBER 22, 2015

preferred modes of transportation for short commutes. Therefore, approximately eight miles of hiking, biking and walking trails will be incorporated into the project site along with one or two pedestrian/bicycle bridges, if feasible, over Waiko Stream to the north. Also, the development makai of the highway will focus onto a pedestrian oriented "Main Street" close to an elementary school and parks. A principal objective of the Project's active transportation plan is to separate pedestrians and bicyclists from automobiles through the use of multi-use cycle tracks and trails. Such facilities will link the Project's mauka and makai neighborhoods with the Project's commercial areas, civic, and recreational facilities.

All of the Project's streets will emphasize traffic calming and street scape beautification. The use of residential roundabouts at key intersections, landscape planting strips to buffer pedestrians from traffic and linear greenways will serve to beautify the project while providing motivation for residents to walk and bike more. The Project's pedestrian and bicycle facilities will be designed to make walking and bicycling safe, accessible and an enjoyable activity for all age groups. Within the Project's residential neighborhoods, sidewalks will be provided on both sides of the street and traffic calming will encourage on-street bicycle riding. Figure No. 22 shows the Project's non-motorized network of multi-use trails, pedestrian and bicycle facilities.

c. Bicycle Network

The Central Maui Pedestrian and Bicycle Master Plan for 2030 (State of Hawai'i – Department of Health- Healthy Hawai'i Initiative, 2012) highlights that Wai`ale Road has significant unused ROW that could be used to create a separated pedestrian and bicycle path that would be an important link in connecting future growth in Waikapū to Kahului and Wailuku. The specific vision for this Waikapū-Wai`ale Road Connector is to connect Waikapū to Wailuku and Kahului by the Wai`ale Road Bikeway and provide a safe and convenient active transportation commute between communities. The Wai`ale Road Bikeway will be a contiguous bike path or cycle track between Kuikahi Drive and Waiko Road, which would then transition into a separated bike path, or at a minimum a bike lane with signage to Waiinu Road, and eventually transition into a multi-use path with a two-way bikeway and possible pedestrian path that would connect Waiinu Road or the Sandhills residential area with Lower Main Street or Wailuku. The County of Maui encumbered monies in its 2015 Capital Improvement Plan budget to produce design guidelines for this facility and a contractor has been selected.

Figure 22
Waikapu County Town
Pedestrian and Bicycle Facility Network

The WCT provides an opportunity to develop a major segment of this bikeway and to integrate it into the new community. The Final Environmental Assessment for the Proposed Wai`ale Road Extension and East Waiko Road Improvements (County of Maui, 2014) states that the Wai`ale Bypass will include a 10-foot bicycle/pedestrian path on the west side of the roadway. Moreover, the internal WCT site plan will provide both separated pedestrian and bicycle facilities along the collector roads and traffic calming along residential streets to ensure that bicycling is made safer. Figure No. 22 shows the Project's non-motorized network of multi-use trails, pedestrian and bicycle facilities.

d. Vehicular Parking

Parking requirements for the Project will be specified within the Project District zoning ordinance and Design Guidelines that will be prepared to implement the land use plan. The parking standards developed for the WCT will be designed to ensure that adequate parking will be provided throughout the development. It is intended that the parking standards and design guidelines will function together to offer innovative solutions to mitigate some of the deleterious effects that parking can have upon the natural environment and the built urban form. The WCT's parking standards and design guidelines will create opportunities for strategic centrally located parking lots within the town center and near the main street business districts; it will also allow for on-street parking, joint-use parking and the opportunity for cash-in-lieu fees, where appropriate. Minimum on-site parking requirements will be established by use. Where practical and appropriate to the site condition, pervious paving solutions and structured grass parking will be permitted. The WCT's parking standards and design guidelines will be subject to review and approval by the Maui Planning Commission and County Council as part of the zoning entitlement process.

e. Pedestrian and Bicycle Crossing of Honoapi'ilani Highway and Major Arterials

The Project has four proposed crossings of Honoapi'ilani Highway, which are shown and labeled in Figure No 23. Intersections A, C, and D are planned to be signalized intersections. With signalization, intersections A, C, and D would include marked crosswalks on all four legs to support safe pedestrian and bicycle crossings of the highway. The signals at these intersections will communicate with roadway users, whether they are walking, biking, or driving about when they have the right-of-way and when it is intended for them to cross the street. At these

Figure 23: Honoapi'ilani and Arterial Pedestrian Crossings

intersections treatments like protected left-turns and leading pedestrian intervals, will address conflicts with left-turning and right-turning vehicles, respectively. Moreover, to increase pedestrian convenience and safety intersection design considerations; such as providing extended crossing times, utilizing audible devices, providing adequate lighting and signage; will be discussed with State transportation planners. At these intersections, the Applicant will also work with State transportation planners to incorporate design elements that will calm vehicular traffic and minimize crossing distances such as adjusting curb radii and utilizing medians, center refuge islands, and corner bulb-outs.

Intersection B differs from locations A, C, and D because instead of cross-streets, an east-west walking path is proposed for the Project at this location. The presence of the walking path is likely to result in mid-block pedestrian crossings of Honoapi'ilani Highway at this location. This pedestrian crossing will be enhanced with high-visibility crosswalk striping, yield lines, and a pedestrian crossing beacon. The crossing beacon would be activated by pedestrians who are crossing the street so that people approaching in vehicles are made aware that pedestrians are crossing. Options for this location include rectangular rapid flashing beacons (RRFB) or a pedestrian hybrid beacon. It is also suggested that a median with pedestrian refuge be provided within the crossing, if feasible. Figure No. 24, A-B, illustrates the types of pedestrian and bicycle improvements that will be considered for the Project's crossing of Honoapi'ilani highway. In addition, along the mauka (west) and makai (east) frontage of Honoapi'ilani highway, a multi-use pedestrian and bicycle path will be proposed. Landscape plantings and signage will be utilized to direct pedestrians to the appropriate controlled crossings. Along the Main Street arterial (location E) a full service roundabout will be constructed with pedestrian improvements.

f. ~~d.~~ Transit Network

Under existing conditions, the Honoapi'ilani and Waiko bus stop is the only bus stop located in the project vicinity. While the Maui Bus has no immediate plans to expand service in this area, as the WCT site develops, the Project allows for the introduction of public transit to the site, and service to the WCT should be considered as the County plans future expansion of public transit service in this area. Additionally, enhancements and amenities (i.e., benches or covered shelter) could be installed at the existing bus stop and any new bus stops to support future transit riders in this area.

Source: State of Hawaii, May 2013
Hawaii Pedestrian Tool Box: A guide for planning, design, operations, education, to enhance pedestrian travel in Hawaii

EXHIBIT 5.19 *No Dedicated Right-Turn Lane*

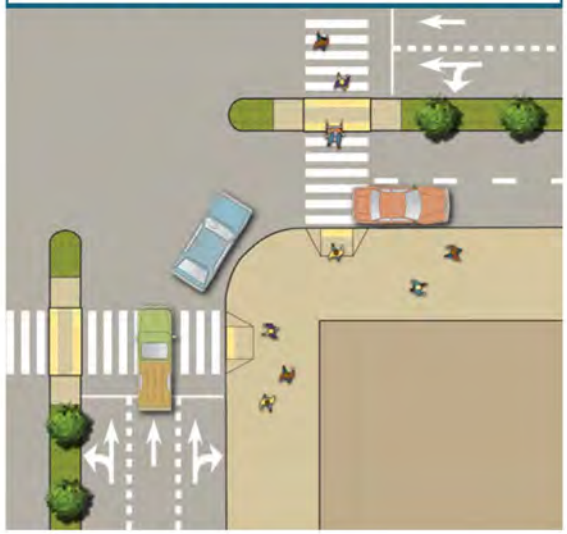


EXHIBIT 5.20 *Dedicated Right-Turn Lane*

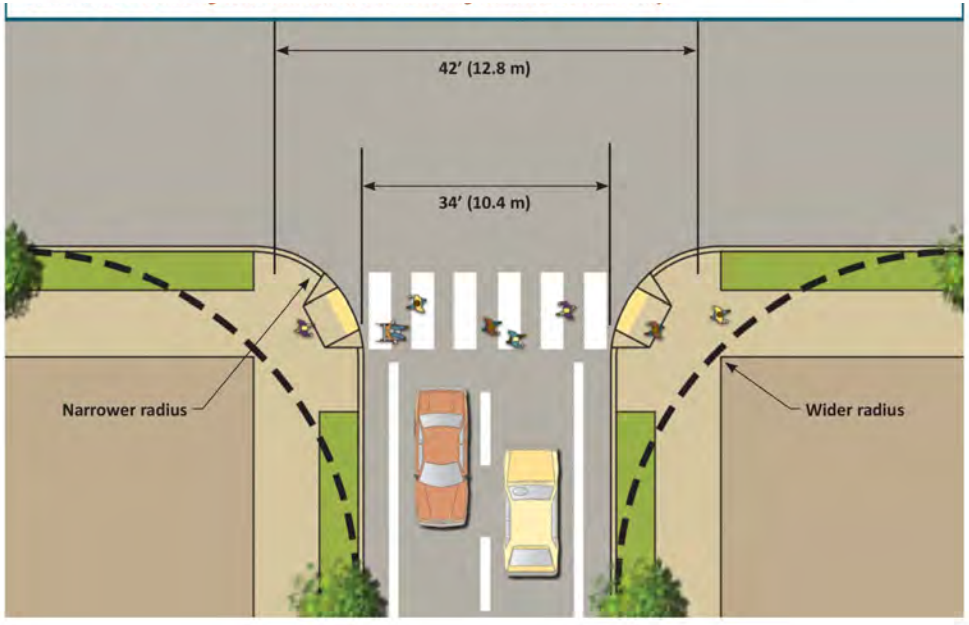


EXHIBIT 5.17 *Corner bulb-outs put pedestrians into the driver's field of vision.*

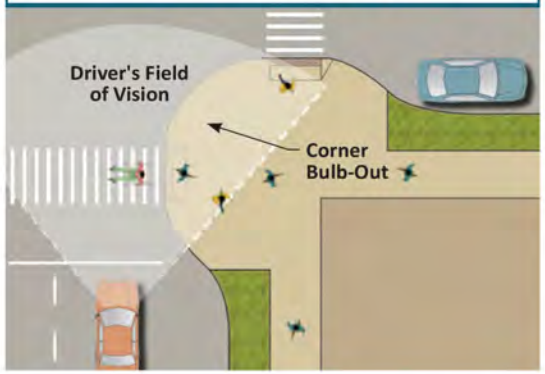


EXHIBIT 5.18 *A median nose added at an intersection crossing provides a refuge for pedestrians, improving their saftety and comfort.*

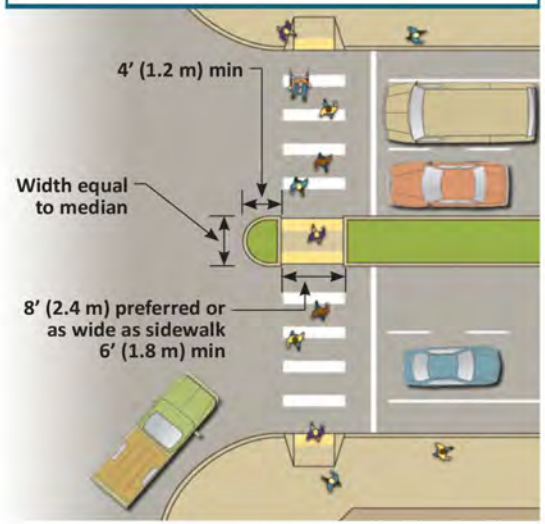
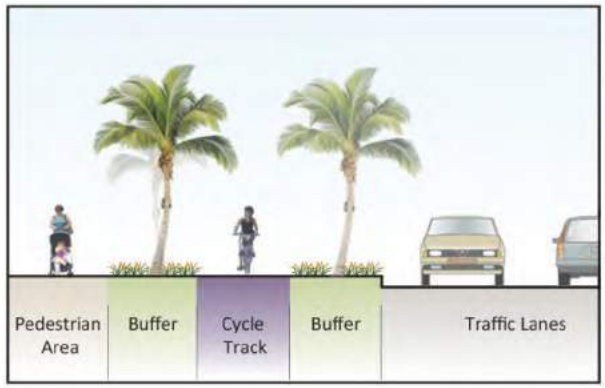


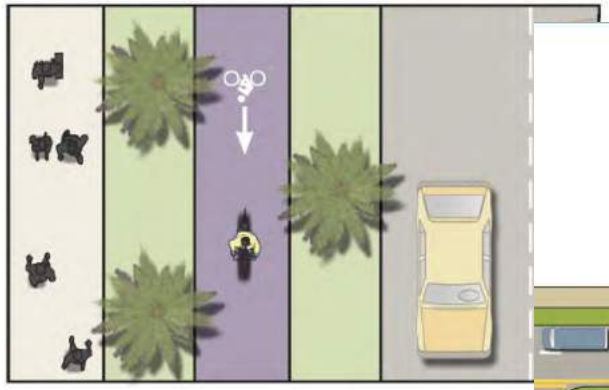
Figure 24 A
Conceptual Honoapi'ilani and Arterial Crossing Concepts

WAIKAPŪ COUNTRY TOWN

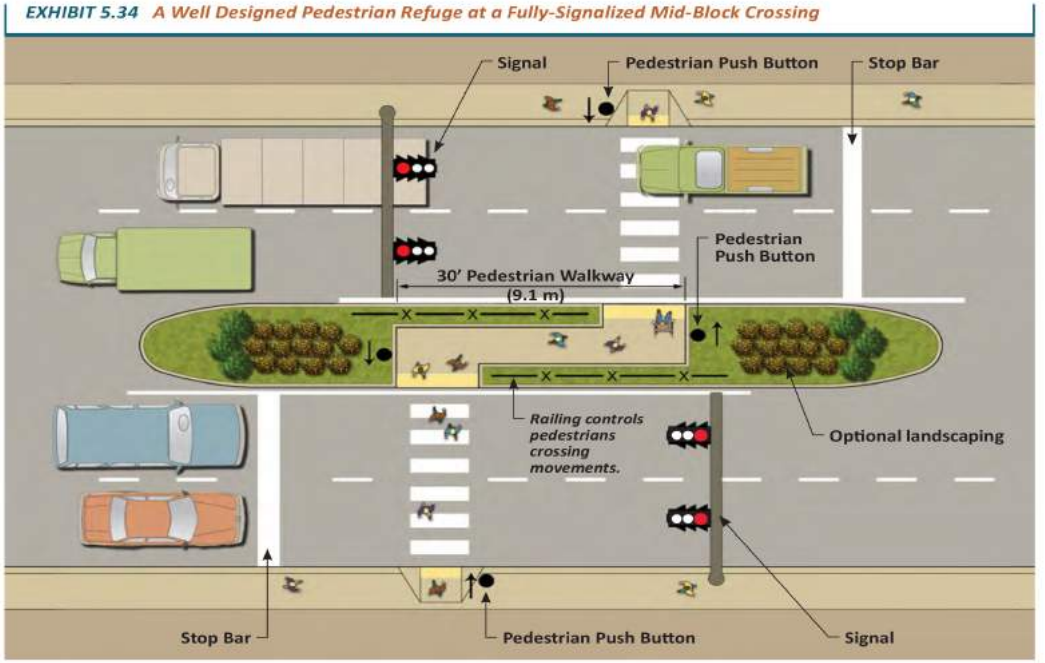
PLANNING CONSULTANTS HAWAII, LLC

Source: State of Hawaii, May 2013 Hawaii Pedestrian Tool Box: A guide for planning, design, operations, education, to enhance pedestrian travel in Hawaii





Cycle Track



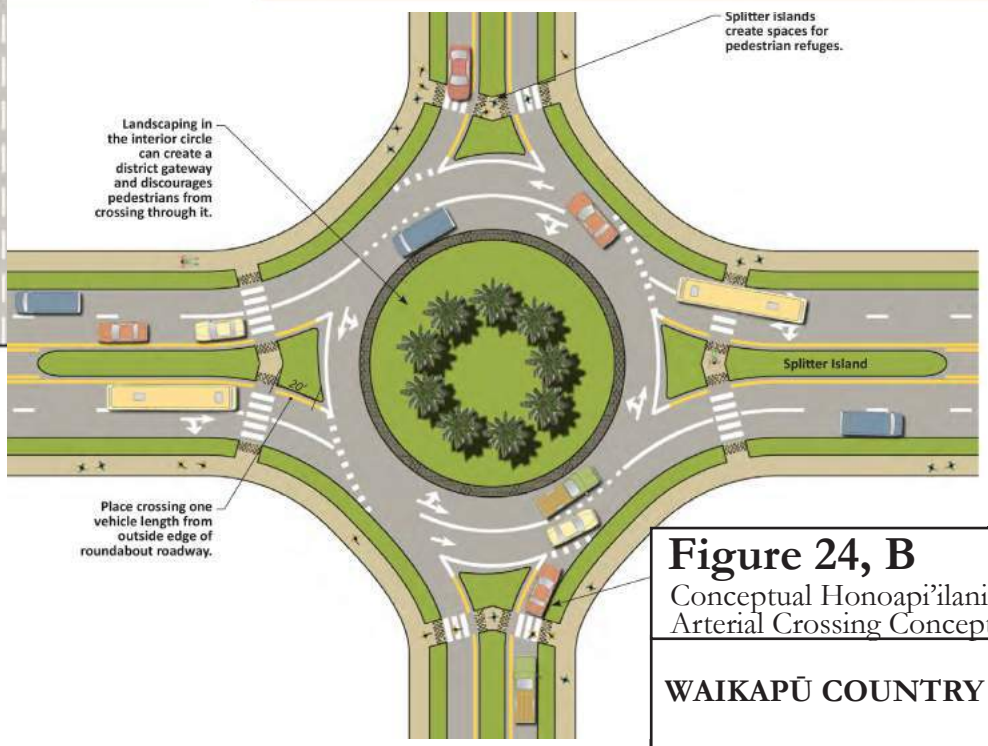


Figure 24, B
Conceptual Honoapi'ilani and Arterial Crossing Concepts

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

4. Parks and Open Space Plan

The WCT offers a variety of open space elements that are intended to serve the diverse recreational needs and interests of the community. There are over 82 acres of active and passive-park and open space elements within the WCT Master Plan. Of the 82 acres, about 32.5 acres are dedicated to the creation of mini-parks, neighborhood parks and a community park. These parks are strategically located to make them easily accessible from the WCTs single- and multi-family residential neighborhoods and the elementary school. The project also includes approximately 50-acres of greenways, some of which incorporate pedestrian and bicycle paths, which will help to safely link neighborhoods to one another and to create visual relief and a diversity of natural topographic elements within the community.

Moreover, the abutting 1,077-acres of agricultural lands owned by the Applicant may create additional opportunities for various forms of open-land recreation such as horseback riding, mountain biking, trail running, hiking and community gardening. The Applicant intends to work closely with the County's Department of Parks and Recreation to plan for the Project's park facilities and to coordinate the subject improvements with nearby facilities including the Waikapū Park and Community Center and the planned Central Maui Regional Park. Figure 25 ~~23~~ is a conceptual illustration of the various park elements within the WCT:

- ***Village Green (1)***. The Village Green is the site of the existing Mill House Restaurant and MTP lagoon. The green open area of the Village Green is approximately 1.5 acres, which includes a passive park on the mauka side of the lagoon. The Village Green will function as the WCTs civic and cultural center. It will be landscaped with tropical shrubs, flowers and canopy shade trees fronting onto the existing lagoon creating a unique sense of place. The Village Green will offer passive recreation in the form of areas for picnics, community gatherings and special events. Views from the green will be of the West Maui Mountains, the mauka agricultural lands and the botanical garden environment that exists around the lagoon and Mill House Restaurant.
- ***Waihe'e Ditch Greenway and Neighborhood Park (2 and 3)***. The Waihe'e Ditch Greenway is intended to become an approximate 40-feet wide multi-use path and trail that will course north to south across the mauka residential neighborhoods and beyond to the rural open space and agricultural trail systems. This multi-use path will become

an on-site amenity for walking, jogging and biking and will provide safe access to several small neighborhood pocket parks located along the greenway.

- ***Waikapū Station Greenway and Neighborhood Parks (4 and 5)***. The Waikapū Station Greenway is intended to link WCT's makai residential neighborhoods with commercial services along Main Street, the elementary school and the Waikapū River Community Park. The greenway is about 1 mile long and is about 40-feet wide. It will provide space for a multi-use pedestrian and bicycle path and landscape planting with canopy shade trees. The Waikapū Greenway also links a small .5-acre neighborhood park at its south end with another .5-acre neighborhood park centrally located to the greenway and the elementary school and the Waikapū River Park along the WCTs western boundary.
- **Mauka Makai Greenway (6).** The Mauka Makai Greenway links the multi-use path located along Honoapi'ilani Highway with the multi-use path located along the Wai`ale Bypass Road. This approximate 30-feet wide, and ½ mile long pathway, will link the makai single-family residential neighborhoods with the Waikapū Station Greenway. It will offer a safe and active transportation route to the elementary school and the Waikapū River Park. This route may also help to facilitate future pedestrian access to a future intermediate school that is planned for Wai`ale and to the County's regional park complex planned just to the east of the WCT.
- **Honoapi'ilani Highway *Multi-Use Path (7 and 8).*** The WCTs urban and rural frontage along Honoapi'ilani Highway is about ¾ miles. Setbacks of at least 60-and are proposed along the mauka and makai sides of the highway. A meandering 10-feet wide multi-use path is proposed along the mauka and makai sides of the highway together with canopy shade trees and tropical bushes and groundcovers. The multi-use paths will provide a safe active transportation route along the project frontage between the Village Green, Main Street, the Waikapū River Park and Waikapū Town.
- ***Waikapū River Park (9).*** The approximate 18.5-acre Waikapū River Park will provide active and passive recreation opportunities to the Waikapū Community. Based upon future community input and the needs of the Department of Parks and Recreation, this park could include active recreation facilities such as softball and soccer fields, basketball and tennis courts or skateboard facilities. The Park may also include passive recreation opportunities such as shaded areas for family picnicking, tot lots, community gardens and jogging and exercise facilities. The Waikapū Station Greenway will connect

the Park by a multi-use separated pedestrian and bicycle path to the Project's residential neighborhoods located to the south and west.

- ***Community Gardens (10).*** The WCT may include opportunities for community gardening within its park system and in appropriate areas within the rural and agricultural lands. It is envisioned that small plots could be offered for lease and that limited shared common facilities could be provided to community gardeners. The provision of community gardens will depend upon community demand for these types of facilities and whether adequate provisions can be made for the gardens security and maintenance.
- ***Open Land Recreation (11).*** Open land recreation uses are permitted within the State and County agricultural districts. These uses may include horseback riding, mountain biking, non-commercial camping, community gardening, petting zoos, hiking and other similar uses. It is expected that these and other similar uses may be permitted within the WCTs agricultural lands, provided that these activities do not interfere with agricultural operations.

5. Agricultural Development Plan

The WCT's principal land use beyond the Project's urban and rural boundaries will be agriculture. The WCT's agricultural lands comprise approximately 1,077 acres, of which 800 acres will be dedicated to agricultural use through a conservation easement. The remaining 277 acres may be subdivided into as many as five agricultural lots. The conservation easement will limit the 800 acre preserve to only those uses permitted within the State Land Use Agricultural District and the County Agricultural District; however; the easement will prohibit farm and/or residential dwellings from being constructed and will only allow agricultural subdivisions which serve the purpose of creating agricultural enterprises[5]. The specific details of the conservation easement are still being considered.

[5] Agricultural enterprises would be any business or non-profit entity engaged in any permitted agricultural and/or special use approved pursuant to HRS, Chapter 205 and/or Maui County Code Chapter 19.30A, except that "farm dwellings", as defined in HRS Chapter 205, or any other type of residential dwellings including "farm labor dwellings", would not be permitted within the Agricultural Preserve.

FIGURE 25

Conceptual Parks and Open Space Master Plan

Not to Scale

WAIKAPU COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

The Applicant intends to maintain ownership of the agricultural preserve. However, it is possible that in the future the Applicant may decide to deed a portion and or all of the preserve to the State and or County for the purpose of establishing an Agricultural Park. Long-term ownership and management options are still being considered. For the foreseeable future, the Waikapū Properties, LLC and Wai'ale 905 Partners intend to manage the 800-acre Agricultural Preserve.

Within the agricultural preserve, several hundred acres will be developed as a public and/or private agricultural park to help facilitate Maui's agricultural development. The Maui Agricultural Development Plan (July 2009) was prepared by the Maui Country Farm Bureau in association with the County of Maui's Office of Economic Development in order to identify opportunities for the development and diversification of Maui's agricultural industry. The Plan states in part:

> *"The industry faces numerous immediate and longer-term challenges and opportunities. The availability of an adequate and reliable supply of affordable irrigation water is a critical issue as competing demands from urban and instream uses intensifies, and drought conditions persist."*
>
> *"Greater access to affordable land, a reliable and affordable inter-island transportation system, and greater access to markets are also critical issues to be addressed if Maui agriculture is to achieve sustained growth."*

The establishment of WCT's centrally located 800-acre agricultural preserve, with highly productive lands and affordable irrigation water, may help Maui farmers compete in local, mainland and international markets. These lands are located about three miles from Maui's only commercial harbor and its principal airport, servicing the mainland and Oahu.

There are currently ~~three~~ four commercial farms farming the Project areas lands. These include Kumu Farms, Hoaloa Farms, Makani Olu Ranch, and Beef and Bloom. ~~Hawai'i Taro LLC, and HC&S~~. ~~Waikapū Properties LLC~~ Makani Olu Ranch is raising a herd ~~heard~~ of Texas Longhorn

cattle and Beef and Bloom Black Angus cattle on the higher elevation agricultural lands. The recent discontinuation of HC&S's farming of sugarcane on the Project's agricultural lands will allow WCT's existing diversified farmers, as well as new farmers, to establish diversified agriculture onto these former sugarcane lands. Vehicular access into the Agricultural Preserve will be from the Wai'ale Bypass and from the Project's internal roadways. Access may also be available from Honoapi'ilani Highway and Kuihelani Highway, subject to approval of the State Department of Transportation. The longer-term agricultural development plan includes the following types of uses, the location of which are shown conceptually on Figure No. 26 A-C ~~24~~, "Conceptual Agricultural Master Plan":

- ***Waikapū Commons Agricultural Park (1).*** This private and/or publically owned and managed agricultural park will provide long-term leases to qualified Maui farmers for diversified agricultural production. The park would be serviced by irrigation water that would be supplied from on-site agricultural wells. The water would be stored in agricultural reservoirs and distributed to the Park as demand warrants and at rates to support profitable farming operations. It is expected that Kumu Farms and Hoaloa Farms ~~Hawaiian Taro LLC~~, both existing farmers on WCT lands, will relocate their operations to the agricultural park. Other qualified farmers will also be given an opportunity to lease these lands for farming endeavors. The area of the Park will likely range from approximately 250 to 800 acres, depending upon farmer demand. Figure 26, A ~~24~~ is an illustrative map identifying conceptually the location of the Agricultural Park and other potential agricultural uses on the Property.
- ***Community Farmers Market, Fruit and Vegetable Stands and other Direct Marketing (2, 3)***. The WCT will encourage direct marketing to consumers of agricultural products grown on the property and from elsewhere within Maui County. It is envisioned that a vibrant farmers market and fresh fruit and vegetable stands may be located within the WCT at strategic locations as shown on Figure 26, A.~~24~~ Because of the WCTs close proximity to Wailuku Town, Kahului and Kīhei, farmers may also decide to establish pick-your-own farms or participate in community supported agricultural programs where orders for produce are placed directly by consumers with local WCT farmers. On-site restaurants, such as the existing Mill House Restaurant, may also serve as customers agricultural products grown on WCT lands.

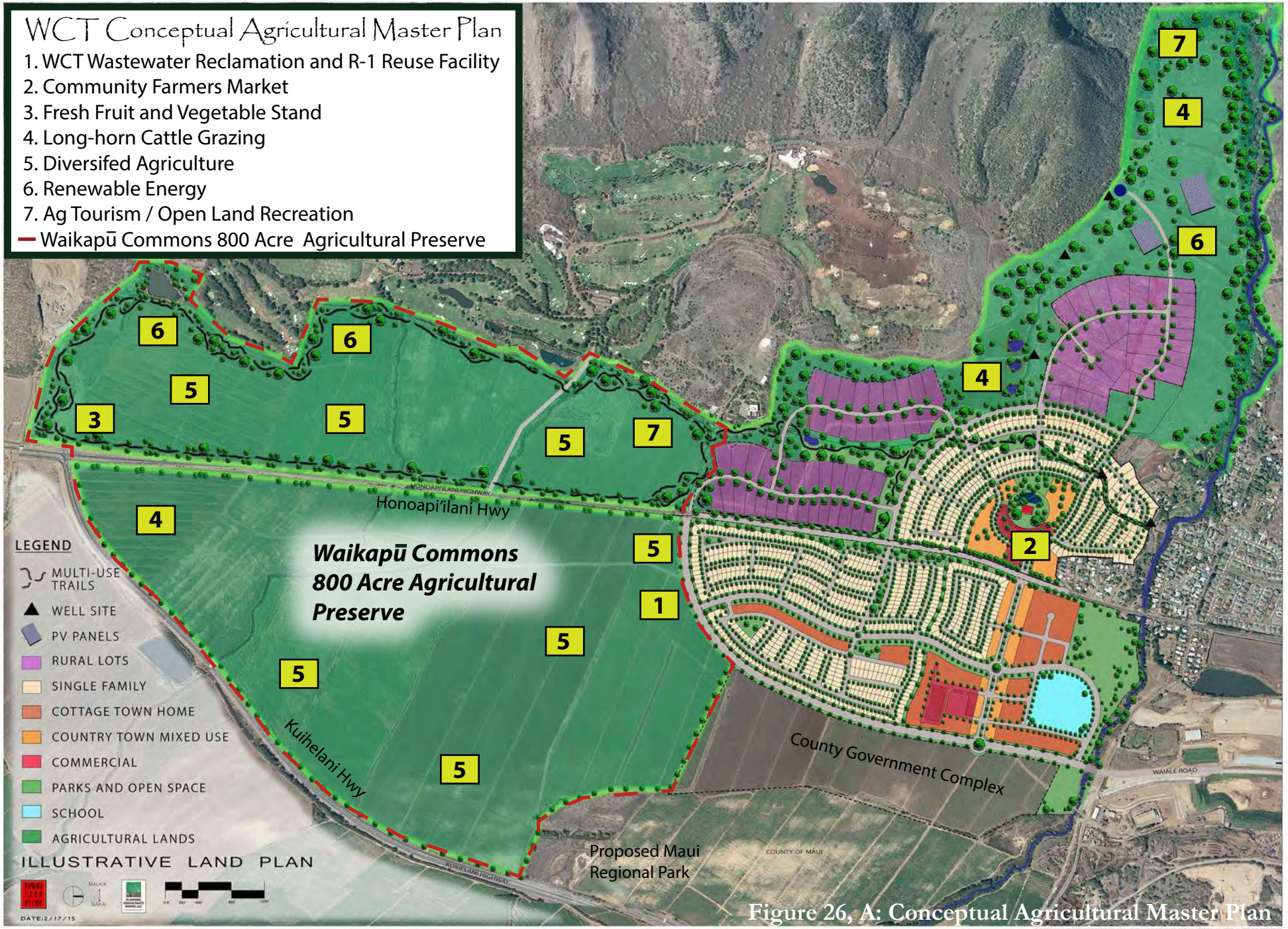


Figure 26, A: Conceptual Agricultural Master Plan

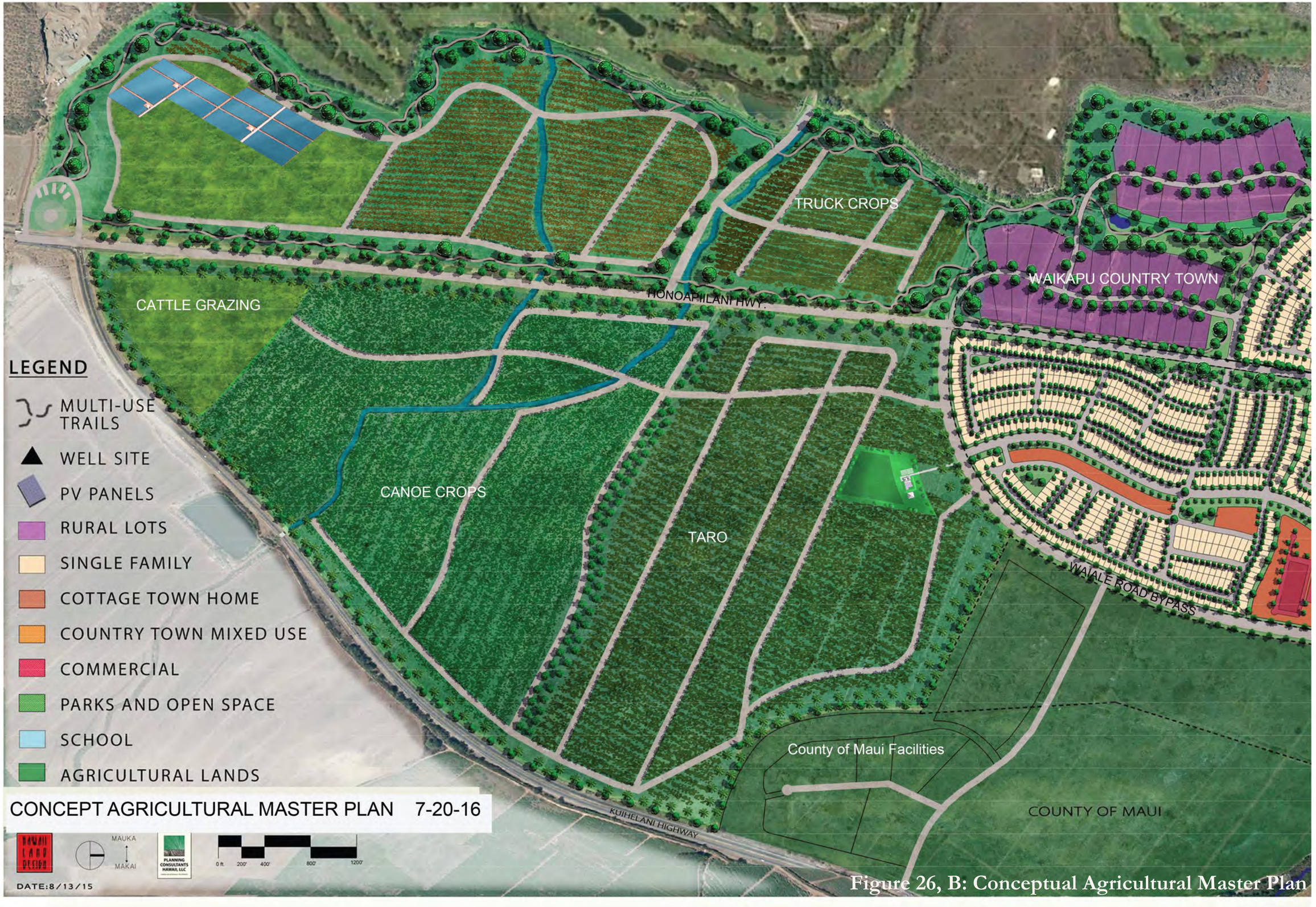


Figure 26, B: Conceptual Agricultural Master Plan

Figure 26, C: Conceptual Agricultural Master Plan

- ***Grazing of WCT Long-horn Cattle (4)***. A herd ~~heard~~ of approximately 200 Longhorn cattle are currently grazing the WCT's mauka agricultural lands. It is envisioned that a larger herd ~~heard~~ of cattle may be established on WCT lands not used for other diversified agricultural uses.
- ***Diversified Agriculture (5)***. Other agricultural production such as the growing of coffee, nursery products, orchards, sustainable forestry, energy crops, sugar and livestock may be conducted on WCT agricultural lands.
- ***Renewable Energy (6)***. Establishing one or more small solar farms may be considered if these farms are technically and economically viable and do not interfere with agricultural operations. These solar farms, if established, would be located on relatively small areas of land and would be subject to the permitting requirements of State and County land use laws, which regulate where and how much agricultural land can be used for renewable energy. Section 205-4.5 (20) & (21), Hawai'i Revised Statutes (HRS), states that solar energy facilities on "B" rated land cannot comprise more than ten percent of the acreage of the parcel or 20 acres of land without the issuance of a special use permit. The State Department of Agriculture in its March 30, 2016 comment letter (**See**: Appendix S, DEIS Agency and Community Comment and Response Letters) suggested that the Applicant consider incorporating compatible agricultural activates onto lands also used for renewable energy. The purpose of the proposed solar farms would be to generate clean renewable energy, while developing a diversity of revenue sources to support the agricultural lands.
- ***Agricultural Tourism/Active Recreation (7)***. Non-intrusive open land recreation activities may be permitted in appropriate locations if they do not conflict with agricultural operations. Likewise, agricultural tourism may be permitted in appropriate locations. Like renewable energy, appropriate agricultural tourism activities could help to generate alternative revenue sources to support the agricultural lands, while creating visitor industry jobs and additional on-site demand for locally produced agricultural products.

The Agricultural Preserve will be dedicated in perpetuity through an agricultural conservation easement once all of the entitlements for the WCT's proposed urban and rural lands are granted in accordance with the WCT Master Plan development as described in Section III.B of the FEIS.

The agricultural conservation easement will prohibit the development of farm dwellings and/or residential dwellings of any kind, including farm labor dwellings, within the Preserve. However, it is planned that any other agricultural use, agricultural accessory uses or special uses as permitted by Hawai'i Revised Statutes (HRS), Chapter 205 and Maui County Code (MCC), Chapter 19.30A will be permitted within the Agricultural Preserve. The underlying State Land Use Designation and County Zoning of the property will not be changed by the conservation easement, except that dwellings units will be prohibited within the Preserve. Once established, the Agricultural Preserve will be managed by the existing ownership entities; or it will be managed by a separate entity with the specific responsibility for the management and operations of the Preserve.

6. Sustainability Plan

Planning Consultants Hawai'i, LLC is preparing a Sustainability Plan to set forth project specific goals, objectives and strategies in the areas of urban design, construction and operation phase management. Together, the strategies identified will help to create a more sustainability community by mitigating development impacts and making more efficient use of scarce resources. Table No. 16 ~~The following~~ documents the Project's sustainability goals, objectives and strategies in the following areas: urban design, energy use, water use, storm drainage, waste management, local food production, and health and wellness.

Table 16: WCT Sustainability Goals, Objectives and Strategies

URBAN DESIGN	
UD.1	**Goal:** Establish a more complete community that balances housing with the provision of on-site supporting commercial, civic and employment uses.
UD.1.a	Integrate a balanced mix of residential, commercial, employment, and civic uses into the development.
UD.1.b	Incorporate compact and mixed use development patterns.
UD.1.c	Provide a diversity of housing choices for low, moderate and high income wage earners.
UD.1.d	Build "Complete Streets".
UD.1.e	Establish a diverse range of active and passive recreation opportunities.

UD.1.f	Encourage community gardening within designated areas.
UD.1.g	Integrate off-road pedestrian and bicycle paths and trails.
UD.1.h	Ensure efficient vehicular and non-motorized connectivity between residential, commercial and civic uses.
UD.1.i	Incorporate adequate transmit stops throughout the development.
UD.1.j	Meet all ADA standards for accessibility.
ENERGY USE	
EU.1	**Goal**: Reduce WCTs demand for transportation fuels
EU.1.a	Incorporate compact and mixed use development patterns.
EU.1.b	Build "Complete Streets".
EU.1.c	Ensure efficient vehicular and non-motorized connectivity between residential, commercial and civic uses.
EU.1.d	Incorporate adequate transit ~~transmit~~ stops throughout the development.
EU.1.e	Incorporate electric vehicle recharging stations within the development.
EU.1.f	Support regional bicycle and pedestrian ways to connect the development with neighboring communities.
EU.2.A	**Objective:** Reduce energy use in residential, commercial and institutional buildings by 30% to 50% or more from baseline levels
EU.2.A.a	Promote energy efficiency as a key consideration in the design of new buildings.
EU.2.A.b	Utilize an Integrated Design Process to determine the optimal mix of energy efficiency measures.
EU.2.A.c	Establish a design team with expertise in the design of energy efficient residential, commercial and institutional buildings.
EU.2.A.d	Utilize the following types of guides in the design of new buildings: ASHRAE Advanced Energy Design Guides for Small Office Buildings, for Small Retail Buildings, for K-12 School Buildings, etc.
EU.2.A.e	Consider utilizing the Energy Star Certified Homes Prescriptive or Performance Path recommendations to achieve Energy Star certification for single- and multi-family residences.
EU.2.A.f	Promote LEED certification of commercial and institutional buildings throughout the project.

EU.2.A.g	Orientate buildings to take optimum advantage of natural cooling and ventilation.
EU.2.A.h	Encourage the use of daylighting within new buildings.
EU.2.A.i	Utilize LED lighting to the maximum extent possible for interior and exterior lighting.
EU.2.A.j	Utilize canopy trees to provide shade and cooling of buildings.
EU.2.A.k	Install solar hot water heating into all single-family homes.
EU.2.A.l	Allow for laundry to be hang-dried in appropriate areas.
EU.3.B	**Objective:** Facilitate carbon storage and sequestration with additional forest and tree coverage
EU.3.B.a	Create an Urban Tree Canopy by planting shade trees in the following types of areas: along residential and collector streets, within parking lots, within passive and active recreation areas, and as landscape features within residential, commercial and institutional lots.
EU.3.B.b	Consider participation in Federal and State reforestation programs such as the State of Hawai'i Forest Stewardship Program (FSP) and the Conservation Reserve Enhancement Program (CREP).
EU.4.C	**Objective:** Develop renewable energy sources to offset at least 40 percent of the project's electrical energy demand
EU.4.C.a	Incorporate PV and battery storage systems as options for potential homebuyers.
EU.4.C.b	If technically and financially viable, develop on-site solar, wind and hydro resources.
EU.4.C.c	Consider farming and/or leasing agricultural lands for viable bio-fuel crops.
EU.4.C.d	Assess the viability of storing energy on-site for direct sale to WCT customers if connecting to the MECO grid is not available.
WATER USE	
WU.1	**Goal:** Significantly reduce the project's potable and non-potable water demand
WU.1.A	**Objective:** Reduce the overall project demand for potable water use by 30 to 50 percent
WU.1.A.a	Utilize low flow fixtures that exceed baseline standards established by the 2006 Uniform Plumbing Code by at least 20%.
WU.1.A.b	Utilize non-potable water for irrigation of common open spaces, parks, etc.

WU.1.A.c	Establish dual water systems to provide non-potable water for irrigation of parks and open space, residential and commercial landscape planting.
WU.1.A.d	Allow for rainwater catchment throughout the project.
WU.1.A.e	Utilize non-potable water reservoirs to store, capture, and manage the supply of non-potable water.
WU.1.A.f	Study the practicality of rainwater harvesting including the capture and storage of runoff for irrigation.
WU.1.A.g	Utilize draught tolerant plants, appropriate for the climate zone, throughout the project.
WU.1.A.h	Utilize drip irrigation and water conserving sprinkler systems.
STORM DRAINAGE	
SD.1	**Goal**: Convert storm water runoff into an economic and environmental resource
SD.1.A	**Objective:** Remove pollutants and facilitate ground water recharge
SD.1.A.a	Utilize a combination of structural and non-structural BMPs in a sequence to enhance treatment of runoff.
SD.1.A.b	Utilize Low Impact Development Techniques such as bioretention, grassed swales, level spreaders, vegetative filter strips, natural buffers and open space to reduce runoff volumes, promote infiltration, and remove pollutants.
SD.1.A.c	Assess the following types of structural systems to treat runoff, facilitate groundwater recharge, and contain any increase in runoff to the site: wet-ponds, infiltration basins, infiltration trenches, French drains, exfiltration trenches, etc.
SD.1.A.d	Promote the use, where practical, of grassed parking and permeable pavements for residential driveways, commercial and non-commercial parking lots and in other areas where appropriate.
SD.1.A.e	Establish a riparian buffer along the Waikapū Stream.
SD.1.A.f	Utilize catch basin inserts and/or oil/grit separators to remove oil, grease, trash and other pollutants from runoff.
SD.2.A	**Objective:** Prevent runoff and pollutants from being discharged from construction sites

SD.2.A.a	During the construction phase, utilize a combination of construction phase BMP's such as: • Silt fences; • Dust screens; • Seeding/sodding/mulching; • Covering exposed dirt; • Regular watering; and • Earthen berms.
SD.2.A.b	Obtain a National Pollutant Discharge Elimination System (NPDES) permit for areas of grading that are larger than one acre.
WASTE MANAGEMENT	
WM.1	**Goal:** Reduce the volume of project waste from entering landfills during construction and operations
WM.1.a	Develop a construction waste management policy and program for the construction phase.
WM.1.b	Establish a recycling program for residential, commercial and institutional users.
WM.1.c	Locate a material recycling collection center within the project.
WM.1.d	Assess the feasibility of establishing an on-site composting program for organic materials.
WM.1.e	Assess the feasibility of instituting a bi-annual durable goods collection drive.
AGRICULTURE DEVELOPMENT & LOCAL FOOD PRODUCTION	
AD.1	**Goal:** Create and maintain economically viable agricultural production on WCT agricultural lands
AD.1.a	Protect in perpetuity approximately 800 acres of prime agricultural lands from urban development through an agricultural easement or similar mechanism and limit subdivision approximately 5 lots for the remaining lands.
AD.1.b	Establish a public and/or private agricultural park within a portion of the project's agricultural lands.
AD.1.c	Provide opportunities for community gardening within the proposed parks and/or open space network
AD.1.d	Encourage the establishment of a farmers market, farm stands, and community

	supported agricultural programs within the WCT.
HEALTH & WELLNESS	
HW.1	**Goal:** Establish a community that promotes health and wellness
HW.1.a	Establish a network of off-road pedestrian and bicycle paths.
HW.1.b	Establish a compact and mixed-use settlement pattern that promotes active transportation.
HW.1.c	Construct "complete streets" that safely accommodate multi-modal transportation.
HW.1.d	Provide a network of parks and open spaces linked by pedestrian and bicycle paths.
HW.1.e	Promote the establishment of health related businesses and services within the development, including: gyms and fitness centers, health food stores, farmers markets, medical services, etc.
HW.1.f	Establish the opportunity for community gardening.
HW.1.g	Promote and support the establishment of pedestrian and bicycle networks linking the project with neighboring communities.
HW.1.h	Incorporate a diversity of park types, including mini-parks, neighborhood parks and community parks with both active and passive uses.

7. Phasing Plan

The WCT will be implemented in two five year phases through 2026. Figure No. 27 ~~25~~, "Conceptual Phasing Plan" and Tables 17 ~~14~~, 18 ~~15~~and 19 ~~16~~ show the Project's conceptual land use program for Phase I - 2017 through 2021 - and for Phase II - 2022 through 2026.

Table 17 ~~14~~: Phase I Conceptual Land Use Program for 2017 through 2021

Land Use	Net Acres	Gross Acres	Residential Units	Net Residential Density	FAR	Sq. Ft. Commercial
Single Family	45.51		332	7.30		
Multi-Family/Town	17.213	24.59	216	12.55		

Land Use	Net Acres	Gross Acres	Residential Units	Net Residential Density	FAR	Sq. Ft. Commercial
Home						
Rural	22.35		15	0.67		
Country Town Mixed-Use	16.168	20.21	127		0.25	58,475
Commercial / Employment		12.89			0.25	140,372
Existing Town Center / Lagoon		4.88				
School		12.00				
Active & Passive Parks		26.66				
Total Residential Units	**690**					
Total ʻOhana Units	**41**					
Total Residential Units	**731**					
Total Commercial / Employment	**198,847**					

Table 18 ~~15~~: Phase II Conceptual Land Use Program for 2022 through 2026

Land Use	Net Acres	Gross Acres	Residential Units	Net Residential Density	FAR	Sq. Ft. Commercial
Single Family	85.54		638	7.46		
Multi-Family / Town Home	3.99	5.7	40	10.00		
Rural	102.47		65	0.63		
Active / Passive Parks		5.78				
Total Residential Units	**743**					
Total ʻOhana Units	**105**					

Land Use	Net Acres	Gross Acres	Residential Units	Net Residential Density	FAR	Sq. Ft. Commercial
Total Residential Units	**848**					

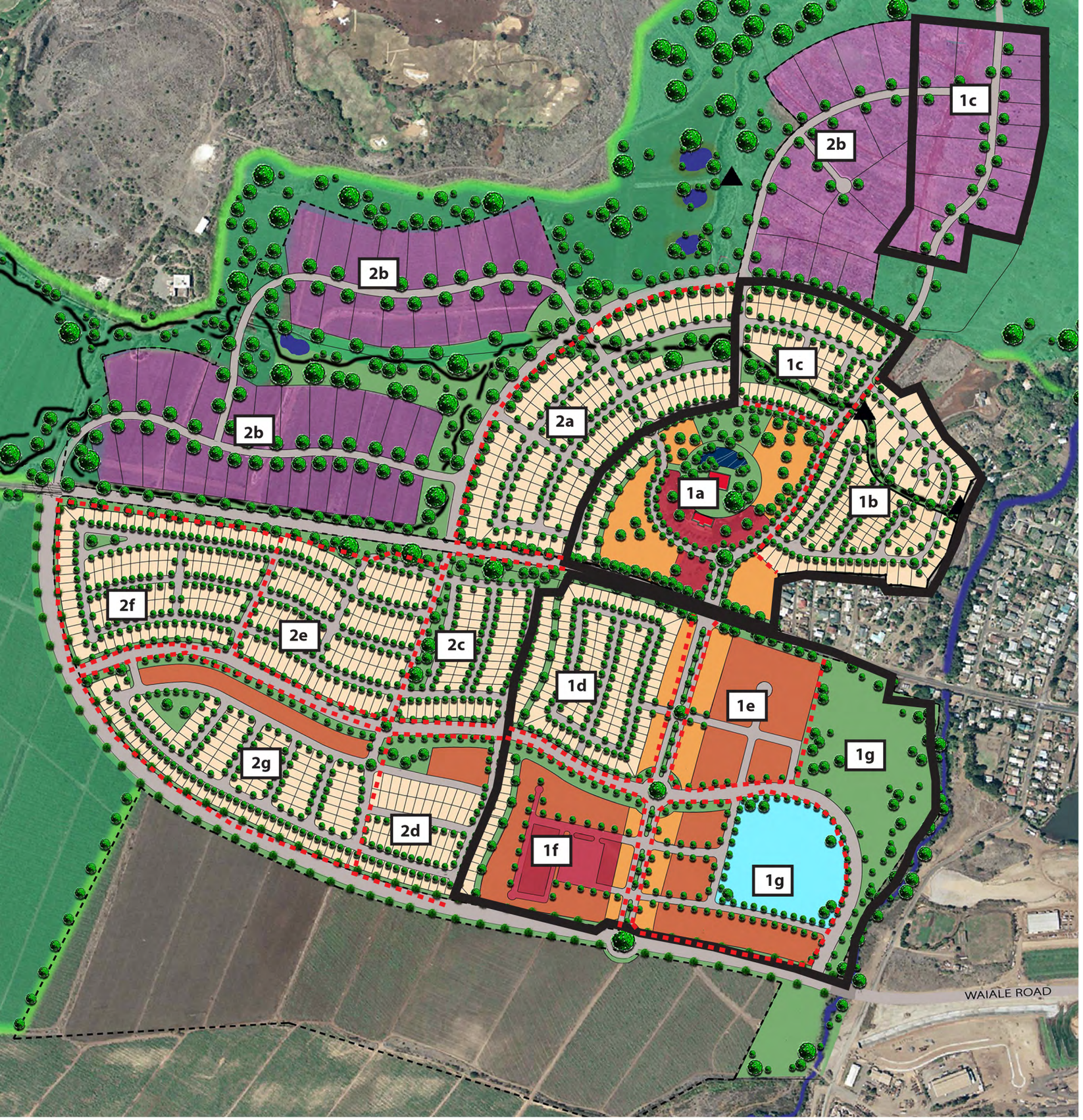
Table 19 ~~16~~: Conceptual Development Program for 2017 - 2026

Land Use	Net Acres	Gross Acres	Residential Units	Net Residential Density	FAR	Sq. Ft Commercial
Single Family	131.05		970	7.40		
Multi-Family / Town Home	21.203	30.29	256	12.07		
Rural	124.82		80	0.64		
Country Town Mixed-Use	16.168	20.21	127		0.25	58,475
Commercial / Employment		12.89			0.25	140,372
Existing Town Center / Lagoon		4.48				
School		12				
Active/Passive Park		32.44				
Greenways / Open Space	49.66	49.66				
Roads		81.163				
Acres	**499.003**					
Residential Units	**1433**					
'Ohana Units	**146**[6]					

[6] For planning purposes it was assumed that about 15 percent of single-family homeowners would decide to build an 'Ohana unit.

Land Use	Net Acres	Gross Acres	Residential Units	Net Residential Density	FAR	Sq. Ft Commercial
Total Residential Units	**1579**[7]					
Commercial / Employment	**198,847**					

[7] Includes ‘Ohana units. The number of ‘Ohana units may increase or decrease.



Hallstrom Absorption:

Phase 1: 2017-2021: 690 Units
Phase II: 2022-2026: 743 Units

Phase 1: 2017-2021

	Units	Sq. Ft.	Acres
Single Family	332		
Rural	15		
Multi-Family	216		
Ohana	41		
Country Town Mixed-Use	127	58,475	
Existing Commercial		29,250	
New Commercial/Employment		111,122	
Elementary School			12.00
Active/Passive Park			26.66

Phase II: 2022-2026

	Units	Sq. Ft.	Acres
Single Family	638		
Rural	65		
Multi-Family	40		
Ohana	105		
Active/Passive Park			5.78

Date: October 1, 2014

Figure 27: Conceptual Phasing Program

HAWAII LAND DESIGN

PLANNING CONSULTANTS HAWAII, LLC

8. Wastewater Treatment Plan

The policy of the DEM is that available wastewater capacity cannot be reserved until a project is ready to receive building permits. If capacity at the KWWRF is available at the time building permits are ready to be issued for the Project, the Project may consider a temporary connection to the County's sewer system and complete the required upgrades for the connection in the Phase I development (**See**: Chapter VIII, Alternatives Analysis, Wastewater Alternative 2).

However, since the DEM stated in its letter dated April 13, 2016 that the Project would not be allowed a connection to the KWWRF, a new private wastewater reclamation facility, collection system, and pump stations will be constructed. This new facility will utilize FCR technology and will include tertiary treatment producing R-1 recycled water which is the highest standard currently regulated by the State Department of Health. The facility will be developed in phases based on demand for wastewater treatment. The FCR facility will be located within the Agricultural Preserve on approximately 12-acres in the area and in the manner shown on Figures 28 and 32. Access to the facility will be from a driveway that will connect to the Wai'ale Bypass Road north of its intersection with Honoapi'ilani Highway. The wastewater facility will be located on property owned by the Applicant and identified as TMK Number (2) 3-6-002:003.

At full buildout of the Project, the wastewater reclamation facility is expected to process an average daily flow of about 0.65 million gpd. The peak flow into the facility is estimated to be approximately 1.3 million gpd. Wastewater processed at the facility will be reclaimed to R-1 recycled water standards, which will allow the non-potable water to be used for above-ground irrigation of most agricultural crops and open space uses, including parks. The Agricultural Preserve as well as the Project's parks and open space elements are expected to be the facility's future recycled water users.

The Wai'ale Bypass frontage of the 12- acre project site will be developed with a driveway and on-site parking; solar panels; an education center; a pre-treatment area and control room; biological treatment reactor area; the final clarifier; filtering and disinfection building and an R-1 recycled water storage tank. The buildings and the associated facilities that comprise the treatment facility will be 30-feet or less in height, and setback at approximately 400-feet from the Wai'ale Bypass.

Location | Site Plan - scale 1:1000

Water Reclamation Facility

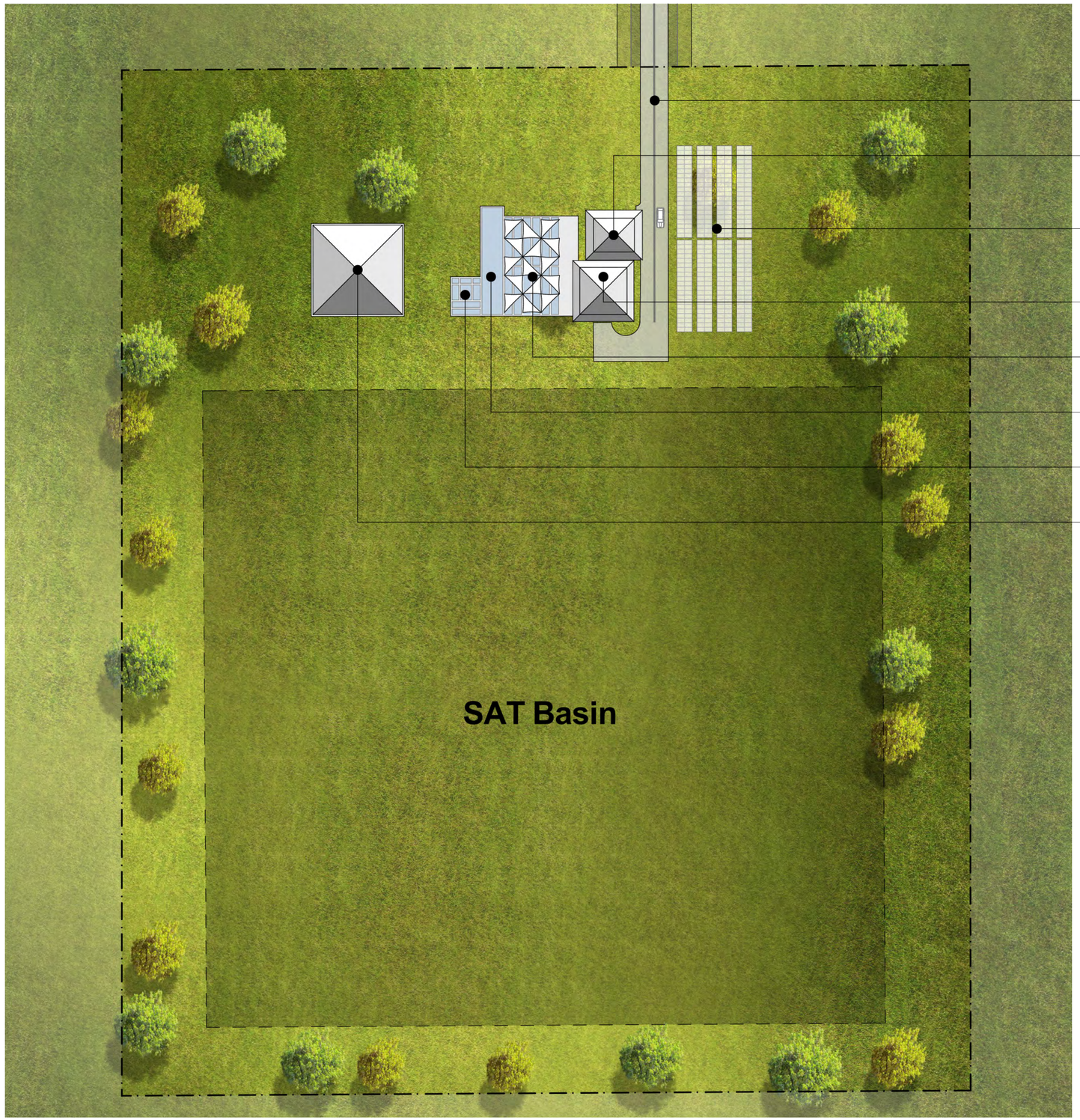


Figure 28: Conceptual WWRF Site Plan

An approximate 5.6 acre Soil Aquifer Treatment Basin will be located at the rear of the property. Agricultural lands will border the facility to the south and west, agricultural lands and then the County's regional park to the north, and agricultural lands and then the Wai'ale Bypass road and Project to the West.

Organica Treatment Plant Process

Organica is a leader in wastewater treatment and reuse in an energy efficient and aesthetically pleasing manner by marrying state of the art technology with a natural systems approach. Organica solutions utilize a Food Chain Reactor (FCR) configuration, consisting of biological treatment in successive reactor zones utilizing fixed biomass on a combination of natural plant roots and Organica's engineered biofiber media, along with a limited amount of suspended biomass (See: Figure No. 29).

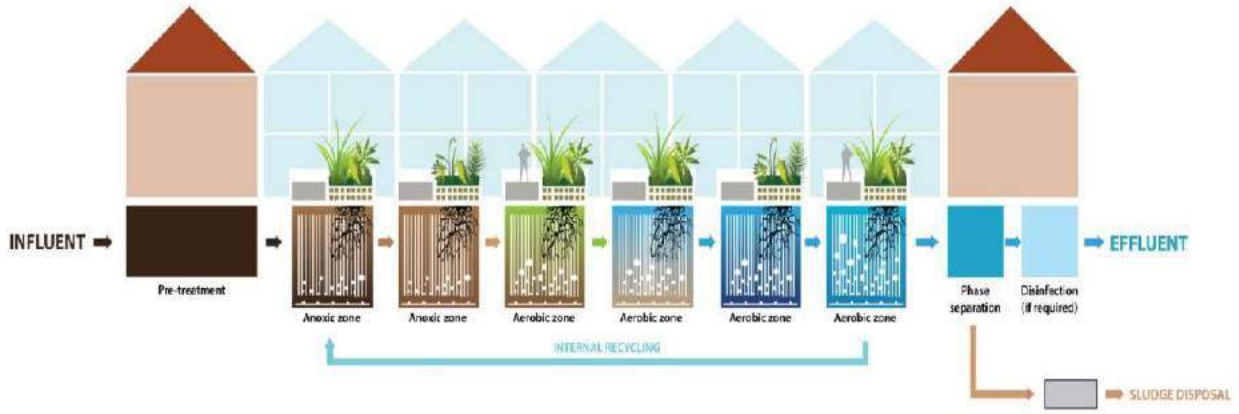


FIGURE 29: ORGANICA PROCESS DIAGRAM OF FCR PROCESS

Organica FCR solutions consist of a series of biological treatment zones simultaneously utilizing both fixed biofilm and suspended biomass in the reactors. Biodegradation of influent contaminants is accomplished by the combination of fixed and suspended biological cultures. Biomass in the Organica FCR is primarily comprised of fixed-film microorganisms, utilizing natural plant roots along with additional engineered (biofiber) media as biofilm carriers. As influent travels through the FCR zones, the available organics and nutrients (various carbon, nitrogen, and phosphorus fractions) are consumed and/or transformed. As a result, the

composition of the ecosystem fixed in the biofilm changes from zone to zone, gradually adapting to localized conditions as the organic and nutrient concentrations vary, as well as dissolved oxygen content. The end result is a specially- adapted ecosystem in each zone, acclimatized to the specific conditions to maximize treatment efficiency. The proposed wastewater reclamation process generally involves the following steps:

1. Pretreatment
2. Biological Treatment
    - FCR multi-zone reactor with 6 zones in each reactor train (**See**: Figure 29)
3. Secondary Phase Separation
    - Coagulation
    - Flocculation
    - Secondary clarifier or filtration
4. Tertiary Treatment
    - Tertiary filtration
    - UV disinfection
5. Solids Management
    - Sludge storage tank
    - Sludge thickening and dewatering
6. Reuse and Disposal
    - R-1 storage
    - R-1 pump station
    - SAT basin

Wastewater Collection and Transmission System

The Project's wastewater collection system improvements would include 8- and 12-inch sewer lines. The system would also include a pumpstation and sewer manholes. The wastewater collection system would be situated within various parcels and roadways within the project area.

Reuse of Treated Wastewater and SAT Basin

The wastewater reclamation facility will be designed to meet the R-1 recycled water quality standards pursuant to HAR State DOH, Chapter 62, Title 11 Wastewater Systems. Accordingly, tertiary treatment (filtration) and disinfection is included in the design. The WWRF will generate 0.65 MGD of R-1 recycled water upon full build out of the project. Using a conservative estimate of 4,500 gallons of water required to irrigate each acre per day, it is estimated that approximately 139 acres of agricultural land will be required to utilize the entire volume of 0.65 MGD of recycled water during dry weather years. R-1 quality recycled water may also be used for the irrigation of common areas and parks. The use of recycled water for agricultural irrigation will be done in the areas defined as "unrestricted" per the DOH Reuse Guidelines.

Also, since DOH regulations require a back-up disposal system, in the event that the effluent does not meet R-1 recycled water standards, an infiltration basin, located adjacent to the WWRF, will be used for disposal of non-compliant effluent. Figure 28 is a preliminary site plan that shows the location of the proposed SAT basin.

This basin would serve as a soil aquifer treatment pond for the wastewater effluent and provide the DOH-required back-up disposal system. Excess R-1 recycled water, along with effluent that does not conform to R-1 recycled water quality standards, would be discharged into this infiltration basin for disposal. The infiltration basin is expected to only contain water or effluent following significant storm events or when a processing problem is encountered with the treatment plant where the effluent cannot be processed as normally planned and/or cannot be discharged for reuse or for agricultural or open space irrigation. The SAT Basin would be designed so that it will typically take between two to three days for the water to infiltrate into the ground. The preliminary required total basin area has been established at 5.6 acres ideally situated on site and/or adjacent, however, there will need to be geotechnical evaluations during the design phase to determine the actual final system size and exact location.

SAT basins are the preferred alternative disposal means as they provide additional buffer and further polish the water through slow percolation and reduce the possibility of contaminating the underlying aquifer when compared to injection wells. SAT has been used as a means of

effluent treatment and groundwater recharge for hundreds of years throughout the world and is still a common methodology used in municipal and industrial applications.

Biosolids Stabilization, Dewatering and Disposal

The waste activated sludge (WAS) solids will be pumped to an aerobic digester. The biosolids in the digester will have a solids retention time of 20 days to meet the Federal requirement to produce Class B sludge for land disposal. From the aerobic digester, the stabilized biosolids will be pumped to a mechanical solids dewatering unit to remove as much water from the biosolids as possible before being hauled off site. The mechanical solids dewatering unit will be located in its own solids handling room sized to accommodate future build-out. The solids handling room will be equipped with a ventilation system to remove any foul odors and to direct it to the centrally located odor control unit.

Biosolids (sludge) removed from the WWRF will be hauled to Maui EKO Systems located at the Central Maui Landfill. The Applicant will contract with Maui EKO Systems to process the biosolids into a usable soil amendment. The Environmental Protection Agency (EPA) currently oversees biosolids for Hawai‘i. However, Hawai‘i plans to seek authorization of EPA’s program in the future. Hawai‘i State Department of Health (DOH) places biosolids conditions in NPDES permits and tracks compliance through its wastewater branch.

Energy Efficiency

The FCR treatment system itself utilizes approximately 30 percent less energy than conventional treatment systems. In addition, the Applicant intends to implement other energy saving measures in the WWRF design. Such measures are planned to include: 1) installation of energy efficient motors; 2) installation of variable frequency drives (VFDs) on all blowers and pumps to allow the equipment to operate more efficiently at lower flows; and 3) installation of a photovoltaic system to provide at least a portion of the energy required for the treatment facility. The treatment facility would also be designed in phases to allow the capacity of the process equipment to better match actual wastewater flows. This would minimize the energy inefficiencies that can result from process equipment operating significantly below their design capacity. In addition, an energy management program at the treatment facility would be developed to promote energy efficiency and minimize operating costs.

Education Facility

A key component of any successful wastewater treatment system and water reuse program is proactive public education. The proposed education center will be utilized by the WCT community and the general public to learn how wastewater is treated and how recycled water is beneficially reused.

Operation and Maintenance

The water and wastewater infrastructure constructed to serve WCT will operate under the ownership of a water company established by the Applicant. The water company will provide the management and operations of both the water and wastewater systems. The water company is expected to be regulated by the Hawai'i Public Utilities Commission and adhere to the Hawai'i DOH standards and Water Reuse Guidelines. Daily operations of the water company will be performed by State of Hawai'i certified operators as required by DOH. The utility operations team will be selected prior to commissioning.

Standard procedures for the operation and maintenance for the WWRF and associated collection system improvements would be implemented by the Applicant. Efforts will mostly revolve around the issue of preventing leaks and leak detection. Treatment tanks will be located aboveground and will be visually inspected for leaks. For the gravity sewer lines, the lines will be tested after the completion of construction (and prior to operation) to confirm that there are no leaks in the system. Proper installation of these sewer lines will minimize the potential for any future leaks.

For the sewer force mains (pressurized), the pump station run-time and flow will be monitored. If there are any significant or unusual changes in the pump operation time and/or flows, the line will be tested for leaks. In the event that the pump station and/or force main would have to be taken off-line for repairs, the flows would be bypassed around the pump station. The pump station will be designed to allow for it to be bypassed in the event of repairs. Maintenance procedures will also be implemented for the treatment plant's SAT basin. The basin will be maintained to keep it vegetation free, which will also render it relatively unattractive habitat for any listed waterbird species. The Applicant will also have the basin inspected on foot twice a day whenever there is water present within it to ensure that no waterbirds are sick, dying or dead

within this basin. If any such birds are found, the operator will immediately contact the Maui DOFAW district office and will work closely with DOFAW biologists to search for and retrieve any potentially infected birds, and to retrieve and dispose of any dead birds found within the area under DOFAW direction.

Organica FCR facilities are highly automated with minimum operator intervention required. Equipment and basic principles of operation are similar to conventional wastewater treatment. In selecting the technology Mana Water carefully examined the operator sophistication required to operate this type of facility to ensure that the level of sophistication, at minimum, does not exceed that required at conventional WWRFs on Maui. Generally, the level of sophistication required is significantly lower than a membrane bioreactor (MBR) and comparable to a conventional activated sludge (CAS) plant. It is anticipated that operation of the WWREF will require the following personnel: Plant Superintendent; two operators; one part-time maintenance personnel; and one part-time electrical maintenance personnel.

Odor and Noise Control

The WWRF is being located to the southeast of the WCT's urban development, within the Agricultural Preserve. The facility's location places it downwind of the WCT and the County's proposed baseyard and regional park. The WCT's elementary school would also be located downwind about one mile to the north of the facility. The WWRF is committed to reducing the H2S concentration at the fence line to at or below 5 ppb to eliminate off-site odors. This concentration is well below the State air requirement for instantaneous concentration of hydrogen sulfide of 25 ppb or less. The sewage intake and headwords equipment is to be housed in a contained pre-treatment building equipped with air filters. Proven and reliable technologies will be incorporated into the planned odor mitigation. Noise control is mitigated by machinery (blowers, scrubbers) being confined to the enclosed pre-treatment area. Minimal noise associated with off haul and/or pumping of sludge is to be limited to 1-2 times per week and scheduled during normal business hours.

Development Schedule and Construction Costs

In order to most economically construct and commission the WWRF, it is possible to synchronize certain aspects of the treatment process with the build out of WCT. While it is necessary to

maintain the full treatment and redundancy requirements, not all phases of the treatment process need to be completed to 100 percent of expected final capacity. For this reason, the preliminary WWRF design is a two train reactor system in order to allow for commissioning of each train in sync with the two phase build-out of WCT. By phasing WWRF construction in tandem with WCT build-out, significant upfront capital cost savings can be realized in equipment such as headworks, limited secondary treatment commissioning, tertiary filtration, UV disinfection channel, aeration diffusers etc. The total estimated cost of the plant is $25.84 million. Figure 30, A-B shows conceptual illustrations of the proposed WWRF.

9 ~~7~~. Infrastructure and Public Facility Development Plan

As noted, the WCT will be implemented in two five year phases through 2026 as shown in Figure No. 27 ~~25~~, "Conceptual Phasing Plan" and Figure Nos. 31 ~~26~~, 32 ~~27~~, 33 A-B and 34 ~~29~~ "Roadways", "Wastewater", "Water" and "Drainage Phasing Diagrams" and Tables 17 ~~11~~, 18 ~~12~~ and 19 ~~16~~. Table No. 20 ~~17~~ summarizes the work, project phasing and order of magnitude costs associated with development of the Project.

Table 20 ~~17~~: Conceptual Order of Magnitude Cost Estimates

Infrastructure Description	Phase I (Makai)	Phase I (Mauka)	Phase II (Mauka)	Phase II (Makai)
General Work Includes activities such as grubbing and grading of the site, staging of construction, and implementation of on-site construction phase mitigation.	$4,200,000	$4,400,000	$3,075,000	$4,995,000
Roadways Includes construction of all internal roadways including residential and collector streets, curbs, gutters and sidewalks. (**See**: Figure No. ~~26~~ 31)	$6,678,400	$8,129,000	$3,104,000	$9,200,000
Offsite Roadways This work includes	~~$800,000~~ $1,900,000	----	$400,000	----

Infrastructure Description	Phase I (Makai)	Phase I (Mauka)	Phase II (Mauka)	Phase II (Makai)
construction of off-site roadway and intersection improvements to mitigate project impacts as described in the TIAR.				
Sewer System[8] Includes developing the on-site sewer system, which includes developing a package wastewater treatment plant and on-site collection system. (**See**: Figure No. 32 ~~26~~)	~~$5,880,000~~ $23,880,000	$5,610,000	~~$4,409,000~~ $12,409,00	~~$52,717,500**~~ $7,717,500
Potable Water System Includes developing potable and non-potable on-site wells and transmission infrastructure. (**See**: Figure No. 33A ~~27~~)	$14,028,000	$4,687,000	~~$10,585,000~~ $10,785,000	$8,890,000
Non Potable Water System (See: Figure No. 33B ~~27~~)	$3,345,000	$2,497,000	$2,140,000	$3,588,000
Drainage System Includes developing on-site detention basis and transmission infrastructure. (**See**: Figure No. 34 ~~29~~)	~~$10,980,000~~ $11,980,000	~~$10,700,000~~ $11,700,000	~~$9,832,000~~ $10,832,000	$12,480,000
~~**Offsite Sewer** Off-site sewer improvements include upgrades to transmission system along Lower Main Street, Waiko and Wai`ale Roads.~~	~~$3,477,000~~	~~——~~	~~——~~	~~——~~
TOTAL COST[9]	**$66,211,400***	**$37,023,000***	**$42,745,000***	**$46,870,000***

[8] Cost estimate includes a private wastewater treatment plant servicing the WCT.

[9] Does not include underground electrical, telephone and cable TV

Water Reclamation and Education Facility

Figure 30, A: WWRF Conceptual Illustration

Figure 30, B: WWRF Conceptual Illustration

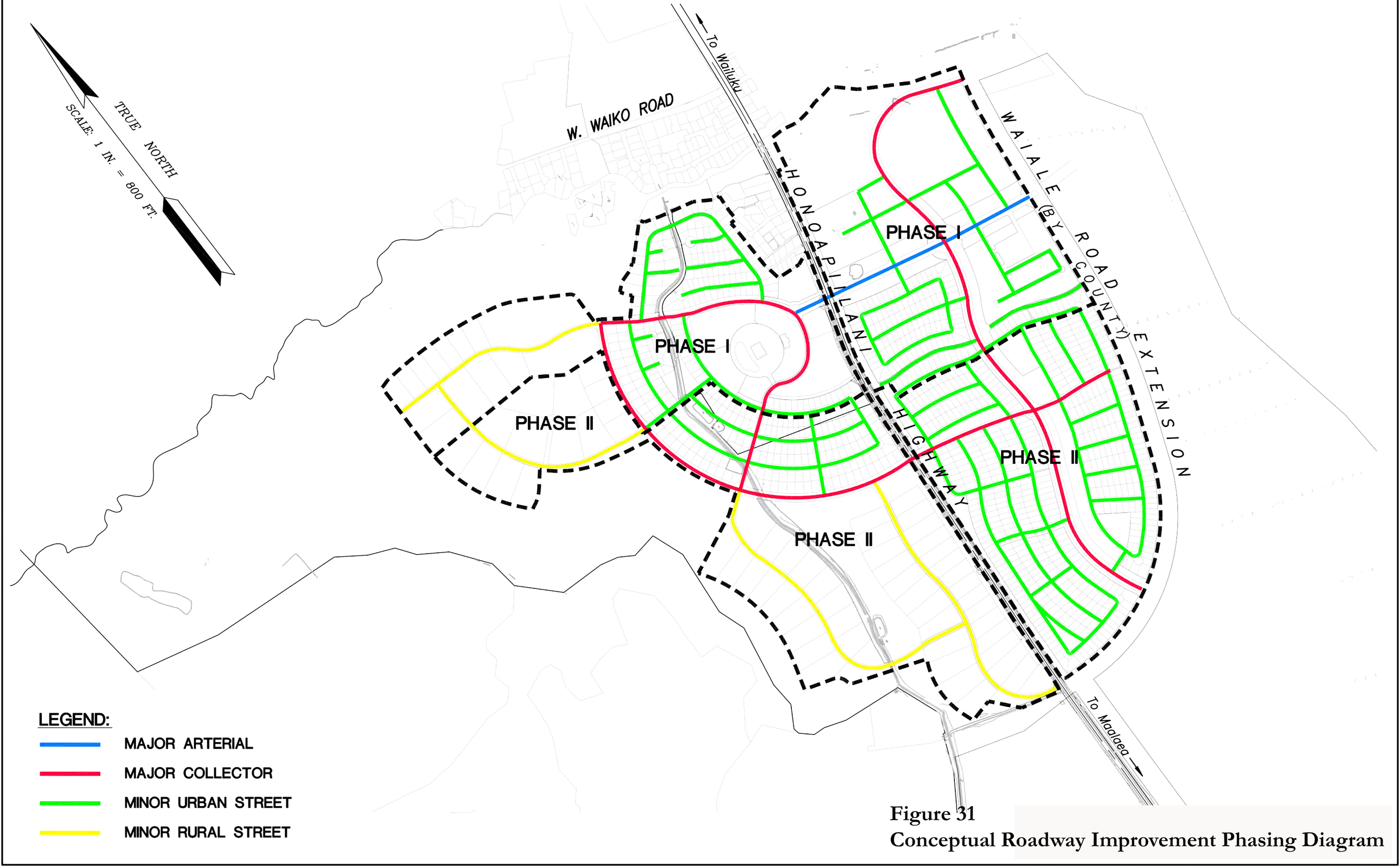


Figure 31
Conceptual Roadway Improvement Phasing Diagram

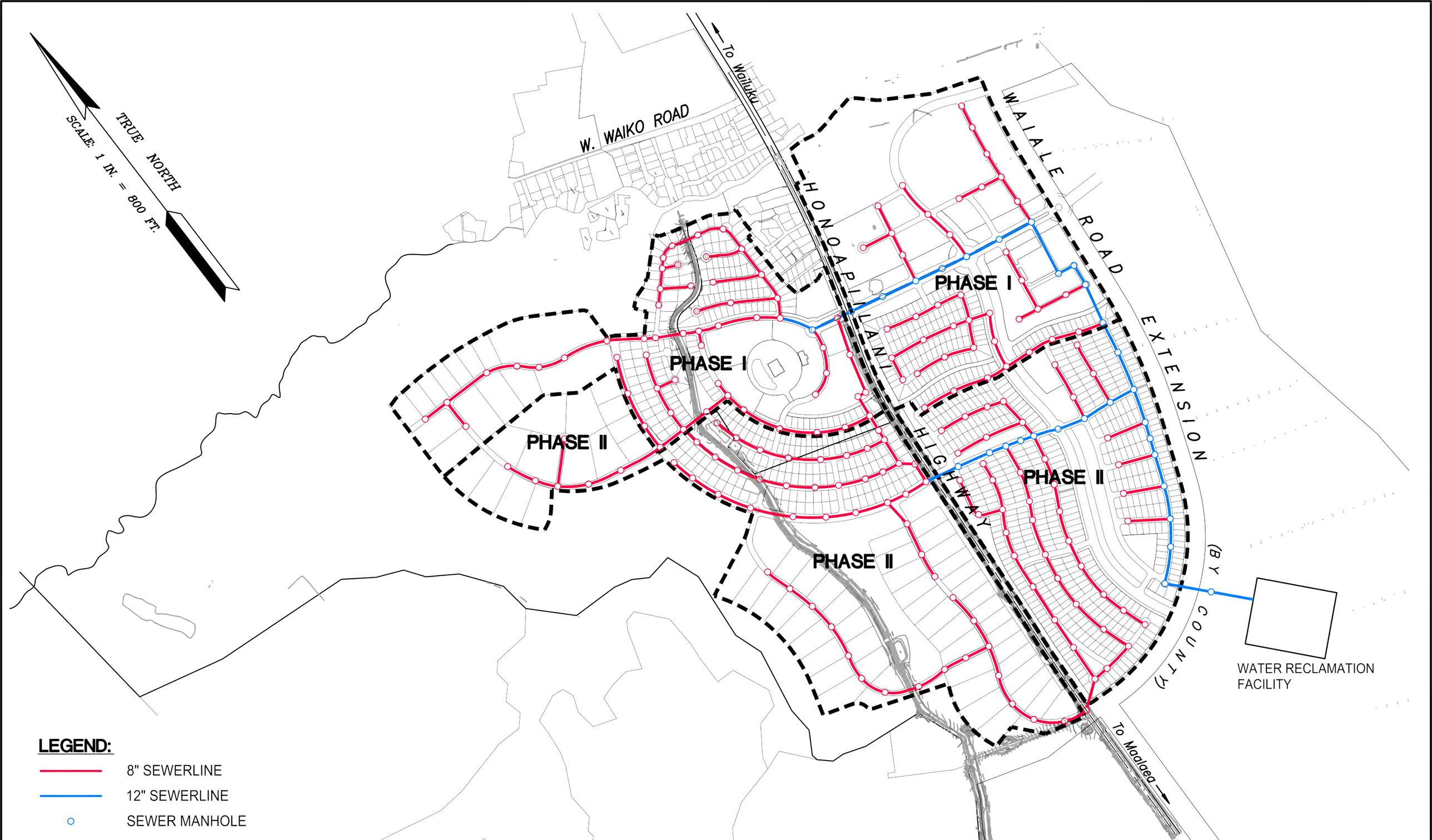


Figure 32
Conceptual Wastewater Improvement Phasing Diagram

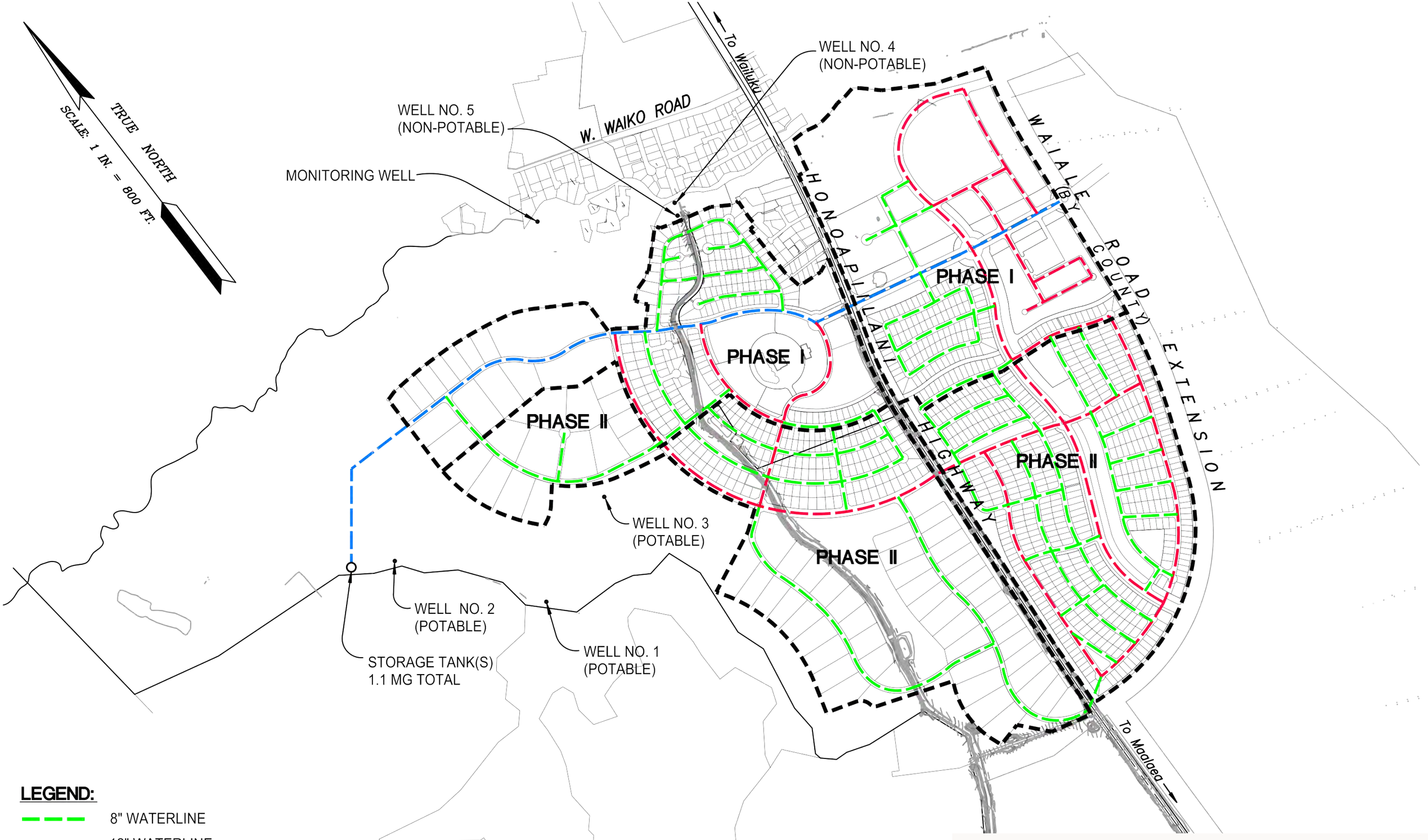


Figure 33, A:
Conceptual Potable Water Phasing Diagram

TRUE NORTH

SCALE: 1 IN. = 800 FT.

To Wailuku

WELL NO. 4
(NON-POTABLE)

WELL NO. 5
(NON-POTABLE)

W. WAIKO ROAD

MONITORING WELL

HONOAPILANI HIGHWAY

WAIALE (BY COUNTY) ROAD EXTENSION

PHASE I

PHASE I

PHASE II

PHASE II

PHASE II

NON-POTABLE
STORAGE AREA

WELL NO. 3
(POTABLE)

WELL NO. 2
(POTABLE)

WELL NO. 1
(POTABLE)

To Maalaea

LEGEND:

NON-POTABLE WATERLINE

Figure 33, B:
Conceptual Non-Potable Water Phasing Diagram

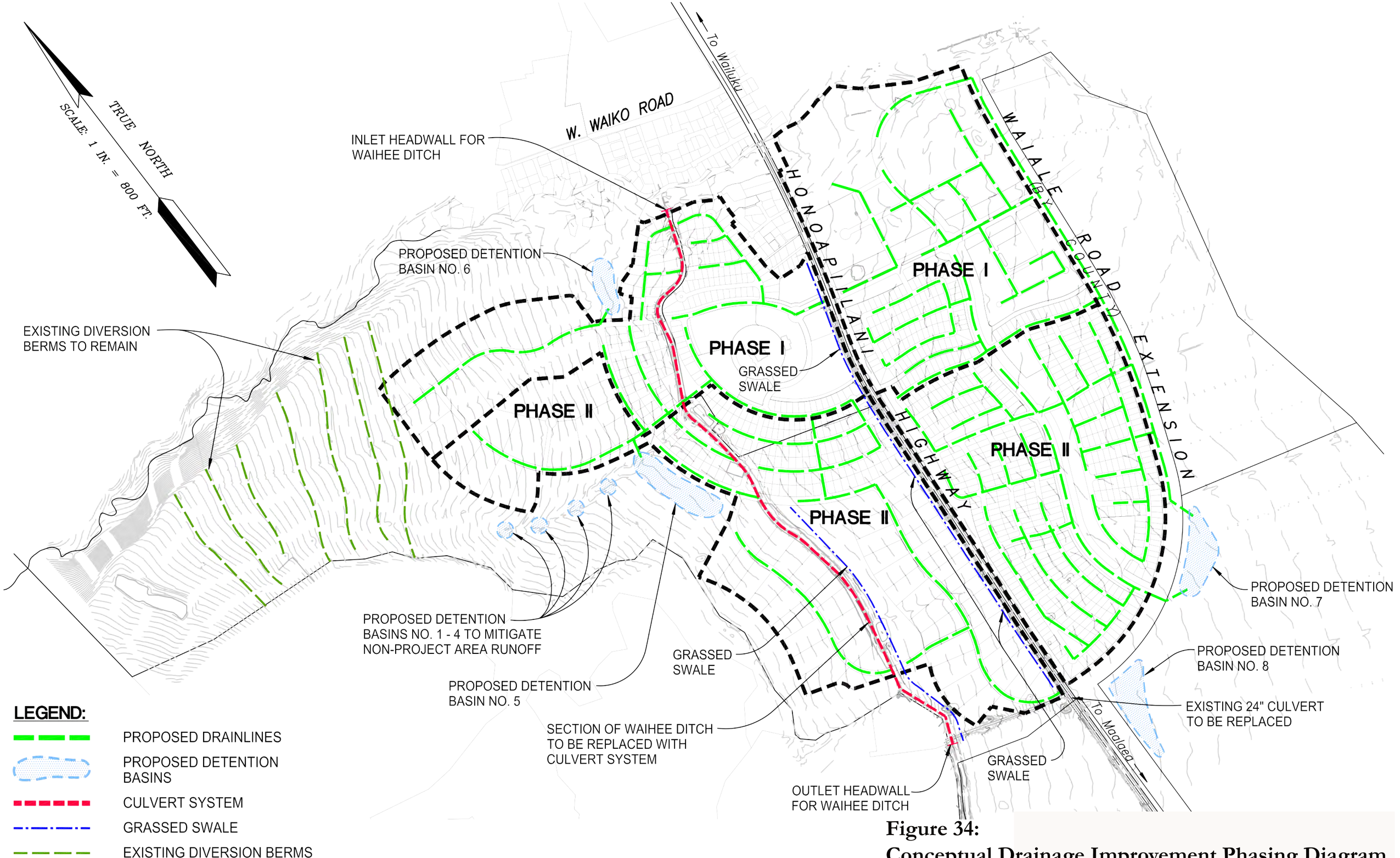


Figure 34:
Conceptual Drainage Improvement Phasing Diagram

Development of the WCT will also require the provision of on-site public facilities including schools and parks. Table 21 ~~18~~ summarizes the work, project phasing and order of magnitude costs associated with development of these facilities.

Table 21 ~~18~~: School and Park Facilities and Cost Estimates

Infrastructure Description	Phase I (Mauka and Makai)	Phase II (Mauka and Makai)
School The WCT is required by State law to address its impact to State educational facilities through the provision of land and school construction fees in proportion to the impacts of the development. The WCT will provide a 12-acre school site within Phase I of the project for this purpose.	**12-acres and $2,606,829[10]**	
Parks The WCT is required to contribute land and/or fees to address its impacts to County park and recreation facilities. The WCT may dedicate[11] ~~will be dedicating~~ approximately 32.5 acres for parks and recreation whereas only 16.5 acres are required.	26.66 acres	5.78 acres

[10] Payment of impact fees will be spread across phases I and II in proportion to the residential units constructed in each phase.

[11] It is likely that the County Department of Parks & Recreation may not want to accept some of the proposed park lands and that these lands will be maintained as private parks that would be open to the public.

C. AGENCY AND COMMUNITY OUTREACH

Master planning for the WCT was initiated in January 2009. Since 2009, the Applicant has consulted with State and County agencies and the Waikapū community regarding the development plans. Meetings have been conducted with the County of Maui's Department of Planning, Department of Public Works, Department of Environmental Management, Department of Parks and Recreation, and Department of Water Supply. Meetings have also been conducted with the State Department of Education, State Department of Transportation, State Office of Planning, and State Land Use Commission. In addition, the Applicant has consulted with the Waikapū Community Association, the General Plan Advisory Committee, the Maui Planning Commission, and the Maui County Council. Table No. 22 ~~19~~ documents community meetings conducted through February 2014.

Table 22 ~~19~~: Neighborhood and Agency Pre-consultation Activities

Date	Organization / Group	Purpose
February 19, 2009	General Plan Advisory Committee (GPAC)	Present the preliminary master plan report and conceptual development plan to the GPAC for inclusion into the MIP's Directed Growth Plan.
March 26, 2009	Waikapū Community Leaders	Present the preliminary master plan report and conceptual development plan to the group for comment and further discussion.
July 21, 2009	Maui Planning Commission	Present the preliminary master plan report and conceptual development plan to the Commission for consideration of its inclusion into the MIP's Urban and Rural Growth Boundaries.
September 14, 2009	Waikapū Community	Present the preliminary master plan report and conceptual development plan to the Community for

Date	Organization / Group	Purpose
		discussion and comment. The meeting was attended by 158 persons. A community survey was administered at the conclusion of the presentation / discussion. (**See:** Appendix K, "September 14, 2009, Community Survey Results").
March 14, 2011	Waikapū Community Association	Present the Master Plan to the Waikapū Community Association for discussion and comment.
March 1, 2012	Maui County Council	Present the preliminary master plan report and conceptual development plan to the Committee for inclusion into the MIP's Urban and Rural Growth Boundaries.
March 25, 2012	Maui County Council	Present the preliminary master plan report and conceptual development plan to the Committee for inclusion into the MIP's Urban and Rural Growth Boundaries.
August 2013	Waikapū Community Association: "Waikapū Country Town Review Committee"	Working with the Waikapū Community Association, a committee of WCA members was established to provide community input into the project.
February 2014	Waikapū Project Review Committee	Present the revisions to the Master Plan, discuss the project schedule, and address questions and concerns.

D. REQUIRED ENTITLEMENTS AND APPROVALS

1. State Land Use District Boundary Amendment (DBA)

The WCT Master Plan will require a State Land Use District Boundary Amendment in order to bring 485 acres of State Agricultural District land into the State Land Use Urban and Rural districts. Table No. 23 ~~20~~ identifies the parcels requiring a State Land Use Commission District Boundary Amendment for all or a portion of the property (**See**: Figure No. 5, State Land Use Designation").

Table 23 ~~20~~: TMK Parcels Requiring a State Land Use District Boundary Amendment

Ownership	Parcel	Acres	Existing State Land Use	Acres Subject to DBA	Proposed State Land Use
Waikapū Properties LLC	(2) 3-6-004:003 (2) 3-6-004:006	657.195 52.976 [12]	Agriculture Agriculture	149.848 53.775[13]	Rural Urban
MTP Land Partners LLC and the Filios, William Separate Property Trust	(2) 3-6-005:007	59.054	Agriculture	45.054	Urban
Wai`ale 905 Partners LLC	(2) 3-6-002:003	521.40	Agriculture	236.326	Urban

2. Community Plan Amendment (CPA)

Community Plan Amendments are required for the approximate 499 acres of land that are proposed for development. The existing MTP properties, which includes TMK Nos. (2) 3-6-005:007 and (2) 3-6-004:006, will require an amendment from Wailuku-Kahului Project District No. 5 (Maui Tropical Plantation) to a new Project District. The new Project District ordinance designation will implement the character and uses proposed in the WCT Master Plan (**See:** Figure 6, A-B: "Wailuku-Kahului Community Plan Map"). Table No. 24 ~~21~~ identifies parcels requiring a Community Plan Amendment for all or a portion of the property.

[12] Acreage identified on TMK Map.

[13] Acreage identified by survey.

Table 24 ~~21~~: TMK Parcels Requiring a Community Plan Amendment

Ownership	Parcel	TMK Acres	Existing Community Plan Designation	Acres Subject to CPA	Proposed Community Plan Designation
Waikapū Properties LLC	(2) 3-6-004:003 (2) 3-6-004:006	657.195 52.976	Agriculture Project District 5	149.848 53.775	Rural or Project District Project District
MTP Land Partners LLC and the Filios, William Separate Property Trust	(2) 3-6-005:007	59.054	Project District 5	59.054	Project District
Wai`ale 905 Partners LLC	(2) 3-6-002:003	521.40	Agriculture	236.326	Project District

3. Change in Zoning (CIZ)

The WCT Master Plan will similarly require a Change in Zoning for all lands proposed for development (**See**: Figure 7, "MTP Land Zoning Map 412"). A new project district zoning ordinance will be created to implement the vision and mix of uses proposed in the WCT Master Plan. Table No. 25 ~~22~~ identifies the parcels subject to a Change in Zoning for all, or a portion of the property.

Table 25 ~~22~~: TMK Parcels Requiring a Change in Zoning

Ownership	Parcel	TMK Acres	Existing Zoning	Acres Subject to CIZ	Proposed Zoning
Waikapū Properties LLC	(2) 3-6-004:003 (2) 3-6-004:006	657.195 52.976	Agriculture Agriculture	149.848 53.775	Rural or Project District Project District
MTP Land Partners LLC and the Filios, William Separate Property Trust	(2) 3-6-005:007	59.054	Project District PD-WK/5	59.054	Project District

Ownership	Parcel	TMK Acres	Existing Zoning	Acres Subject to CIZ	Proposed Zoning
Wai`ale 905 Partners LLC	(2) 3-6-002:003	521.40	Agriculture	236.326	Project District

4. Environmental Impact Statement (EIS)

The Community Plan Amendment is a "trigger" action for Hawai'i's Environmental Impact Statement law, Chapter 343, Hawai'i Revised Statutes. Additionally, off-site infrastructure work affecting State and County rights-of-way are anticipated, which may also act as triggers. Because of the overall scope of the project, which will induce significant population growth and require new infrastructure and public facility systems, it is anticipated that the project could produce environmental impacts. As such, the EIS is being prepared to examine potential impacts and mitigation measures resulting from implementation of the proposed WCT Master Plan. The State Land Use Commission is the Accepting Authority for the EIS. The EIS Preparation Notice served as official notice that the Approving Agency had determined that the project may have significant effect and that an EIS is required. The Notice was published in the Environmental Bulletin on May 23, 2015. Comments received following publication are documented in Chapter VII and incorporated into Appendix L ~~I~~ of the ~~DEIS~~ FEIS.

CHAPTER IV

Affected Natural Environment, Potential Impacts and Mitigation Measures

IV. AFFECTED NATURAL ENVIRONMENT, POTENTIAL IMPACTS AND MITIGATION MEASURES

A. PHYSICAL ENVIRONMENT

1. Climate

Existing Conditions. The climate of Central Maui is very much affected by its location on the isthmus, between the western side of Haleakalā and the West Maui Mountains, which gusty northwest trade winds funnel through. The project site experiences relatively strong trade winds that blow from north to south across the isthmus and out to sea. At 30-feet above ground level, wind speeds across the site range from about 5.5 meters per second to 7.5 meters per second, which is approximately 12 to 17 miles per hour. (vi)

A generally semi-arid climate pertains. The project site receives its highest rainfall during the winter and lowest rainfall during the summer. Throughout the year rainfall is relatively low, averaging approximately 20- to 30-inches per year, with the monthly average ranging from 0.25 inches in August to approximately 5-inches in January. (vii). Temperatures are generally moderate. The average high temperature in July averages 84 degrees in July and the average low in January is 64 degrees. It typically rains about 71 days per year and is sunny about 281 days per year.

Climate change over the next several decades is expected to produce a rise in sea levels around Hawai‘i and variations in its air and ocean temperatures, rainfall, and the frequency and intensity of storm events. These climatic changes could result in the Hawaiian Islands experiencing more frequent and severer droughts, tropical storms, coastal erosion events, flooding, and wildfires. Climatic change is also producing warmer and more acidic oceans, which

is causing damage to coral reefs and may degrade the State's fisheries. There are also concerns that rising sea levels could produce saltwater intrusion into some of the State's aquifers and that fresh water stream flows may decrease due to less rainfall and an increasing frequency of droughts. Climatic changes could produce negative impacts to Hawai'i's economy. Hawai'i's agricultural industry will suffer if climatic change reduces the availability of water for irrigation and if crops are exposed more frequently to storm events, outbreaks of disease and insects. The tourism industry could also be negatively impacted by an increase in coastal erosion, beach loss and severe storm events.

Potential Impacts and Mitigation Measures. The Project will not have a significant impact upon climatic conditions. However, the Project will implement a package of sustainability practices in the areas of energy conservation, water conservation, drainage mitigation, land planning and urban design that will make the Project more resilient to climatic change. Moreover, the Project's Agricultural Preserve may help to increase local food production, which will increase Hawai'i's food security (**See**: Section III.B.5).

2. Topography and Soils

Existing Conditions. Maui, like the rest of the Hawaiian Islands, was formed as the Pacific Plate moved over a "hot spot," where the release of magma over thousands of years formed large volcanic islands. The process created two distinct shield volcanoes, Mauna Kahalawai (West Maui Mountains) in the west, and Haleakalā to the east, which together create the island of Maui. The West Maui Mountains comprise 25% of Maui's land area. These mountains are steep and jagged, rising to 5,788 feet at Pu'u Kukui, with deep cut valleys formed by erosion from wind, rain and streams. Haleakalā, the larger eastern volcano, forms 75% of Maui's land area. It rises to 10,023 feet at Pu'u 'Ula'ula (Red Hill). As each volcano erupted they released lava and ash and, together with alluvium deposits, created the Central Maui isthmus, which joins the volcanoes together forming the island of Maui.

The project site lies within the fertile Central Maui isthmus, between the town of Wailuku to the north and Mā'alaea to the south. The elevation on the mauka development site ranges from approximately 350 feet above mean sea level at its southeasterly corner to approximately 710 feet above mean sea level at its northwesterly corner, with a slope averaging approximately 8%.

The elevation on the makai development site ranges from approximately 256 feet above mean sea level at a low point along the southerly border to approximately 408 feet above mean sea level at the northwesterly corner, with a slope averaging approximately 4%. The land within the agriculture preserve areas will remain undeveloped.

There are three soil series and seven soil types within the area proposed for development. The soil series are Pulehu Series, ʻĪao Series and the Wailuku Series. Each series consists of well-drained soils that are on alluvium fans formed from weathered basic igneous rock. The topography is gentle to moderately sloping, and the soil series are highly suited for both agriculture and urban development. The specific soil types are shown in Figure No.35 ~~30~~, "USDA Soils Map" and Table 26 ~~23~~, "Waikapū Country Town Soil Types".

Table 26 ~~23~~: Waikapū Country Town Soil Types

Waikapū Country Town Soil Types
ʻĪao clay, 3 to 7 percent slopes (IcB)
This soil occurs at elevations of 100 to 500 feet with slopes that range from 3 to 7 percent. It is a well-drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 15 inches of clay, 15 to 48 inches of clay, and 48 to 60 inches of silty lay. The available water capacity is moderate at about 8.4 inches. Permeability is moderately slow. Runoff is medium and the erosion hazard is slight to moderate.
Pulehu silt loam, 0 to 3 percent slopes (PpA)
This soil occurs at elevations of 0 to 300 feet with slopes that range from 0 to 3 percent. It is a well-drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 21 inches of silt loam and 21 to 60 inches of silty clay loam. The available water capacity is moderate at about 8.4 inches. Permeability is moderately moderate. Runoff is slow and the erosion hazard is no more than slight.
Pulehu cobbly clay loam, 3 to 7 percent slopes (PtB)
This soil occurs at elevations of 0 to 300 feet with slopes that range from 3 to 7 percent. It is a well-drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 21 inches of cobbly clay loam and 21 to 60 inches of silty clay loam. The available water capacity is moderate at about 7.5 inches. Runoff is slow and the erosion hazard slight.

Water > 40 acres (W)
Water bodies greater than 40 acres.
Wailuku silty clay, 3 to 7 percent slopes (WvC and WvB)
This soil occurs at elevations of 50 to 1000 feet with slopes that range from 3 to 7 percent. It is a well-drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 12 inches of silty clay and 12 to 60 inches of silty clay. The available water capacity is moderate at about 8.4 inches. Runoff is slow and the erosion hazard slight.
Wailuku silty clay, 7 to 15 percent slopes (WvC and WvB)
This soil occurs at elevations of 50 to 1000 feet with slopes that range from 7 to 15 percent. It is a well-drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 12 inches of silty clay and 12 to 60 inches of silty clay. The available water capacity is moderate at about 8.4 inches. Runoff is slow and the erosion hazard slight.

Potential Impacts and Mitigation Measures. Implementation of the WCT Master Plan will require grading for roads, parks, and buildings upon development.

A grading permit will need approvals from State DLNR SHPD, Maui County Planning Department, and Department of Public Works (DPW) before construction begins. Grading plans for the site will be reviewed by DPW and SHPD.

The existing topography would be altered to the extent necessary for construction of the proposed project. Cut and fill quantities are anticipated to be similar, so little or no fill would be brought to or taken from the site. A National Pollutant Discharge Elimination System (NPDES) permit will be required from the State of Hawai‘i, Department of Health (DOH) prior to grading activities. During site preparation, storm runoff from the project area will be controlled in compliance with the County’s “Soil Erosion and Sediment Control Standards.” Typical mitigation measures include appropriately stockpiling materials on-site to prevent runoff and building over or establishing landscaping as early as possible on disturbed soils to minimize length of exposure.

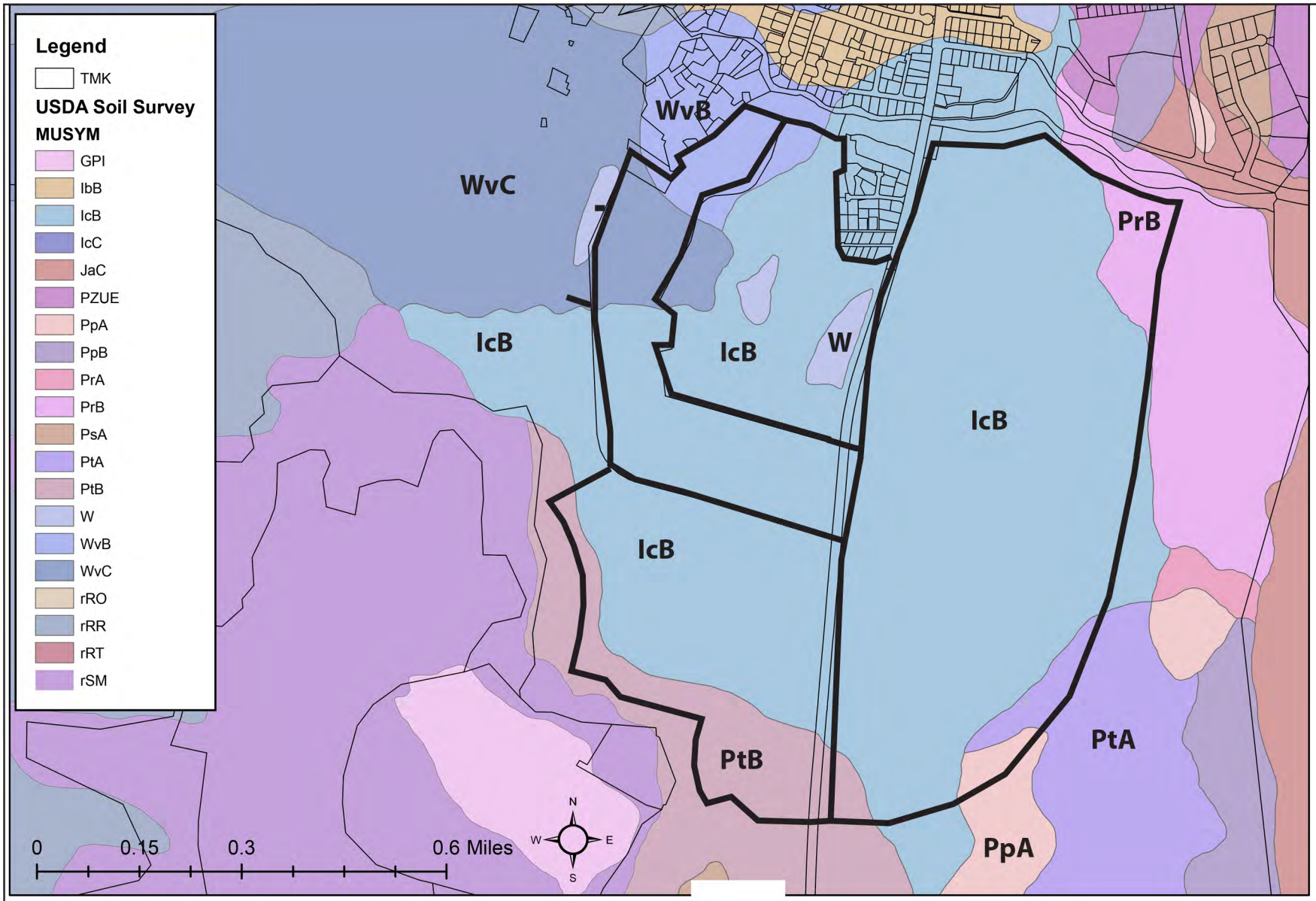


Figure 35

USDA Soils Map

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

Impacts to the soils include the potential for soil erosion and the generation of dust during construction. Clearing and grubbing activities will temporarily disturb the soil retention values of the existing vegetation and expose soils to erosion forces. Some wind erosion of soils could occur without a proper watering and revegetation program. Heavy rainfall could also cause erosion of soils within disturbed areas of land.

To the extent possible, improvements will conform to the contours of the land, further limiting the need for extensive grading of the site. In addition, graded areas will be limited to specific areas for short periods of time. Measures taken to control erosion during the site development period may include:

- Minimizing the time of construction;
- Retaining existing ground cover as long as possible;
- Constructing drainage control features early;
- Using temporary area sprinklers in non-active construction areas when ground cover is removed;
- Providing a water truck on-site during the construction period to provide for immediate sprinkling as needed;
- Using temporary berms and cut-off ditches, where needed, for control of erosion;
- Watering graded areas when construction activity for each day has ceased;
- Grassing or planting all cut-and-fill slopes immediately after grading work has been completed; and
- Installing silt screens where appropriate.

Construction activities on the property will comply with all applicable Federal, State and County regulations and rules for erosion control. Before issuance of a grading permit by the County of Maui, the final erosion control plan and BMPs required for the NPDES permit will be completed. All construction activities will also comply with the provisions of Chapter 11-60.1, Hawai‘i Administrative Rules (HAR), Section 11-60.1-33, pertaining to Fugitive Dust. After construction, the establishment of permanent landscaping will provide long-term erosion control.

3. Natural Hazards

Existing Conditions. Natural hazards impacting the Hawaiian Islands include hurricanes, tsunamis, volcanic eruptions, earthquakes, stream flooding, and coastal flooding.

Seismic hazards are those related to ground shaking. Landslides, ground cracks, rock falls and tsunamis are all seismic hazards. Engineers and other professionals have created a system of classifying seismic hazards on the basis of the expected strength of ground shaking and the probability of the shaking actually occurring within a specified time. The results are included in the Uniform Building Code (UBC) seismic provisions.

The UBC seismic provisions contain six seismic zones, ranging from 0 (no chance of severe ground shaking) to 4 (10% chance of severe shaking in a 50-year interval). Kauai County is located in Zone 1, County of Honolulu is Zone 2A, County of Maui is Zone 2B and County of Hawai‘i is Zone 4.

In addition to seismic hazards, devastating hurricanes do occur and have impacted Hawai‘i twice since 1980: Hurricane Iwa in 1982 and Hurricane Iniki in 1992. While it is difficult to predict these natural occurrences, it is reasonable to assume that future events could be likely, given the recent record.

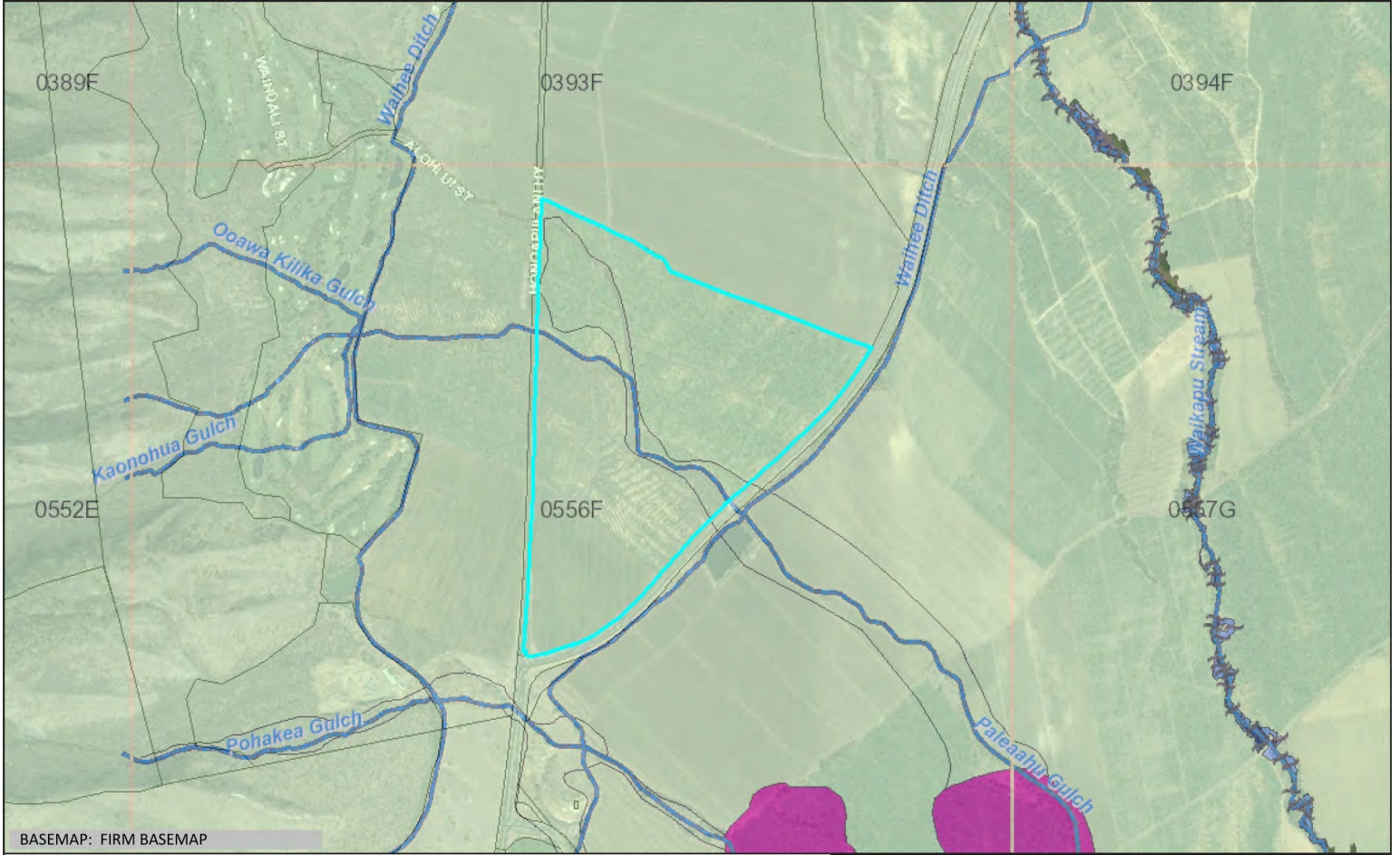
Tsunamis are large, rapidly moving ocean waves triggered by a major disturbance of the ocean floor, which is usually caused by an earthquake but sometimes can be produced by a submarine landslide or a volcanic eruption. About 50 tsunamis have been reported in the Hawaiian Islands since the early 1800s, including the most recent Tsunami as a result of the March 2011 earthquake in Japan. The Waikapū Country Town is outside of the Civil Defense Tsunami Evacuation Zone.

Volcanic hazards are not a concern in the Central Maui area due to the dormant status of Haleakalā. In Hawai‘i most earthquakes are linked to volcanic activity, unlike other areas where a shift in tectonic plates is the cause of an earthquake. Each year, thousands of earthquakes occur in Hawai‘i, the vast majority of them so small they are detectable only with highly sensitive instruments. However, moderate and disastrous earthquakes have also occurred.

The 1938 Maui Earthquake, with a magnitude of 6.7-6.9 on the Richter scale and an epicenter six (6) miles north of Maui, created landslides and forced the closure of the road to Hana. Damaged water pipes and ground fractures also were reported in Lāhainā. More recently, on October 16, 2006, a 6.7 magnitude earthquake struck on the underwater segment of the major rift zone of the Hualalai volcano on the northwest side of the Island of Hawai'i. The earthquake caused rockslides and some damage to roadways on Maui.

Flood hazards are primarily identified by the Flood Insurance Rate Map (FIRM) prepared by the United States Department of Homeland Security Federal Emergency Management Agency (FEMA), National Flood Insurance Program. Flood zone designations can also be identified by using the Hawai'i National Flood Insurance Program, Flood Hazard Assessment Tool. A portion of TMK Parcel Nos. 3-6-002:003 and 3-6-004:003, paralleling the Waikapū Stream, are located in Zones AEF and AE and XS. Zones AEF and AE are Special Flood Hazard Areas subject to inundation by the 1% annual chance flood. These areas have a 1% chance of being subjected to the 100-year flood each year. Mandatory Flood Insurance must be carried within Special Flood Hazard Areas. Zone AEF is defined as the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE. Zone AE is an area where the base flood elevation has been determined. Zone XS is an area of Non-Special Flood Hazard Area, which is an area considered to be of low to moderate risk. Mandatory flood insurance is not required in the Non-Special Flood Hazard Area. Zone XS is defined as an area of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood (**See**: Figure No. 36, A-E, "Flood Hazard Assessment Maps").

Potential Impacts and Mitigation Measures. Any structures built within the WCT site will be constructed for protection from earthquakes and the destructive winds and torrential rainfall of tropical hurricanes, in accordance with the Building Code adopted by the County of Maui. All work will comply with applicable flood zone standards, such as those set forth in Chapter 19.62, "Flood Hazard Areas",Maui County Code.



Flood Hazard Assessment Report

www.hawaiinfip.org

Waikapu Country Town

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-002:001
WATERSHED:	POHAKEA; WAIKAPU
PARCEL ADDRESS:	0 HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030556F
PANEL EFFECTIVE DATE:	SEPTEMBER 25, 2009

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 0.30 0.60 mi

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL*)

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

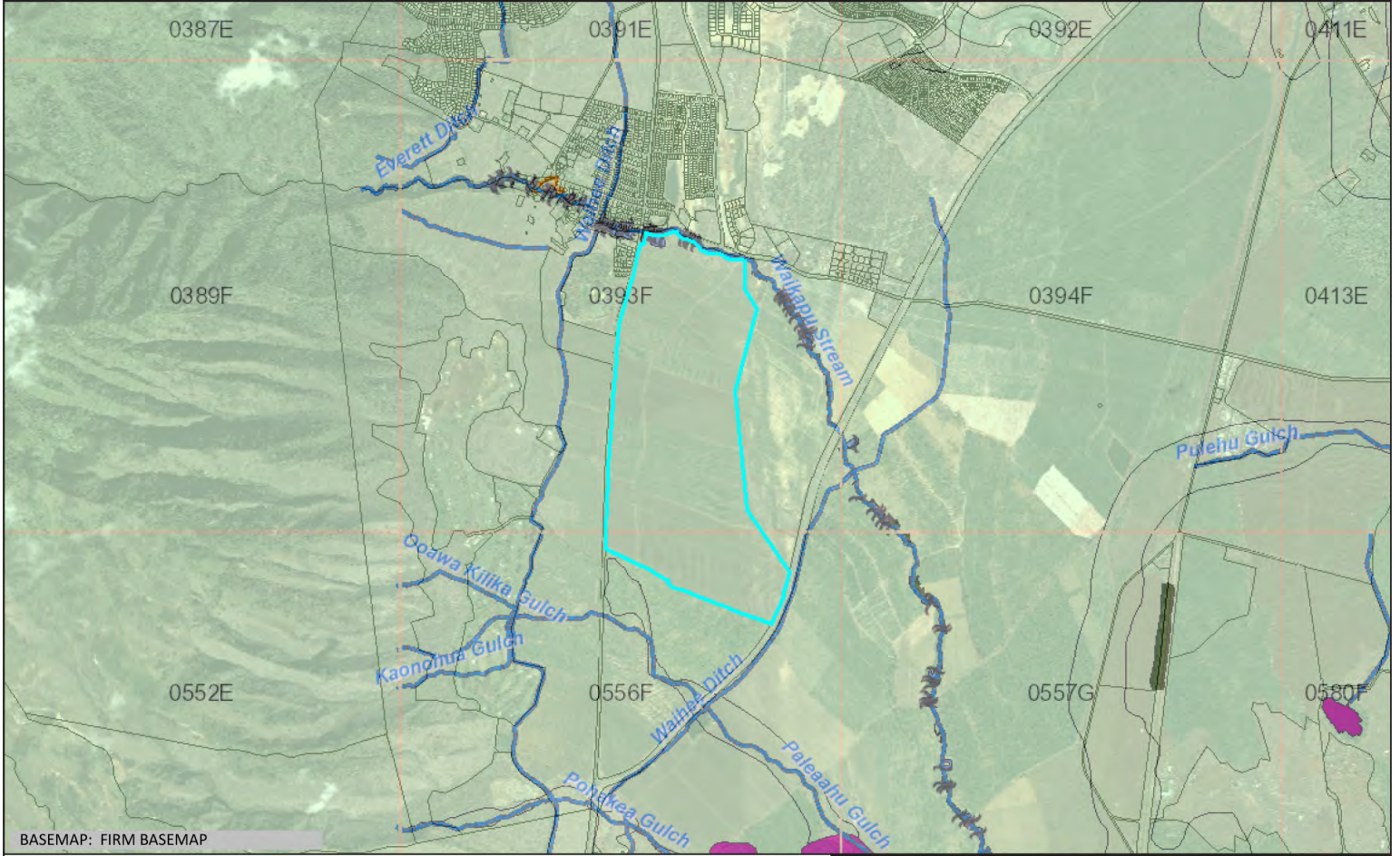
NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

Figure 36 A: Flood Hazard Assessment Map



Flood Hazard Assessment Report

www.hawaiinfip.org

Waikapu Country Town

Property Information

COUNTY: MAUI

TMK NO: (2) 3-6-002:003

WATERSHED: IAO; WAIKAPU

PARCEL ADDRESS: 0 HONOAPIILANI HWY
WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE: NOVEMBER 04, 2015

LETTER OF MAP CHANGE(S): NONE

FEMA FIRM PANEL - EFFECTIVE DATE: 1500030393F - NOVEMBER 04, 2015
1500030556F - SEPTEMBER 25, 2009

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 0.60 1.20 mi

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL*)

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

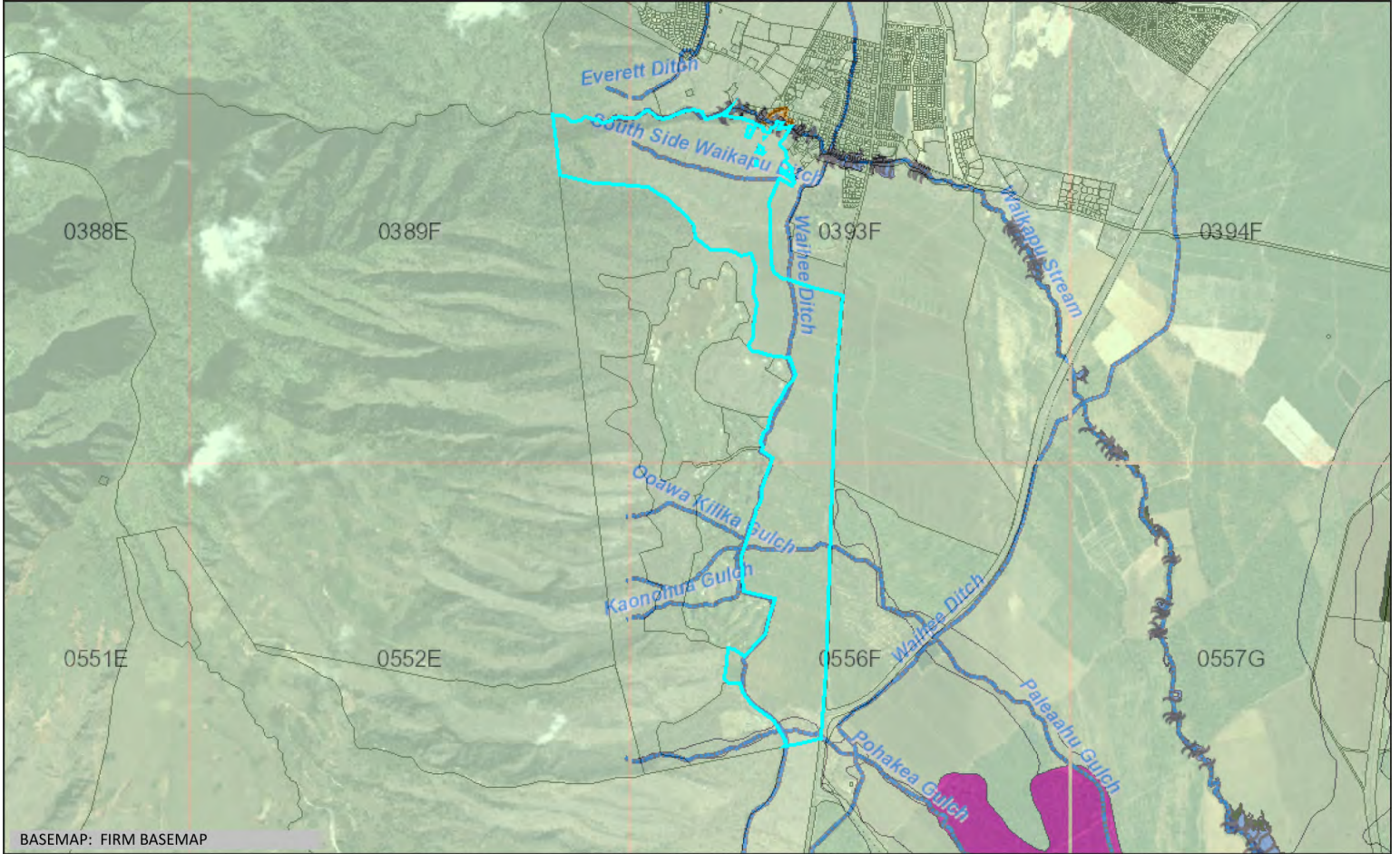
NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

Figure 36 B: Flood Hazard Assessment Maps



Flood Hazard Assessment Report

www.hawaiinfip.org

WAIKAPU COUNTRY TOWN

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-004:003
WATERSHED:	POHAKEA; WAIKAPU
PARCEL ADDRESS:	0 HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL - EFFECTIVE DATE:	1500030389F - NOVEMBER 04, 2015 1500030393F - NOVEMBER 04, 2015 1500030556F - SEPTEMBER 25, 2009

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 0.60 1.20 mi

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL*)

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

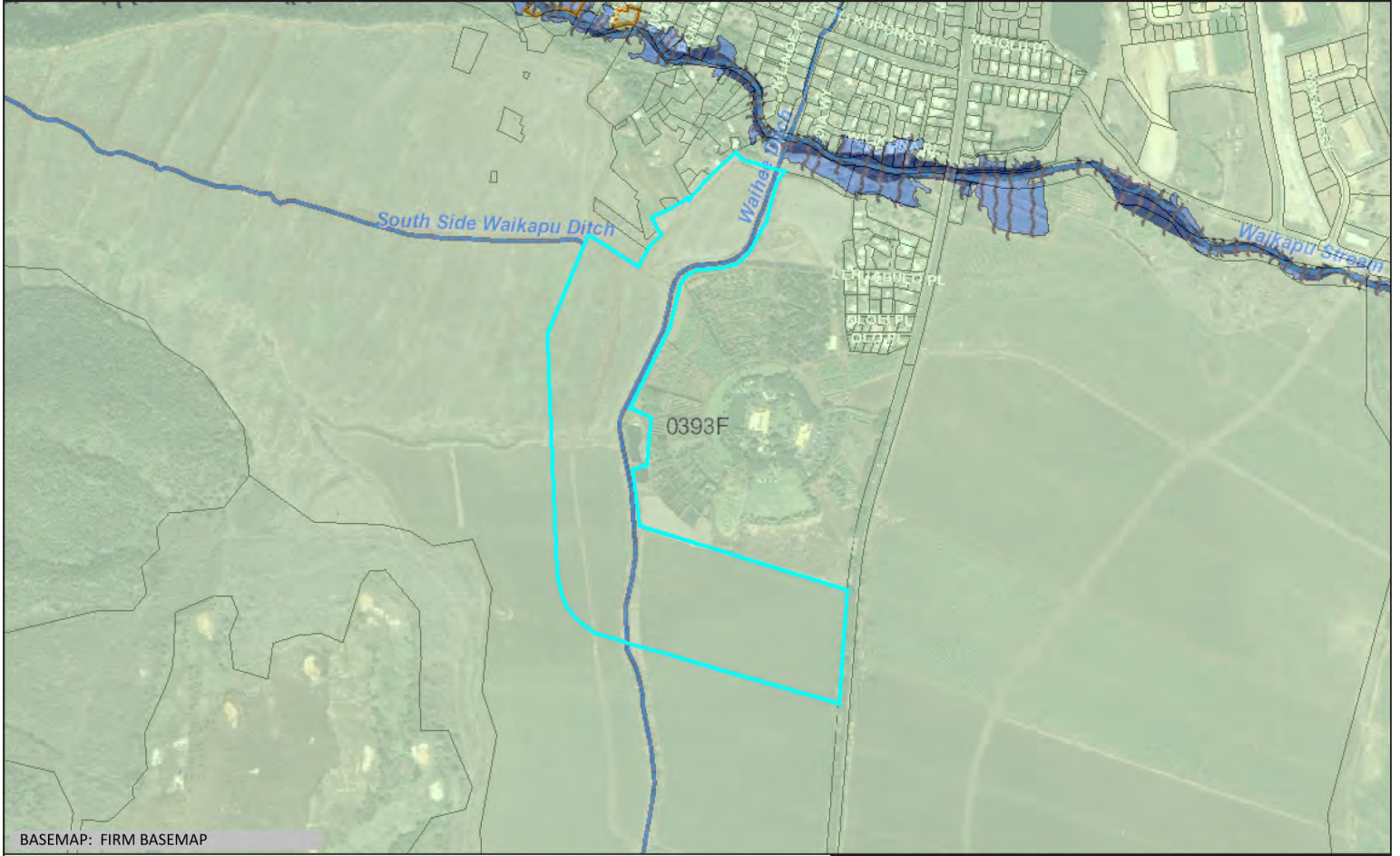
NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

Figure 36 C: Flood Hazard Assessment Maps



Flood Hazard Assessment Report

www.hawaiinfip.org

WAIKAPU COUNTRY TOWN

Property Information

COUNTY: MAUI

TMK NO: (2) 3-6-004:006

WATERSHED: WAIKAPU

PARCEL ADDRESS: 2000 HONOAPIILANI HWY
WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030393F
PANEL EFFECTIVE DATE:	NOVEMBER 04, 2015

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 600 1,200 ft

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND

(*Note: legend does not correspond with NFHL*)

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

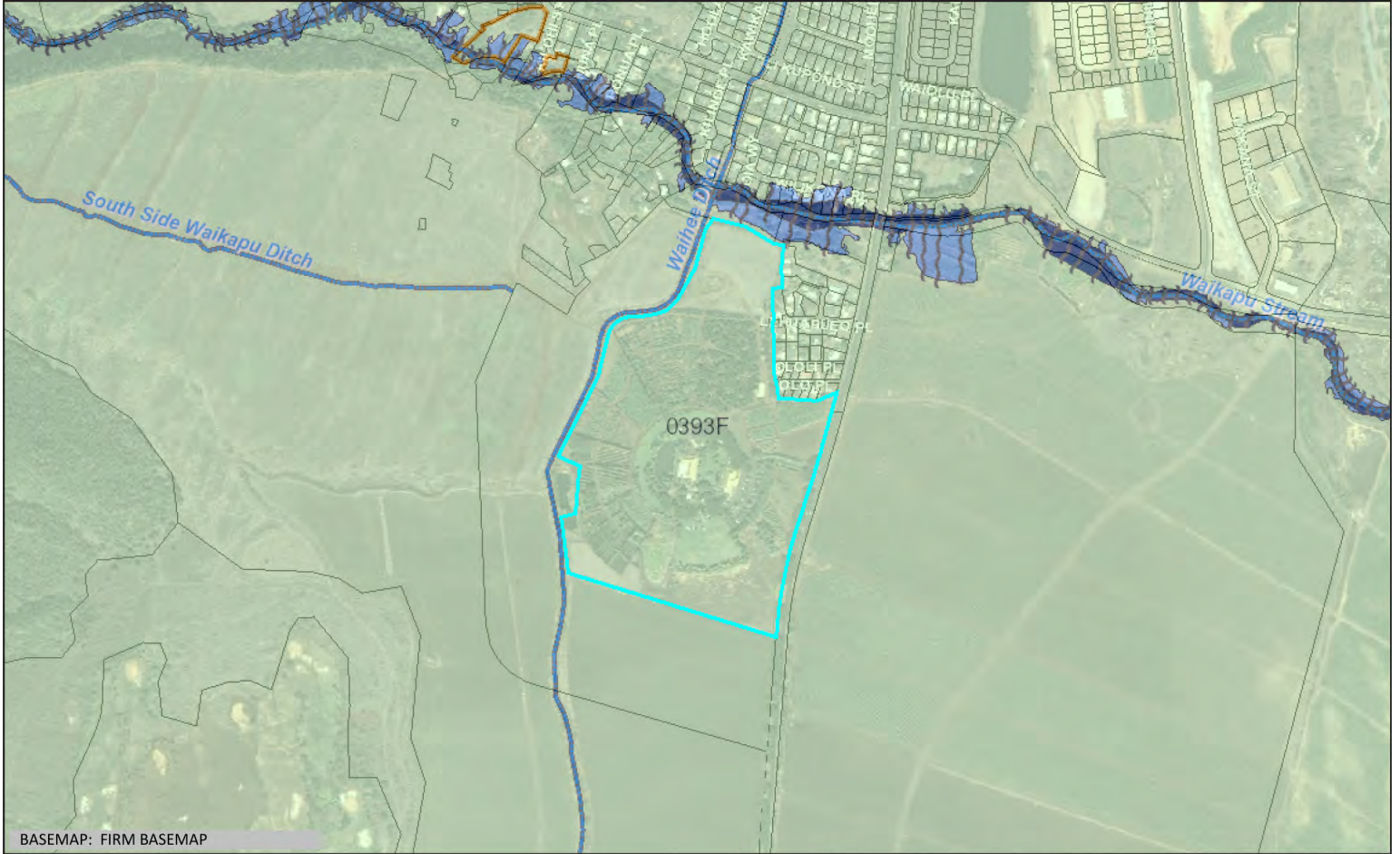
NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

Figure 36 D: Flood Hazard Assessment Maps



Flood Hazard Assessment Report

www.hawaiinfip.org

WAIKAPU COUNTRY TOWN

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-005:007
WATERSHED:	WAIKAPU
PARCEL ADDRESS:	1670 HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030393F
PANEL EFFECTIVE DATE:	NOVEMBER 04, 2015

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 600 1,200 ft

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL*)

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

Figure 36 E: Flood Hazard Assessment Maps

Flood Hazard Assessment Report

www.hawaiinfip.org

WAIKAPU COUNTRY TOWN

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-006:036
WATERSHED:	WAIKAPU
PARCEL ADDRESS:	0 WAIKAPU WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030393F
PANEL EFFECTIVE DATE:	NOVEMBER 04, 2015

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 100 200 ft

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL)*

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

Figure 36 F: Flood Hazard Assessment Maps

The project area located adjacent to the Waikapū Stream, within the Special Flood Hazard Area, is proposed to be set aside for parks, open space and agriculture. No structures will be will be located within Zone AEF.

The WCT project site is located approximately 3.5 miles inland of Kahului Harbor and about 4 miles inland of Mā‘alaea Harbor and should therefore not be impacted by tsunami or coastal flooding. In addition, the proposed development will be designed with a drainage system, including detention basins, to mitigate any increase in runoff that could negatively impact neighboring properties.

4. Flora and Fauna

Existing Conditions. Botanical and Faunal Surveys were conducted by Robert W. Hobdy, Environmental Consultant, in February 2013 for the 494 acres proposed for development (**See**: Appendix B, “Botanical and Faunal Surveys”).

A total of 130 plant species were recorded during the survey. Seven species were found to be common within the project area: buffelgrass (Cenchrus ciliaris), Guinea grass (Megathyrsus maximus), sugar cane (Saccharum officinarum), smooth rattlepod (Crotalaria pallida), cheeseweed (Malva parviflora), ’uhaloa (Waltheria indica) and Java plum (Syzygium cumini). These species are found naturally in Hawai‘i as well as throughout the tropics nearly worldwide and are common.

Just 3 native species were found within the project area: ’uhaloa, koali awahia (Ipomoea indica) and popolo (Solanum americanum). These species are found naturally in Hawai‘i as well as throughout the tropics nearly worldwide and are common. Four plant species found during the survey were introduced over a thousand years ago by Polynesian voyagers: kukui (Aleurites moluccana), niu (Cocos nucifera), hau (Talipariti tileaceum) and ’ihi’ai (Oxalis corniculata). The remaining 123 species were non-native plants, including some useful forage grasses, but many are considered to be agricultural or roadside weeds.

All of the mammals recorded are common non-native species of no particular concern. None of the endangered Hawaiian hoary bats were detected during the survey. Birdlife is dominated by

widespread introduced species. While no protected seabirds were found on the property, the ‘ua’u and ‘a’o are known to overfly the area between the months of March and November.

Three native insects were recorded during the survey. The indigenous dragonflies, the globe skimmer and the green darner are both widespread and common, both in Hawai‘i and elsewhere, and are of no particular conservation concern. The Blackburn’s sphinx moth, however, is an endangered species and is of special concern. Just two individuals of its preferred host plants, the tree tobacco, were found on the northern end of the sugar cane fields at the base of a stockpiled sand pile. These two plants were carefully examined for eggs, larvae or signs of feeding. One plant was found to have two mature eggs on separate leaves. The eggs had turned brown, indicating they were ready to hatch out young larvae. Tree tobacco plants are not native to Hawai‘i, but fall under the protection of the Endangered Species Act (1973) during the period of their association with the Endangered Blackburn’s sphinx moth. The occurrences of the non-native amphibians, reptiles and mollusks are of no particular interest or concern.

Potential Impacts and Mitigation Measures. As a result of the above findings it is determined that there is little of botanical concern and that the proposed project is not expected to have a significant negative impact on the botanical resources in this part of Maui. No recommendations with regard to plants are deemed appropriate or necessary.

With respect to the ‘ua’u and ‘a’o which are known to overfly the property, it is recommended that any significant outdoor lighting be shielded to direct the light downward so that it is not visible from above. This is because the ‘ua’u and ‘a’o are easily confused and distracted by bright lights and often crash to the ground, where they are particularly vulnerable to being run over by vehicles or killed by predators.

As for the presence of the two tree tobacco plants that were found on the northern end of the sugar cane fields at the base of a stockpile, one of which was host to two mature Blackburn’s sphinx moth eggs, Hobdy recommended that this occurrence be reported to the U.S. Fish and Wildlife Service so that the required protections and management actions could be clarified.

In a December 15, 2015 e-mail to Planning Consultants Hawai'i LLC, the U.S. Fish and Wildlife Service provided the following guidance to mitigate impacts to the Blackburn's sphinx moth that might exist on the WCT property (See Appendix Q ~~L~~):

1. Survey protocol

Surveys for Blackburn's sphinx moth and its potential host plants will be conducted by a qualified individual during the wettest portion of the year (Hawai'i Island: January to April; Maui North shore: November to April; rest of Maui: October to April – early surveys can be done if there have been Kona storms), approximately four to eight weeks following a significant rainfall event. In some cases, multiple surveys may be recommended.

If *Nothocestrum sp*. or *N. glauca* are detected during surveys, the plants will be visibly marked with flagging and the following documented: 1) general larval plant density; 2) proximity of larval plants to project sites; 3) average height of the larval plants; 4) signs of larval feeding damage on leaves; and 5) presence of Blackburn's sphinx moth larvae on leaves.

2. Avoidance and minimization

N. glauca frequently occurs in disturbed areas. Blackburn's sphinx moth adults lay eggs on *N. glauca* and moth larvae feed on the leaves of the plant before they crawl from the plant and burrow into the soil or crevices in rock where they pupate for up to a year or longer. They are most likely to pupate within 33 ft. (10 m) of the larval host plant, although they may transit farther over paved and hardened surfaces to find a suitable site to enter the ground. The minimization measures below are conservative because our understanding of the species' resource limitations and behavior is limited. Clearing of the *N. glauca* would be completed using the following safeguards to ensure the potential for direct effects to Blackburn's sphinx moth eggs, larvae, and pupae are minimized:

- If *N. glauca* is less than three feet in height and no Blackburn's sphinx moth eggs, larvae, or signs indicating the possibility of pupating larvae (such as frass, chewed stems or other browsing characteristics) are detected, the entire plant(s) may be removed and the soil within 33 ft. (10 m) may be disturbed.

- If *N. glauca* is more than three feet in height, it is possible that the signs of Blackburn's sphinx moth foraging have been shed and pupating larvae may be in the ground in the area beneath the plant(s). Therefore, if there are no signs of Blackburn's sphinx moth on *N. glauca* more than three feet in height, the above-ground portion of the plant(s) may be cut off and removed and the following measures implemented to minimize the potential for future use of the plant by Blackburn's sphinx moth and potential impact to a pupae that may already be in the soil near the plant:
    - Stems will be treated with herbicide or re-trimmed to prevent leaf growth and potential use by the Blackburn's sphinx moth.
    - A 33-ft (10-m) disturbance-free buffer will be established around the plant's location for one year. After one year, the plant roots may be removed and the soil disturbed if necessary. The one-year waiting period will ensure any larvae pupating in the soil will have pupated and emerged from the soil prior to disturbance of the plant(s) or soil.

In accordance with the U.S. Fish and Wildlife's guidance, a qualified biologist will be retained to resurvey the previously identified Tree Tobacco (*N. glauca*) plants, and immediate area, for the presence of Blackburn's sphinx moth larvae. Depending upon the height of the tree, and the presence or absence of the Blackburn's sphinx moth, the prescribed mitigation measures documented above will be adhered to. Based upon the guidance provided, the Applicant understands that by implementing the necessary mitigation measures, the presence of the host Tree Tobacco plant and Blackburn's sphinx moth should not constrain development of the project site.

CHAPTER V

Affected Human Environment, Potential Impacts and Mitigation Measures

V. AFFECTED HUMAN ENVIRONMENT, POTENTIAL IMPACTS AND MITIGATION MEASURES

A. HUMAN ENVIRONMENT

1. Surrounding Land Uses

Existing Conditions. The project site is bound to the south by agricultural lands that are owned by the Applicant. These lands are leased by HC&S for sugar cane cultivation. To the west are agricultural lands that rise to the base of the West Maui Mountains. These lands are used for diversified agriculture and grazing cattle. To the east are agricultural lands that were recently acquired by the County of Maui for a County baseyard and regional park complex. Beyond the County owned property is agricultural land that A&B Properties proposes to develop. The proposed A&B development, known as Wai`ale, may include up to 2,550 residential units together with civic and commercial uses. In 2014 A&B Properties obtained a State Land Use Commission District Boundary Amendment from Agriculture to Urban to support the Wai`ale Development. To the north is the Waikapū Stream, which separates the proposed development from Waikapū Town. Waikapū Town is comprised mostly of single-family residences. Many of these residences were constructed from the early 1900s through the 1950s for workers of the Wailuku Sugar Company. The older neighborhoods are located along East and West Waiko Roads and are bound by the Waikapū Cemetery to the east, the Waikapū Stream to the south, and the mauka reaches of West Waiko Road. In recent years development has begun to stretch north, towards Wailuku, both mauka and makai of Honoapi'ilani Highway.

Potential Impacts and Mitigation Measures. The project area is located within the MIPs Small Town Growth Boundary. The MIP describes Waikapū Country Town as a "self-sufficient small town with a mix of single-family and multi-family housing units in a walkable community that includes affordable housing in close proximity to Wailuku's employment centers ….". The

Waikapū area is an evolving community. The immediate area has seen several new housing developments built-our over the prior decade. These subdivisions have predominantly served the local market rather than off-shore buyers. With the planned development of Wai`ale and the WCT, Waikapū will evolve to become a more complete community, supportive of a concentration of residential housing, public facilities such as parks and schools, shopping, employment and infrastructure to become a more independent small town. The direct, indirect and cumulative impacts associated with the region's growth is discussed in Chapters IV through VI of the ~~DEIS~~ FEIS.

2. **Air Quality**

Existing Conditions. An Air Quality Study was conducted by B.D Neal & Associates to examine the potential short- and long-term air quality impacts that could occur as a result of the construction and operation phases of the development and suggests mitigation measures to reduce any potential air quality impacts where possible and appropriate (**See**: Appendix C, "Air Quality Study".

Both Federal and State standards have been established to maintain ambient air quality. Seven parameters are regulated: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone, and lead. State of Hawai'i air quality standards are either equally or more stringent than the comparable national standards. Hawai'i air quality standards are comparable to the national standards except those for nitrogen dioxide and carbon monoxide which are more stringent than the national standards.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the project area is very much affected by its elevation near sea level and by nearby mountains. The predominant trade winds tend to be channeled through the area by the mountains to the east and west. Temperatures in the project area are generally very consistent and warm with average daily temperatures ranging from about 68°F to 81°F. A generally semi-arid climate pertains. The project site receives its highest rainfall during the winter and lowest rainfall during the summer. Throughout the year rainfall is relatively low, averaging approximately 20- to 30-inches per year, with the monthly average ranging from 0.25 inches in August to approximately 5-inches in January.[ix]

At 30-feet above the ground, wind speeds across the site range from about 5.5 meters per second to 7.5 meters per second, which is approximately 12 to 17 miles per hour.[x] Except for periodic impacts from volcanic emissions (vog) and possibly occasional localized impacts from traffic congestion and local agricultural sources, the present air quality of the project area is believed to be relatively good. There is very little air quality monitoring data from the Department of Health for the project area, but the limited data that are available suggest that concentrations are generally within state and national air quality standards. During this study's air quality modeling, it was determined that present 1-hour and 8-hour worst-case carbon monoxide concentrations are well within both the state and the national ambient air quality standards.

Potential Impacts and Mitigation Measures. There may be some short- and/or long-term impacts on air quality that may occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust could occur during the project construction phases. To a lesser extent, exhaust emissions from stationary and mobile construction equipment, from the minor disruption of traffic, and from workers' vehicles may also affect air quality during the period of construction.

State air pollution control regulations require that there be no visible fugitive dust emissions at the property line. Therefore, an effective dust control plan must be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by the following types of BMP's:

- Watering of active work areas;
- Using wind screens;
- Keeping adjacent paved roads clean; and
- Covering of open-bodied trucks.

Other dust control measures to consider include:

- Limiting the area that is disturbed at any given time;
- Mulching or chemically stabilizing inactive areas that have been worked; and

- Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions.
- Planning the different phases of construction, focusing on minimizing the amount of dust-generating materials and activities, centralizing on-site vehicular routes, and locating potential dust-generating equipment in areas of least impact;
- Providing adequate dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and

Exhaust emissions can be mitigated by moving construction equipment and workers to and from the project site during off-peak traffic hours.

To assess the potential long-term impact of emissions from project-related motor vehicle traffic operating on roadways in the project area after construction is completed, a computerized air quality modeling study was undertaken. The air quality modeling study estimated current worst-case concentrations of carbon monoxide at intersections in the project vicinity and predicted future levels both with and without the proposed project. During worst-case conditions, model results indicated that present 1-hour and 8-hour worst-case carbon monoxide concentrations are well within both the state and the national ambient air quality standards.

In the year 2026 without the project, worst-case carbon monoxide concentrations were predicted to decrease (improve) despite an increase in traffic, and concentrations would remain well within standards. This is because emissions from the increase in traffic will be more than offset by the retirement of older, more-polluting vehicles over time. With the project in the year 2026 and with proposed roadway improvements, estimated worst-case carbon monoxide concentrations indicated only minimal or no impact compared to the without project case. Concentrations would remain well within standards. Due to the negligible impact the project is expected to have, implementing mitigation measures for long-term traffic-related air quality impacts is unnecessary and unwarranted.

Regarding the Project's WWRF, the primary issue is the potential for off-site odor nuisance, typically from hydrogen sulfide (H2S) emissions. The Hawai'i Department of Health has established a standard for H2S of 0.025 ppm for a one-hour average. While this standard may

provide protection from detrimental health effects of H2S, it does not guard against odor nuisance. The odor threshold for sensitive individuals is generally taken to be about 0.005 ppm. The Applicant's wastewater reclamation facility designer, Mana Water, has committed to limiting the concentration of H2S at the facility boundary to 0.005 ppm. This, and the significant agricultural buffer around the facility, should effectively preclude the occurrence of offsite odor nuisance from the facility.

3. **Noise Quality**

Existing Conditions. The noise level is an important indicator of environmental quality. In an urban environment, noise is due primarily to vehicular traffic, air traffic, heavy machinery, and heating, ventilation, and air-conditioning equipment. Ramifications of various sound levels and types may impact health conditions and an area's aesthetic appeal.

A Noise Assessment Report was prepared by D.L. Adams & Associates to describe the existing and future traffic noise levels in the environs of the project site. Traffic noise level increases and impacts associated with the project were determined within the project site and along public roadways servicing the development. Impacts from on-site activities and short-term construction noise at the project site were also assessed. Recommendations for minimizing noise impacts are also provided (**See**: Appendix D, "Noise Assessment Report").

The project area is currently exposed to varying daytime ambient noise levels, depending on the proximity to major roadways. The areas adjacent to Honoapi'ilani Highway experience the highest ambient noise levels during peak traffic hours where vehicular traffic noise is the dominant noise source.

Ambient noise levels range from 53 to 64 dBA adjacent to Honoapi'ilani Highway. The ambient noise environment is relatively low in areas that are far from the major roadways. The areas adjacent to Honoapi'ilani Highway experience the highest ambient noise levels during peak traffic hours where vehicular traffic noise is the dominant noise source. The results from the long-term noise measurements conducted at the WCT site indicate that the existing day-night level is less than 60 dBA for areas located beyond 65 feet from the edge-of-pavement of Honoapi'ilani Highway. Therefore, the noise levels for a majority of the project site are within

the HUD site acceptability standards, which state a design goal of Ldn ≤ 65 dBA for the exterior noise level. The noise sources that exist throughout the project site include traffic, wind, birds, occasional aircraft flyovers, and construction equipment.

Potential Impacts and Mitigation Measures. The Noise Assessment Report (See Appendix D) addresses the following noise related impacts:

- Construction phase impacts to neighboring properties and residents of the project;
- Operational phase impacts from project generated traffic and stationary mechanical equipment; and
- Impacts to residents of the project from internal and external vehicular traffic.

Construction Phase Traffic Impacts

The various construction phases of the project will generate significant amounts of noise. Depending on when construction occurs, the WCT development may impact existing adjacent properties, such as the homes and businesses adjacent to Honoapi'ilani Highway and Waiko Road. Similarly, residences from the initial phases may be impacted by construction noise from subsequent phases due to their proximity to the construction site.

Development of the project areas will involve excavation, grading, and other typical construction activities during construction. The use of impact equipment is not anticipated. The actual noise levels produced during construction will be a function of the methods employed during each stage of the construction process. Earthmoving equipment, e.g., bulldozers and diesel-powered trucks, will probably be the loudest equipment used during construction. In cases where construction noise is expected to exceed the HDOH "maximum permissible" property line noise levels, a permit must be obtained to allow the operation of construction equipment.

Prior to issuing the noise permit, HDOH may require action by the contractor to incorporate noise mitigation into the construction plan. HDOH may also require the contractor to conduct noise monitoring or community meetings inviting the neighboring residents and business owners to discuss construction noise. The contractor should use reasonable and standard practices to mitigate noise, such as using mufflers on diesel and gasoline engines, using properly

tuned and balanced machines, etc. However, HDOH may require additional noise mitigation, such as temporary noise barriers, or time of day usage limits for certain kinds of construction activities. Table 27 ~~24~~ identifies standard construction noise source control methods.

Table 27 ~~24~~: Construction Noise Source Control Methods

Construction Noise Source Control Methods	
Scheduling	Limit activities that generate the most noise to less sensitive time periods (e.g. daytime hours).
Substitution	Use quieter methods/equipment when possible (i.e. low noise generators, smaller excavators, etc.).
Exhaust Mufflers	Install quality mufflers on equipment
Reduced Power Options	Use smallest size and/or lowest power as required.
Quieter Backup Alarms	Install manual adjustable or ambient sensitive alarms. Do not use backup alarms during night work.
Motors	Insulate or enclose motors
Equipment Selection	Electric equipment is quitter than pneumatic equipment
Equipment Retrofit	Rubber chucks in jackhammers
Equipment Maintenance	Sharpen and balance tools, repair silencing equipment, replace worn parts and open airways
Staging Area	Maximize the distance between the construction staging areas and nearby receptors to the greatest extent possible

Mechanical Equipment

Expected mechanical equipment may include air handling equipment, condensing units, refrigeration units, etc. Noise from this mechanical equipment at the commercial, mixed-use, and school sites could significantly impact the proposed adjacent noise sensitive residential areas. The HDOH Community Noise Rule stipulates maximum permissible noise limits at the property line for mechanical equipment. The noise limits are 60 dBA during the day and 50 dBA during the night for business and commercial areas. Mitigation of mechanical noise to meet the HDOH noise rules should be incorporated into the project design. For mixed zoning districts, the

primary land use designation is used to determine the maximum permissible noise limits. However, the HDOH takes into consideration background noise levels when assessing noise infractions.

The build out of residential units in the may also incorporate stationary exterior mechanical equipment. For single family homes, noise limits are 55 dBA during the day and 45 dBA during the night. For multi-family homes, noise limits are 60 dBA during the day and 50 dBA during the night. As with the commercial build out, the design and selection of exterior mechanical equipment for the residential units must comply with the HDOH property line noise limits.

Impacts from On- and Off-site Traffic

Future year traffic projections show that the FHWA maximum noise limit of 67 dBA will be satisfied for homes that are located more than 60 feet from the edge-of-pavement of Honoapi'ilani Highway. Although the FHWA criteria is not a regulatory requirement for this project, as it has no authority to enforce land use, its noise limit criteria is recommended by the FHWA to be used as a guideline for consideration of land use and the impact of traffic noise.

The projected traffic volumes and speed limits on the future roadways that provide access to the WCT are not significant enough to generate noise levels greater than 60 dB at the adjacent residential property lines. This is true for the main access roads off of Honoapi'ilani Highway as well as the future Wai`ale Road extension.

The results from the long-term noise measurements conducted at the WCT site indicate that the existing day-night level is less than 60 dBA for areas located beyond 65 feet from the edge-of-pavement along Honoapi'ilani Highway. Therefore, the noise levels for a majority of the project site are within the HUD site acceptability standards, which state a design goal of Ldn ≤ 65 dBA for the exterior noise level.

Residences within the WCT development that are located along Honoapi'ilani Highway and the major perimeter roadways will be exposed to elevated traffic noise. HUD site acceptability standards must be satisfied by providing minimum setback distances or other traffic noise mitigation measures in order to reduce the noise impact to these homes.

Vehicular traffic noise from Honoapi'ilani Highway may impact the proposed development unless noise mitigation is considered. Table 28 ~~25~~ identifies the minimum setback distances to satisfy the HUD Site Accessibility Standards.

Table 28 ~~25~~: Minimum Setback Distances to Satisfy HUD Site Acceptability Standards

Minimum Setback Distances to Satisfy HUD Site Accessibility Standards	
Roadway	**Setback**
Honoapi'ilani Highway	60 feet
Future Wai`ale Road Extension	None Required
Future Main Street	None Required
Future Collector and Minor Streets	Non Required

The guidelines listed below are general in nature and should be applied where residential housing is constructed within the setback limits listed above and noise mitigation becomes necessary. The following are effective noise mitigation measures.

- Construct barrier walls and/or earthen berms along roadways.
- Air-condition buildings instead of relying on natural ventilation.
- Acoustically soften interior spaces by the addition of thick carpeting with a padding underlayment, an acoustical tile ceiling, louvered closet doors, etc.
- Use exterior wall constructions which exhibit high noise reductions.

Typical exterior-to-interior noise reductions for naturally ventilated homes, i.e., with open windows, are approximately 9 dB. Adding absorption to interior spaces, (acoustically softening), can further reduce the noise levels 1 to 5 dB, depending upon the absorption initially present, and the amount of absorption added to the space. Air-conditioned or mechanically ventilated homes will also typically exhibit higher exterior-to-interior noise reductions achieved by several types of building constructions.

Noise impacts from the Wastewater Reclamation Facility

Based on data collected of similar facility and operations, the wastewater treatment facility is not expected to produce high noise levels at or beyond property lines adjacent to it. It is anticipated that noise level at the proposed WWRF site would be compliant with the HDOH noise regulations for all operating hours and classifications. The exact noise level generated by the facility will be a function of the specific design, equipment selection, and operations. If noise from the proposed facility is significantly higher than the data collected at a similar facility, it may require additional acoustical mitigation based on the specifics of the actual equipment and design.

4. **Historical and Archaeological Resources**

Existing Conditions. Archaeological Services Hawai'i, LLC conducted an archaeological inventory survey (AIS) of the parcels and portions of parcels that are proposed for urban development. The AIS also addressed traditional sites previously identified in adjoining lands and or near the Project. These sites are discussed in significant detail in the Traditional and Historical Background and Previous Archaeology sections of the AIS (**See**: Appendix E). As described in the AIS, the Project's Area of Potential Effect is the lands that will undergo ground altering activities during development. Furthermore, the mauka most property along Waikapū Stream within TMK [2] 3-6-004:003 is to be developed utilizing only hiking trails and open space, which already currently exist, and thus minimal ground altering activities are anticipated; however the area was subjected to 31 backhoe trenches in 2007. Note that these lands are to remain in agricultural use, are not subject to changes in land use entitlements, and will not be subject to urban or rural development but are also addressed in the AIS.

The parcels subject to the study included ~~subject parcels to be developed~~ (TMK's 3-6-002:003; 3-6-004:003, 006; and 3-6-005:007) (**See**: Appendix E, "Archaeological Inventory Survey"). The AIS was conducted to determine the presence/absence, extent, and significance of historic properties within the project area and to formulate future mitigation measures for these remains. For the purpose of conducting the AIS, the project area was divided into five areas of analysis based primarily on the TMK's. These areas are described below (**See:** Figure 37 ~~32~~, AIS Site Survey Map).

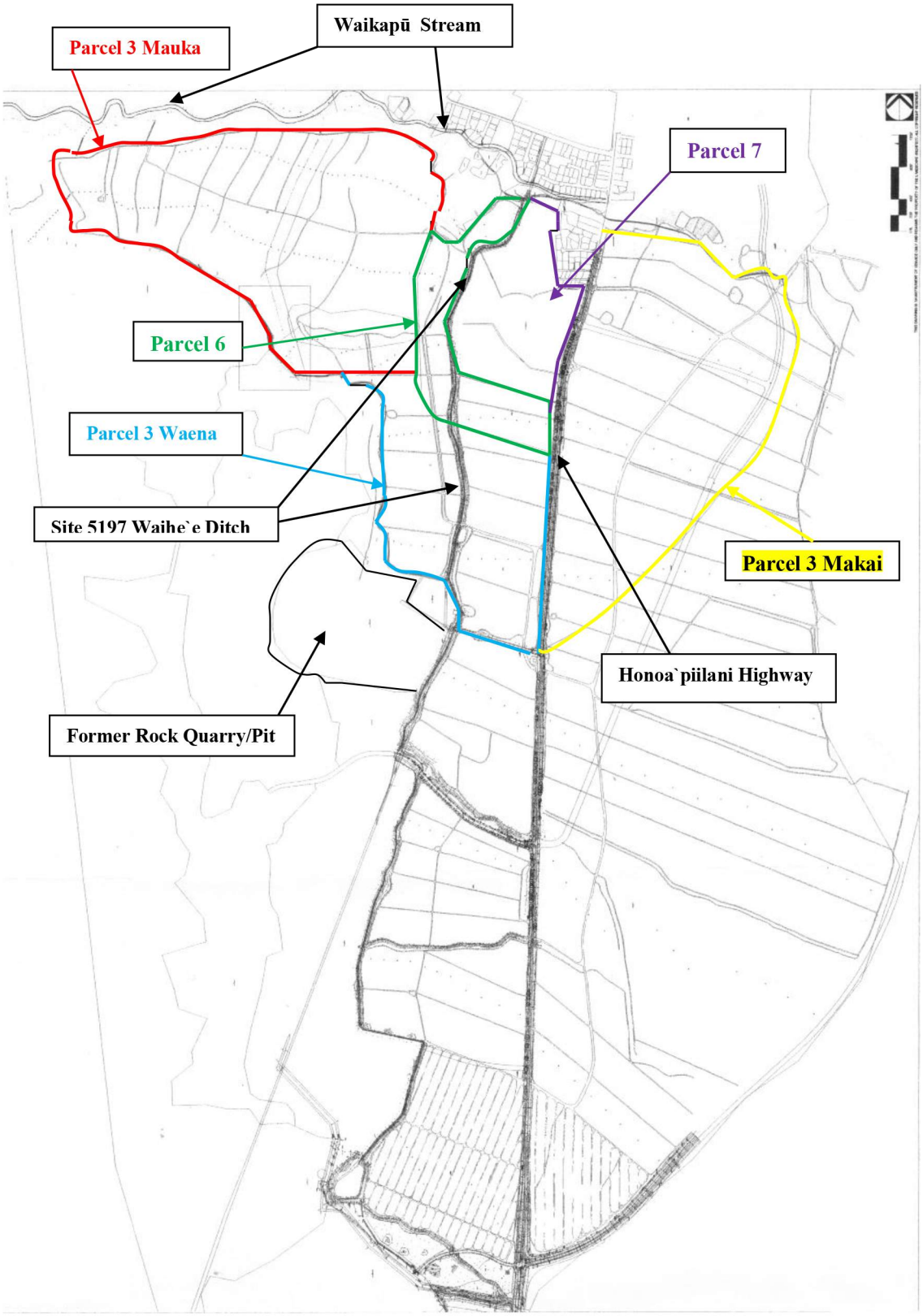


Figure 37: AIS Site Survey Map

Parcel 3 Mauka

Parcel 3 Mauka is the northern portion of TMK 3-6-004:003 and comprises approximately 180 acres that defines the northwestern portion of the project area. Parcel 3 Mauka is currently utilized as pastureland, but was formerly fallow sugarcane.

Parcel 3 Waena

Parcel 3 Waena is the southern portion of TMK 3-6-004:003 and comprises approximately 70-acres. Site 5197 (Waihe`e Ditch) bisects the parcel north/south. Parcel 3 Waena is currently utilized as active sugarcane, pastureland and small scale agriculture.

Parcel 3 Makai

Parcel 3 Makai is a portion of TMK 3-6-002:003 and comprises approximately 250 acres. Parcel 3 Makai is cultivated in active sugarcane.

Parcel 6

Parcel 6 is an L-shaped parcel identified as TMK 3-6-005:006 and consists of 52.976 acres. The northern third of Parcel 6 is currently utilized as pastureland and was formerly fallow sugarcane; the central portion is in small scale agriculture for vegetables and fruit trees, and the southern third is active sugarcane.

Parcel 7

Parcel 7 is within the central portion of the overall project area and consists of the 59.054 acres which constitutes TMK 3-6-005:007 and the MTP. This parcel is enclosed by Waihe`e Ditch to the west; Honoapi`ilani Highway and residential development to the east; existing rural and residential lots to the north and Parcel 6 to the south.

HISTORIC LAND USE

The district (*moku*) of Wailuku is comprised of the following *ahupua`a*: Wai`ehu, Waihe`e, Waikapū, and Wailuku (See Figures 10 and 11 of the AIS in Appendix E of the ~~DEIS~~ FEIS). This region has also been referred to poetically as (four waters) (Nā Wai ‘Ehā and Elbert 1986: 377).

The land that encompasses the Wailuku District was extremely fertile with an abundance of water; thus, enabling large scale cultivation of *kalo* (taro).

The Waikapū Stream supported major irrigation systems with numerous pondfields (*lo'i)* and irrigation canals/ditches *('auwai)*, as well as agricultural crops and animal husbandry practices evidenced by LCA testimony during the Māhele and early map documentation (Figure 13 of the AIS). Subsequently, by the late-1800s the Waikapū Stream utilizing the same *'auwai* irrigation systems contributed to sugarcane cultivation that expanded far beyond the valley.

LAND TENURE

The entire Waikapū *ahupua`a* is comprised of 15,684 acres. There were 121 claims heard for Waikapū during the Māhele of 1845 (Creed 1993). Of these claims, 100 or 82% were awarded. Of these awards, the claimants listed in descending order the following land usage, *lo`i*, *kula*, house lot, salt, *wauke*, Hala, unspecified, potato, pig, sugar, fish , banana and a bull pen. Based on Creeds analysis, *lo`i* constituted the vast majority with 50%, *kula* 2.1%, house lots (1.8%) and the remaining less than 0.5%.

An analysis was conducted of the historic land tenure for the five specific project areas comprising the subject property. The assessment helped to determine the placement of back trenches for subsurface testing. The analysis produced the following documentation:

Parcel 3 Mauka

A total of twenty-eight (28) LCA's and seven (7) Grants were identified. Of the LCA claims, the majority were for *lo`i* (n=21), *kula* (n=11), house lots (n=5) and *hala* (n=5). For the seven grants, only two had land use which was for sugarcane at Grant 1844 'āpana 1 and 2.

In Parcel 3 Waena

No LCA or Grants were documented.

Parcel 6

A total of nineteen (19) LCA's and one (1) Grant were identified within this area. For the nineteen *Kuleana* claims, two had no information, *lo`i* were represented by 16, *kula* (n=7), house lots (n=3) and one no information. The Grant (GR 3152) was to Cornwell but no land use information was available.

Parcel 7

There were eleven (11) Land Commission Awards and 8 Grants within this area. For the *Kuleana* claims there were *lo`i* (n=7), house lots (n=6), *kula* (n=2), sugarcane (n=1) and *`auwai* (n=1). Of the eight Grants, only 2 had information which consisted of sugarcane.

Parcel 3 Makai

No Land Commission Awards were claimed and a total of one (1) Grant was identified within this section and consisted of a reservoir and sugarcane.

As exemplified in the land use tables and Figures 14 and 15 of the AIS (**See**: Appendix E, "Archaeological Inventory Survey"), other post-Contact land use consisted of the commercial production of sugarcane. The earliest commercial sugar production on Maui Island began in Wailuku in 1823 when Hungtai Sugar Works was founded by Chinese merchants. Wailuku Sugar Company was started in November of 1862 by James Robinson and Company, Thomas Cumming, J. Fuller, and C. Brewer and Company. In 1865, C. Brewer and company acquired controlling interest, with Robinson and Company and Cumming as the minority stockholders. In 1894, the Waihe`e Sugar Company and the Waikapū Sugar Company were bought out by the Wailuku Sugar Company. To assist in the infrastructure of sugarcane production, railroad construction was initiated in 1895. At this same time, political and economic issues surrounding water-rights emerged to the forefront (Donham1989:15). In the 1980's, the Wailuku Sugar Company converted to the Wailuku Agribusiness in order to diversify agricultural production.

TRADITIONAL SETTLEMENT PATTERNS

As noted, the current project area is situated along the foothills of the West Maui Mountains in the Waikapū *ahupua`a*. Previous archaeological investigations, coupled with the history of the

area focusing on previous land use, topographic features and ethno-historic accounts, can be used to develop a general predictive model for traditional Hawaiian settlement and subsistence patterns for the project area. The general region, including and encompassing the current project area, is referred to and appears to have once been part of a large wetland taro production area:

> *…Spreading north and South from the base of Waikapū to a considerable distance below the valley are the vestiges of extensive wet-taro plantings, now almost obliterated by sugar-cane cultivation; a few here and there are preserved in plantation camps and under house and garden sites along the roads. Among these gardens there were, in 1934, a few patches of dry Japanese taro. Far on the north side, just above the main road and at least half a mile below the entrance to the canyon, an extensive truck garden on old terrace ground showed the large area and the distance below and away from the valley that was anciently developed in terraced taro culture. On the south side there are likewise several sizable kuleanas where, in 1934, old terraces were used for truck gardening. In the largest of these a few old patches were flooded and planted with Hawaiian taro, and there was some dry Japanese taro. Several terraces were used as ponds planted with lotus for their edible seed. There were probably once a few small terraces on the narrow level strip of the valley bottom in the lower canyon… (Handy and Handy 1972:497).*

A hypothetical model for traditional Hawaiian settlement was developed by Kirch (1985) and Cordy (1978). According to this postulation, the project area would have been an ideal setting for early Hawaiian permanent habitation. Utilizing dates from other Hawaiian Islands, Cordy postulated that initial pre-Contact settlement in lower valleys and coastal regions occurred from 300 to 600 A.D. and by 1000 A.D. fishponds, protected bays, and religious structures.

The subject area contains a dominant waterway, Waikapū Stream with rich alluvial soils. Traditionally, this stream would have been utilized to create extensive irrigation systems containing numerous pondfields with associated *`auwai*. This stream not only supported the main dietary staple, *lo`i kalo,* but also *mai`a* (bananas), *`uala* (sweet potatoes), *kī* (ti) and trees

such as *niu* (coconuts), *wauke* (paper mulberry) and *lau hala*, but was also the freshwater source for the Keālia Ponds.

Habitation and religious structures, along with agricultural sites would have been distributed near the *lo`i* patch and down by the shore for marine exploitation, fish pond maintenance and the collection of salt at the salt pans of Mā`alaea and/or Keālia. Historically, the water source would have been important for some of the same reasons but habitation structures would also have been established around towns, railroads and plantation camps. By reviewing old maps and the Māhele record, the historic settlement patterns can be discerned. Conversely, through these archival records and archaeological investigations, the traditional settlement patterns can merely be inferred.

SITE EXPECTABILITY

Since these earlier studies, numerous archaeological studies have been conducted in the Waikapū and Wailuku *ahupua`a*. The majority of the studies have been implemented based on requirements set forth in the laws pertaining to the environmental impact of proposed development. A significant portion of development has occurred in areas of fallow pineapple and sugarcane. The impact of commercial agriculture on archaeological sites located in non-sand substrates located below 500 feet amsl appears to be severe and has resulted in the complete destruction of a significant portion of pre-contact sites. In areas that contain a sand matrix, intact, previously disturbed and isolated human remains have been documented. Pre-contact site components appear to have been less impacted by intensive agriculture in areas located above 500 feet amsl. Post-contact sites in the region are typically associated with agricultural activities [clearing mounds, water diversion structures (flumes and ditches), habitation, roads, and railroads] and ranching activities (walls).

Based on the aforementioned background information and settlement patterns, the type of sites and/or features that may be encountered within the project area would be associated with traditional and historic habitation, as well as agricultural and animal husbandry sites. Due to the extensive grading activities associated with sugarcane cultivation and the construction of the MTP commercial buildings, no surface structural remains associated with the pre-Contact and

post Contact areas are anticipated; however, features associated with sugarcane cultivation are likely. Remnant subsurface historic properties may include rock alignments, buried cultural deposits, pits and human burials. The likelihood of encountering these subsurface features throughout will be dependent upon the depth of the sugarcane till zone.

AIS FINDINGS

Archaeological procedures were conducted intermittently from February through June 2013 by supervisor Ms. Diane Guerriero (B.A.) and archaeological personnel Ms. Rochelle Barretto. Overall direction and coordination was performed by Ms. Lisa Rotunno-Hazuka (B.A.) and the Principal Investigator was Mr. Jeffrey Pantaleo (M.A).

The AIS fieldwork consisted of a pedestrian survey and subsurface exploration through the execution of 150 backhoe test trenches within the five aforementioned zones. The following historic properties were identified (**See**: Figure No. 38 ~~33~~, Historic Properties Identified during AIS):

- Sites 50-50-04-7881-7884 (formerly TS1, 3-5) comprised of 19 subcomponent features were newly recorded with the majority related to sugarcane cultivation.
- Site 5197 Waihe`e Ditch is extant within the central portion of the project area and was also recorded.
- Site 7881 Features 1-18 consists of concrete lined ditches, sluice gates, dirt culverts with concrete lined headwalls.
- Site 7882 (TS3) is a disturbed, historic L-shaped retaining wall.
- Site 7883 (TS3) comprises a World War II bunker.
- Site 7884 Features 1- 3 (TS 2 and 5) are secondarily deposited historic materials recorded at three localities within the project area.

Potential Impacts and Mitigation Measures. During the investigation, no evidence of traditional Hawaiian activities, with the possible exception of Site 7882 (remnant retaining wall or terrace) was recorded. These negative results are primarily due to the compounded

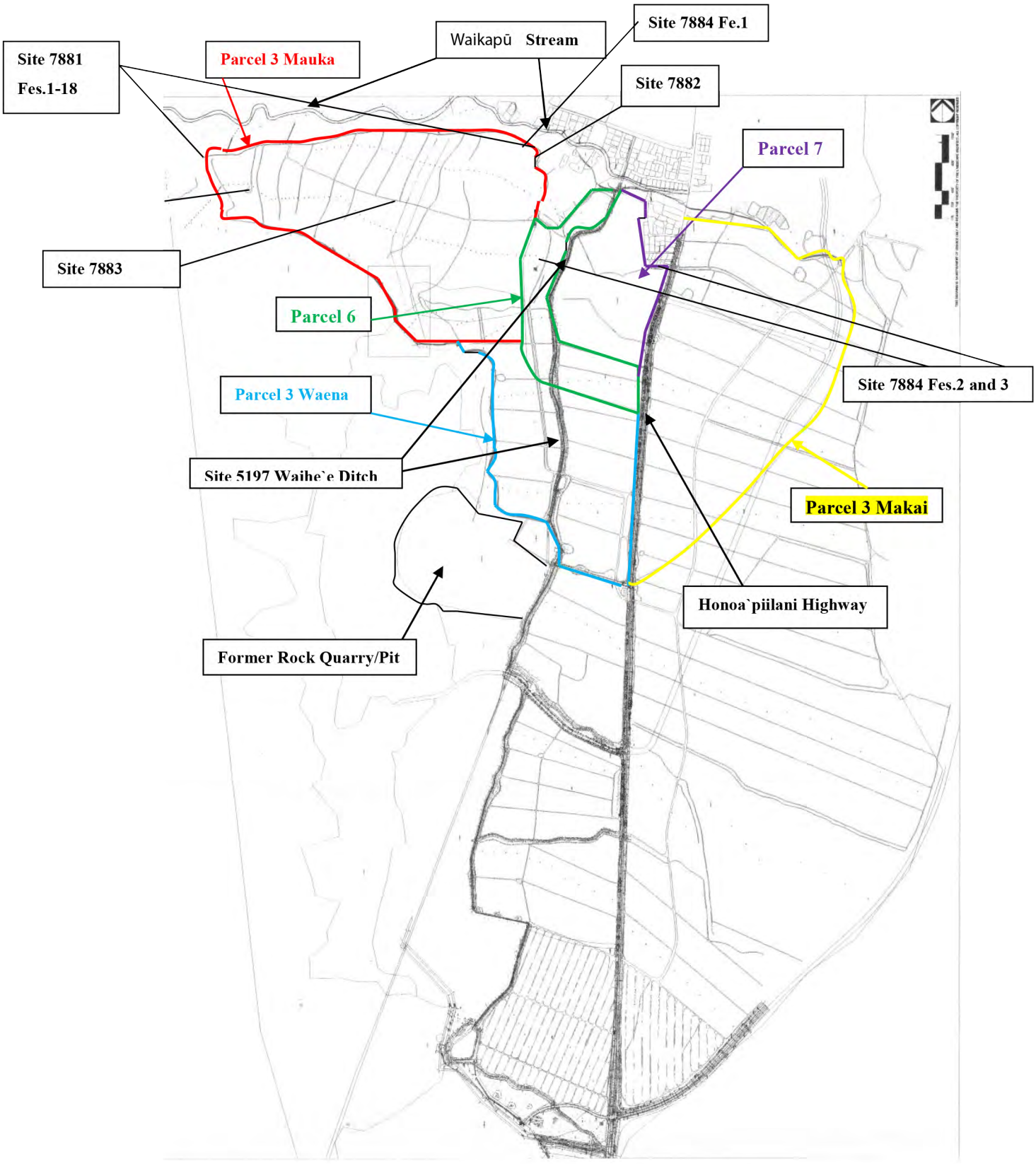


Figure 38:
Historic Properties Identified During AIS

disturbances from sugarcane cultivation, historic habitation and modern land use; and possibly the inherent bias of random sampling during the inventory survey testing. Sites 7881-7884 are considered significant under Criterion D, and one historic property, Site 7883 may be considered significant under Criterion C.

Site 7881 Features 1-18 is comprised of historic agricultural irrigation features consisting of a reservoir, concrete and earthen ditches, as well as sluice gates. These features are located along the northern boundary of Parcel 3 Mauka outside the proposed A.P.E. and will not be adversely affected.

Site 7882 is a remnant L-shaped retaining wall or terrace also located in the Parcel 3 Mauka within the northeast corner. This feature may have been constructed during the traditional period, but this supposition is inconclusive.

Site 7883 consists of a World War II bunker located within the east central portion of Parcel 3 Mauka. This site has been documented at the inventory level and may or may not be affected by proposed development.

Site 7884 comprises surficial scatters of historic domestic refuse (Features 1 and 2) and Feature 3 is a small historic trash dump, likely associated with former habitation.

A section of Site 5197 Waihe`e Ditch bisects the central portion of the project area in a north/south direction. This historic property was also recorded during the current undertaking and may be covered (though continue to be operational) during construction.

Based on the proposed development plan, Site 7884 Features 2-3 (historic trash scatter and refuse pit); a section of Site 5197 (Waihe`e Ditch) and possibly Site 7883 (WWII bunker) may be adversely affected during the development activities. These aforementioned historic properties have been properly recorded and may be removed and or altered during construction; however if it is recommended that if Site 7883, the WWII bunker cannot be preserved in place within the planned development, an interpretive plaque commemorating this site should be erected. Additionally, Sites 7881 (agricultural waterways, sluice gates, reservoirs) and 7882 (L-shaped

retaining wall) may be removed and or altered during construction; although no ground-altering activities are planned at this time.

Archaeological monitoring of Parcel 3 Mauka and Waena is primarily recommended for those areas which contain former LCA's and Grants, as well as extant historic properties; however spot monitoring inspections of other localities not expressed above may also be instituted. Parcels 6 and 7 contain numerous LCA's and Grants; thus monitoring will initially be full time until the nature of the subsurface conditions in relationship to the proposed ground-altering activities is determined. Similarly for Parcel 3 Makai, monitoring will initially be full-time; yet it is envisioned that the primary focus will be along the eastern and western perimeters which are close to Wai`ale and Waiko Roads, known areas to contain traditional and historic burials.

Prior to the commencement of construction, an Archaeological Monitoring Plan (AMP) detailing the localities to undergo monitoring procedures will be prepared and submitted to SHPD for review and approval.

5. **Cultural Resources**

A Cultural Impact Assessment (CIA) was prepared by Hana Pono, LLC to describe existing Native Hawaiian cultural activities, practices and resources that occur on the property, potential impacts from the project, and mitigation, if necessary, to address these impacts.

The CIA was prepared In accordance with the State Office of Environmental Quality Control (OEQC), "Guidelines for Assessing Cultural Impacts". The CIA identifies traditional, historical, or other noteworthy practices, resources, sites, and beliefs attached to the project area and analyzes the impact of the proposed development on these practices and cultural features. Information was collected through extensive research of historical and literary archives and by interviewing and consulting with lineal descendants, kūpuna, and long standing residents who have in depth knowledge of the area. (**See**: Appendix F, "Cultural Impact Assessment", for a complete presentation of the CIA). In addition, cultural consultant Hōkūao Pellegrino prepared a Ka Pa'akai Cultural Analysis based upon the results of the Project's AIS and CIA reports (**See**: Appendix F, A: Ka Pa'akai Cultural Analysis. The analytical framework for the Ka Pa'akai Cultural Analysis is based upon an assessment of the following:

1. The identity and scope of "valued cultural, historical, or natural resources" in the petition area, including the extent to which traditional and customary native Hawaiian rights are exercised in the petition area;
2. The extent to which those resources – including traditional and customary native Hawaiian rights – will be affected or impaired by the proposed action; and
3. The feasible action, if any, to be taken by the (agency) to reasonably protect native Hawaiian rights if they are found to exist.

Description of Historical and Existing Conditions. The WCT project site has been used for agricultural purposes, primarily for sugarcane, since the 1870s. Prior to sugarcane, the lands along the Waikapū Stream, and in and around the existing Waikapū Town, were settled by native Hawaiians who cultivated loʻi kalo (wetland taro) and other traditional crops in terraced loʻi. The Waikapū Stream, one of four streams that comprise the Nā Wai ʻEhā, is an important cultural resource to native Hawaiians, who continue to have riparian rights for agricultural purposes. There are Kuleana lots, still owned by native Hawaiian and kamaʻāina families, within Waikapū and in close proximity to the Waikapū Stream. The Waikapū Stream corridor provides access to the Waikapū Valley, where native Hawaiian groups are currently reintroducing indigenous plants and trees into the valley.

The entire project area is located within the ʻili (subdivision) of ʻAikanahā, Kaumuʻīlio, Luapueo, Koʻolau, Kaloapelu, ʻĀhuakōlea, Kaʻōpala, Kaʻalaea, Kamaʻuhāliʻi, Pikokū, ʻŌlohe, Waihalulu, Kamaʻūhāliʻi, in the ahupuaʻa (land division) of Waikapū, moku (district) of Wailuku (Nā Wai ʻEhā), mokupuni (island) of Maui. The total land mass of the Waikapū ahupuaʻa, the southernmost ahupuaʻa in Nā Wai ʻEhā, consists of 15,684 acres from mauka to makai (mountain to the sea). The boundaries of the Waikapū ahupuaʻa are described in detail on page 18 of the CIA (See Appendix F).

Within the Waikapū watershed is an abundance of wai (water). Waikapū Stream was and continues to be an important cultural resource and part of the cultural landscape. Waikapū Stream flows on average of 3-4 MGD (Million Gallons per Day), which classifies it as a small perennial stream (USGS). It flows continuously above the diversions located in the stream built by the former Wailuku Sugar Company.

The upper regions of the Waikapū watershed once had an abundance of endemic and indigenous plants which were utilized for various cultural purposes by Hawaiians of the ahupua‘a. The dryland forested areas were dense with koai‘a (*Acacia koa*), ‘a‘ali‘i (*Dodonaea viscosa*), and alahe‘e (*Psydrax odorata*). All of these tree species would have been used for house construction. The stems of the olonā (*Touchardia latifolia*), a wet forest native plant would have been used for making cordage. Other native plants of importance that were commonly found in the Waikapū watershed was ko‘oko‘olau (*Bidens spp.*) and māmaki (*Pipturus albidus*), used for lā‘au lapa‘au (medicinal purposes). In the low lands of Waikapū, dry gulches, and at the entrance of Waikapū Valley is wiliwili (*Erythrina sandwicensis*) which was used to make papa he‘e nalu (surfboards).

The interior portion of the Waikapū watershed once allowed for extensive traditional pre-contact ‘auwai (irrigation systems) which irrigated vast amounts of land for kalo cultivation. The Waikapū Stream once flowed mauka to makai through the plains of Kama‘oma‘o, into the Keālia fishpond / wetland / estuary, and emptied into Mā‘alaea Bay. Hawaiians utilized the fresh water resources of the Waikapū Stream for lo‘i kalo cultivation. Ancient ditches called ‘auwai were built to bring a portion of stream water into traditional kuleana farm lands. Conservative estimates confirm that at the time of the Māhele of 1848, over 1,400 lo‘i kalo were under cultivation throughout the Waikapū ahupua‘a on a total of about 800 acres. According to oral accounts and scientific data, Waikapū stream once also contained native stream life such as the ‘o‘opu and ‘ōpae. Gathering and eating these aquatic species helped feed the pre- and post-contact populace of Waikapū.

Waikapū Stream experienced some of the earliest impacts and changes due in part to the establishment of Maui’s first sugar plantation; Waikapū Sugar Company, started by James Louzada and Henry Cornwell. Diversions built by Wailuku Sugar Company disrupted the Waikapū Stream and cut off the mauka to makai stream flow to Keālia. Native stream life began to decline and the wetlands of Keālia, which depended upon the stream flow, started to stagnate and dry up. By the early 1900s, the cultural landscape had increasingly changed due to impacts of the sugar plantation and the amount of water used to grow sugar. A visitor to Waikapū in the late 1860s wrote:

> *"The vestiges of extensive wet kalo plantations, are now almost obliterated by sugar-cane cultivation; a few here and there are preserved in plantation camps and under house and garden sites along the roads. The waters of this great stream, now utilized for irrigating a great acreage of sugarcane, was formerly diverted into loʻi."*

In 2013, there were fewer than 15 loʻi kalo on a total of 2 acres of kuleana land that are in cultivation. By comparison, 1,400 loʻi kalo were under cultivation 160 years ago.

There are ongoing efforts in the Waikapū ahupuaʻa to revitalize the water resources of the Waikapū Stream and to restore the remaining kuleana lands with loʻi kalo. The only remaining intact Māhele kuleana lands within the project boundaries are those found along the Waikapū Stream. However, only one such parcel of land is being utilized in its traditional form. The upper most kuleana parcel awarded to Kupalii (LCA 3546) is being leased and managed by Hui Mālama o Waikapū where a few of the loʻi kalo have been restored as well as a native dryland koaiʻa forest. Other lands adjacent to the project area are also being revitalized and used as they once were during the Māhele. Eassie Miller Jr. and his ʻOhana are continuing to cultivate loʻi kalo and maintain their family cemetery. Across the stream is the Pellegrino ʻOhana. The Pellegrino ʻOhana is also cultivating loʻi kalo by utilizing the Waikapū Stream.

The Waikapū Stream is an important cultural resource that plays a significant role in the current traditional practices of the area. Waikapū Valley is another cultural resource which is used for traditional gathering of lāʻau lapaʻau or medicinal plants as well as native plant and tree seeds used for propagation by Hui Mālama o Waikapū and other kamaʻāina of Waikapū. Traditional varieties of kalo and maiʻa (banana) grow in areas throughout the valley and families still gather them as a food source.

The project area was impacted by plantation agriculture at a very early period of time, therefore many kamaʻāina of Waikapū have no recollection of specific traditional practices other than sugarcane cultivation and cattle grazing in the project area. Those that were interviewed during the CIA process remembered cultural practices on kuleana lands being cultivated around the

project area but no accounts of traditional practices on the land being proposed for development.

There are, however, three kuleana lots still owned by descendants of the original claimant Ehunui (L.C.A. 2499 and Grant 1513) found within the lands owned by Waikapū Properties, LLC, but outside of the lands proposed for development.

Potential Impacts and Mitigation Measures. The purpose of the CIA was to investigate the impact that the WCT will have on the cultural practices and customs of the project area and surrounding lands through archival, literary, and oral accounts.

Waikapū has a long and rich cultural history and a strong representation of traditional cultural practices. The cultural practices and beliefs that are subject to this assessment include Hawaiian subsistence and residential agriculture on kuleana lands. These lands utilize the Waikapū Stream, which is a valuable cultural resource. Intricate irrigation systems built prior to western contact continue to be maintained and utilized. There are also on-going projects in the mauka portion of the Applicant's land that are being utilized for cultural site and native habitat restoration, while providing a traditional access point into the Waikapū Valley for gathering of lāʻau lapaʻau (medicinal plants) and native seed gathering.

The surrounding lands as identified through oral and archival accounts are also considered traditional cultural properties or Kuleana lands. These historic lands are associated with traditional practices and beliefs that have been in use prior to the Māhele of 1848. The surrounding traditional cultural properties are associated with events that have made an important contribution to the broad pattern of the Hawaiian culture while yielding information important for research on prehistory or current historical practices. The traditional agricultural practices and cultural/natural site restoration projects have an important value to the native Hawaiian people, the Waikapū community, and other ethnic groups found in Hawaiʻi by enhancing cultural identity and well-being.

Mitigation Measures

The CIA demonstrates that development of the WCT will not have a direct impact upon cultural sites, practices and traditions within the project area. However, the project could produce indirect impacts if not property managed. The following are areas of cultural concern and proposed mitigation measures.

Mahi Kuleana Parcels

There are two kuleana lots privately owned by the Mahi family (LCAw: 2499, R.P. 4070 AP 1 &2 to Ehunui) and (Grant 1153 to Ehunui) that are situated within TMK: (2) 3-6-004:003 on lands that are proposed to remain in agricultural use. These Kuleana lots are identified as TMK: Nos. (2) 3-6-005:009 (0.06 acres) and TMK: (2) 3-6-005:010 (0.5 acres). The subject parcels were initially situated within the confines of the development project, but the development plan was modified to go around these two parcels of land. The Mahi family has expressed that they would like to preserve their lands. In the oral interviews provided by the Mahi Family, they have voiced their concerns about the need to keep these lands in their family while working with the developer to seek a solution that will benefit both parties.

Waikapū Stream

Another community concern is the desire to protect and restore the Waikapū Stream. Waikapū Stream is considered Waikapū's most valuable cultural resource. Waikapū Properties, LLC uses a percentage of Waikapū Stream surface water via Wailuku Water Company's delivery system. The use of this water is for the MTP; irrigation of lands leased to HC&S for cultivating sugarcane, and irrigation to support diversified agriculture. Waikapū Properties since 2012 has drilled a total of 5 groundwater wells to be used for the Project and current and future agricultural endeavors. In May of 2014, The State Commission on Water Resource Management returned 2.9 mgd of surface water to the Waikapū Stream via the IIFS (Interim Instream Flow Process) (CWRM) and established a groundwater aquifer sustainable yield of 4 mgd (CWRM). The Waikapū community and many kuleana farmers are having discussions with the Applicant to establish a long term water use plan for both surface and groundwater. One significant concern of expressed by Kuleana farmers that are using water from Waikapū Stream for kalo cultivation is sedimentation into the stream. It was noted that sedimentation has occurred during large rainfall events as well as from maintenance and management issues associated with the existing

plantation infrastructure. The Applicant is committed to working with neighboring kuleana farmers to help resolve these issues.

Ground Water

The sustainable yield of the Waikapū aquifer is 3 million gallons per day (mgd). The Applicant has drilled 5 ground water wells that will be used for servicing the Project's potable and agricultural water demand. Concerns have been expressed about overall impact of the drilling of wells upon the health of the aquifer and surface water stream flows. The Applicant will strictly adhere to the water use allocations set forth by the State Commission on Water Resources Management (CWRM) to ensure that the pumpage from the on-site wells remains well within the sustainable yield for the aquifer.

Kuleana Agricultural Lands Adjacent to Waikapū Stream

The cultivation of kalo is an important traditional and customary right that is being practiced by kuleana farmers along the Waikapū Stream. These farmers rely upon stream water for their crops. Kalo farmers have shared their concerns about the accessibility of stream flow via the WCT's ʻauwai and the quality of the water within the Waikapū Stream.

Native Dryland Forest and Watershed

Degradation of native plant species and habitats within the Waikapū Ahupua'a are a significant concern for kuleana farmers that rely upon the Waikapū Stream and for Hui Mālama o Waikapū and other kamaʻāina of Waikapū that are actively engaged in the restoration of native dryland forests and invasive species eradication within the Ahupua'a. There is a concern that indirect impacts by increased accessibility into the Ahupua'a by future residents could result in further damage to the forest by introducing additional invasive species and disease. The Applicant is committed to working with the kamaʻāina of Waikapū and other concerned residents to develop proper access management programs to protect the Ahupua'a for future generations.

Inadvertent Finds (Artifacts & Burials)

Because the development will occur on former kuleana lands, there may be the potential of inadvertent finds such as artifacts and burials during the Project's construction phase. It is recommended that if any cultural features (i.e. artifacts, burials, etc.) are uncovered during

construction that the developer immediately contact the State Historic Preservation Division and comply with all applicable state laws. It is further recommended that close communication be maintained with the Waikapū Community since many of the kuleana lands once belonged to Hawaiian families, many of whom have descendants that continue to live in Waikapū.

On-going Community Input

The Waikapū community desires to continue to provide input on how to incorporate traditional cultural practices and knowledge within the development plan in order to maintain the unique traditions and practices of Waikapū and to preserve the community's identity.

Ka Pa'akai Cultural Analysis

The Ka Pa'akai Cultural Analysis (See: Appendix F, A) synthesizes and expands upon the work conducted in the Project's AIS and CIA to address the Land Use Commission's (LUC's) decision making criteria for evaluating a Project's impacts to the rights of Native Hawaiians to exercise traditional and customary practices. In the September 11, 2000 Hawai'i Supreme Court landmark decision ((*Ka Pa'akai o Ka 'Āina v Land Use Commission*), the court established a three-part process relative to evaluating the preservation and protection of customary and traditional native practices: first, to identify whether any valued cultural, historical, or natural resources are present; and identify the extent to which any traditional and customary Native Hawaiian rights are exercised; second, to identify the extent to which those resources and rights will be affected or impaired by the proposed action; and third, to specify the feasible action, if any, to be taken by the regulatory body to reasonably protect Native Hawaiian rights if they are found to exist.

The Ka Pa'akai Cultural Analysis finds that there are specific valued cultural, historical and natural resources present and traditional and customary Native Hawaiian rights being exercised within the proposed Project. The Ka Pa'akai Cultural Analysis offers specific mitigation measures to ensure that there are minimal to no adverse effects on any of the cultural practices identified within the CIA. These mitigations center upon the following:

- Ensuring access to and along the Waikapū Stream for traditional and customary practices of Native Hawaiians occurring both within the stream and within the interior valley of the Waikapū watershed;
- Ensuring that the owners of the Mahi Kuleana parcels have access to their parcels;
- Ensuring that current and future Native Hawaiian practices associated with access to kuleana water for loʻi kalo cultivation are protected;
- Conducting archaeological monitoring during development of the subject Property.

The Ka Pa'akai Cultural Analysis further recommends that the Hawai'i Land Use Commission follow-up with the Applicant to ensure that Native Hawaiian rights and practices are preserved and that mitigation measures are formalized prior to securing entitlements. The Applicant has worked with the Waikapū community for several years to support traditional and customary Native Hawaiian Cultural practices within the Waikapū watershed and the Applicant concurs with the general findings of the Ka Pa'akai Cultural Analysis. The specific details regarding the Applicant's commitments can be addressed through further consultation with the relevant stakeholders.

6. **Visual Resources**

Existing Conditions. The WCT project area is located between the town of Wailuku to the north and Māʻalaea to the south along the Honoapi'ilani Highway. The project site generally slopes from west to east with a high elevation of approximately 710 feet mean sea level (msl) at the northwesterly corner and a low elevation of about 256 feet above msl at the southerly corner, within the fertile Central Maui isthmus.

Views from within the project site are both diverse and dramatic. Largely unobstructed views of Haleakalā, the West Maui Mountains, the Central Maui isthmus and the Pacific Ocean are available at the mid and upper elevations. At the higher elevations Wailuku and Kahului, East Maui and South Maui are all visible. From the lower elevations largely unobstructed views are available of the West Maui Mountains, Haleakalā, and sugar cane lands that stretch from Honoapi'ilani Highway to Māʻalaea and Kīhei.

These same lower elevation views are presently available from Honoapi'ilani Highway looking into the project site. The existing mauka view from Honoapi'ilani Highway into the project site is of agricultural fields planted in sugar and diversified crops, the MTP, and the valley and ridgelines of the West Maui Mountains. The makai view from the highway, where not obstructed by right-of-way vegetation, is of the existing sugarcane fields and Haleakalā. When the sugarcane has been harvested there are intermittent views of the ocean horizon (**See:** Figure 8 A-N, "Site Photographs").

Potential Impacts and Mitigation Measures. Chris Hart & Partners, Inc. prepared an island-wide Scenic Resources Inventory Study for the County of Maui, Department of Planning, in July 2006 in support of the General Plan 2030 Update. The purpose of the study was to inventory and rate the island's scenic resources so that appropriate advanced planning and mitigation strategies could be employed to protect these resources. The MIP incorporates the study's scenic roadway corridor recommendations into its "Context and Character Map" and references the corridors in policies within Chapter 3, Heritage Resources (**See:** Figure No. 39 ~~34~~, "Maui Island Plan, Context and Character Map").

The Scenic Resources Inventory Study identifies the area along Honoapi'ilani Highway, fronting the project site, as an area of "High" scenic resource value. In the study, areas of "Exceptional" and "High" resource value are described as having "dramatic and diverse resource values consistently throughout the corridor" and are "typically in a natural condition and unmarked by development." The study's GIS inventory provides "field study" notes that describe the character of the subject corridor. The notes describing the Honoapi'ilani corridor, fronting the project site, are as follows:

> *"High concentration of agricultural lands; open space; and distant Haleakalā views. Intact West Maui mountain views and expansive views of Mā'alaea and the Kīhei coastline and Lana`i views exist. There is considerable utility clutter along the highway. Sprawl conditions along the highway between Waikapū and Mā'alaea should be avoided through the establishment of clear boundaries and features such as landscape plantings and entry signage."*

"Registered Historic Parcels" and "Registered Historic Sites" only represent those listed on State or National Registers and included within Maui County's GIS system. Sites shown are not all-inclusive and do not represent all historic sites on Maui. As additional data becomes available it will be integrated into future mapping.

Kahana
Ka'anapali
Lahaina
Wailuku
Kahului
Pa'ia
Ha'iku
Keanae
Hana
Property Location
Olowalu
Pukalani
Makawao
Kihei
Keokea
Kipahulu
Makena

This map is for informational purposes only and subject to change based on future research and findings.

Figure 39: MIP Context and Character Map

Character & Context Map

Island of Maui

Background Map

For Informational Purposes Only

Legend

- Primary Road
- Na Ala Hele or Other Trail
- Stream
- Wetland, Pond or Reservoir
- Waterfall
- Registered Historic Site
- Registered Historic Parcel
- Parks

Scenic Corridor
- Exceptional
- High
- Medium

Boating Facility
- Boat Launch Ramp
- Small Boat Harbor

Aquatic Activity
- Ocean Recreation
- Board Surfing
- Body Surfing
- Canoe Paddling
- Snorkling/Diving

Miles 0 1 2 3 4 5 6

This is not a zoning map. Please contact the Planning Department for Zoning confirmation.

Prepared by:
Long Range Planning Division
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Map I-1

Chapter 3, Heritage Resources, of the MIP contains policies that discourage sprawl and the merging of the island's small towns. MIP policies also protect views of Haleakalā, the West Maui Mountains, the Pacific Ocean and other scenic resources. As such, design strategies are needed to mitigate the impact of the WCT on visual resources from the Honoapi'ilani Highway fronting the project site. The following documents scenic resource impacts and describes proposed urban design strategies to help mitigate these impacts.

- ***Sprawl.*** The WCTs urban and rural development will have approximately 4,700 linear feet of frontage along the Honoapi'ilani Highway. The proposed development pattern will produce a significant change from the largely undeveloped and open space views that currently exist along what will become the frontage of the project. It is unavoidable that the current open space views of sugarcane will be impacted by the development. However, the following urban design and landscape architectural treatments will be implemented to help reduce the appearance of sprawl like conditions and to create an aesthetically pleasing sense of place fronting the project site:
    - ***Large Setbacks along the Highway.*** Setbacks of at least 60 feet, and in some areas significantly more than 60-feet, will be utilized along each side of the Honoapi'ilani Highway to separate the development from the public right-of-way.
    - ***Landscape Planting within the Right*-of-Way**. Within the setbacks, the planting of large canopy Monkey Pod trees, tropical shrubs and ground covers will be maintained to create a sense of separation and definition between the urban development and the highway and to create a green canopy enclosure and greenway as a passage through the town.
    - ***Separated Pedestrian and Bicycle Facilities***. An approximate 10-feet wide shared pedestrian and bicycle track, separated from the highway, will meander along the highway frontage. The shared use path will promote non-motorized transportation, while producing more opportunities for the public to experience the pleasant scenery along the highway.

- ***Haleakalā and West Maui Mountains from Honoapi'ilani Highway***. From Honoapi'ilani Highway, the elevation of the project site rises rather gradually, at a 3% to 6% slope,

from about 325-feet above msl to about 550-feet above mls where the Waikapū Ditch traverses north to south across the property. From the Waikapū Ditch the slopes increase to between 10% and 15% as the elevation increases to the foot of the West Maui Mountains. The foot of the West Maui Mountains is at an elevation of approximately 1,250 feet at the upper reaches of the WCT property and is about 6,800 feet from the highway.

In order to mitigate the obstruction of views from the highway to the West Maui Mountains and Haleakalā, buildings will be setback at least 75-feet from the highway and building heights will be limited to a maximum of 30-feet along the highway frontage. Building placement and areas of separation will also help to create view corridors between the highway and the mountains.

Within the project, roadways are purposefully aligned, where practicable, to capture mauka and makai view corridors. This opportunity exists at each entrance into the project site and along these roads as they travel east to west. In addition, views of the West Maui Mountains, Haleakalā and the Pacific Ocean will also be preserved in various locations from public spaces within the WCT, including the Village Green, the Waikapū River Park, Waihe'e Ditch Greenway and the Waikapū Station Greenway.

- ***Open Space Resources***. The project will impact views of agricultural lands on each side of the Honoapi'ilani Highway fronting the development. While these views are not unique within Central Maui, they do enhance Maui's beauty and are an important visual resource. In order to mitigate this impact, approximately 800 acres of agricultural land will be preserved in perpetuity as an open space buffer and permanent separation between Waikapū Town and Mā'alaea. Along the section of the highway where agricultural land is to be preserved, largely unobstructed views of Haleakalā, the West Maui Mountains and partial views of the Pacific Ocean exist.

Within the project site, the WCT will transform the current character of the MTP from a visitor oriented attraction to a park-like village center, with its existing lagoon, gardens, open spaces, shops, and restaurant coming together to create a new sense of place. While the existing agricultural and open space ambiance of the lands abutting the MTP will become an urban and

rural settlement pattern, the WCT will maintain a rural and agricultural ambiance at its boundaries because of the preservation of agricultural lands and incorporation of agricultural supporting activities, such as a farmers market, within the project site.

From an urban design perspective, the proposed project will complement the unique country-town architectural character that exists in Waikapū, Wailuku, Pāʻia, and Makawao. WCT design guidelines are being developed to control the density, architectural design, and variation of all buildings in the WCT to help preserve scenic resources and the aesthetic character of the development. Goals of the design guidelines will be to preserve views and maintain the aesthetic character of the community. A defining quality of the urban design character of the development will be to create architecturally pleasing streets with landscape planting that frames the travel ways and provides scale around architectural elements. As part of the ~~DEIS~~ FEIS, a visual impact assessment was conducted to determine how views might be impacted along Honoapi'ilani Highway, fronting the project site, following the Project's build-out. Figure No. 40 ~~35~~, A-E is a simulation of before project and after project views along Honoapi'ilani Highway.

1. ***Before***. Looking in a south-easterly direction towards sugar land with Haleakala in the background.

1. ***After***. Looking in a south-easterly direction over the makai development with Haleakala in the background and separated pedestrian and bicycle path in the foreground.

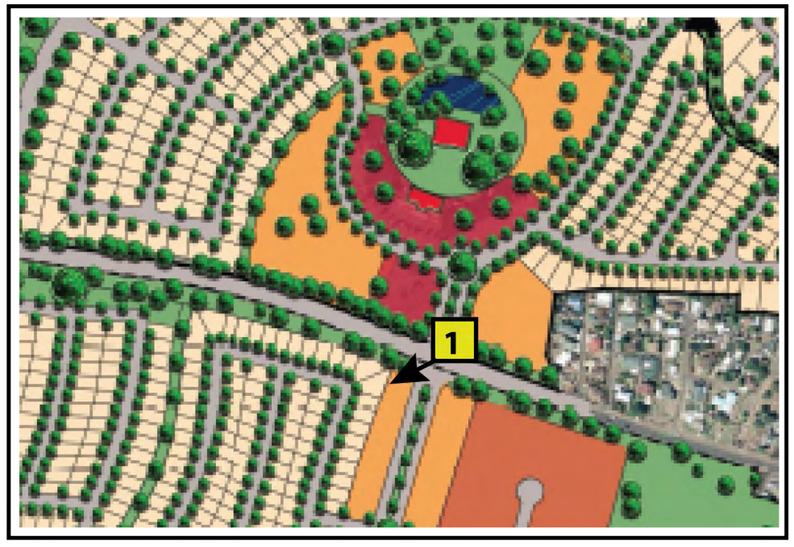


Figure 40, A
Visual Simulation of Pre- and Post Project Views

WAIKAPŪ COUNTRY TOWN

HAWAII LAND DESIGN

PLANNING CONSULTANTS HAWAII, LLC

2. ***Before***. Looking in a south-easterly direction towards sugar land with Haleakala in the background.

2. ***After***. Looking in a south-easterly direction over the makai development with canopy trees in the background and separated pedestrian and bicycle path in the foreground.

Figure 40B:
Visual Simulation of Pre- and Post Project Views

WAIKAPŪ COUNTRY TOWN

HAWAII LAND DESIGN

PLANNING CONSULTANTS HAWAII, LLC

3. ***Before***. Looking in a north-westerly direction with the West-Maui Mountains in the background and the MTP grounds in the foreground.

3. ***After***. Looking in a north-westerly direction through the project with the West-Maui Mountains in the background.

Figure 40C:
Visual Simulation of Pre- and Post Project Views

WAIKAPŪ COUNTRY TOWN

HAWAII LAND DESIGN
PLANNING CONSULTANTS HAWAII, LLC

4. ***Before***. Looking in a south-westerly direction through the MTP with the West Maui Mountains in the background.

4. ***After***. Looking in a south-westerly direction through the project with the West Maui Mountains in the background and the separated pedestrian and bicycle path in the foreground.

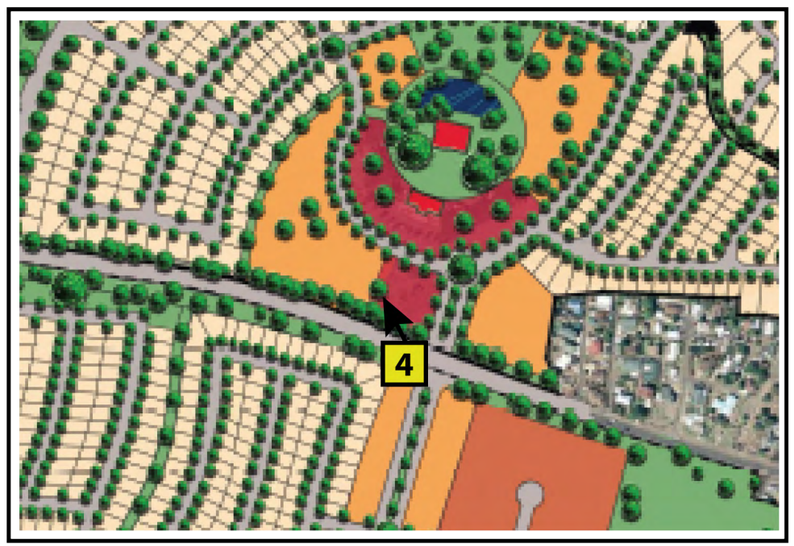


Figure 40 D:
Visual Simulation of Pre- and Post Project Views

WAIKAPŪ COUNTRY TOWN

HAWAII LAND DESIGN
PLANNING CONSULTANTS HAWAII, LLC

5. ***Before***. Looking in a westerly direction through the MTPs agricultural fields with the with the West Maui Mountains in the background.

5. ***After***. Looking in a westerly direction through the project with the West Maui Mountains in the background and the separated pedestrian and bicycle path in the foreground.

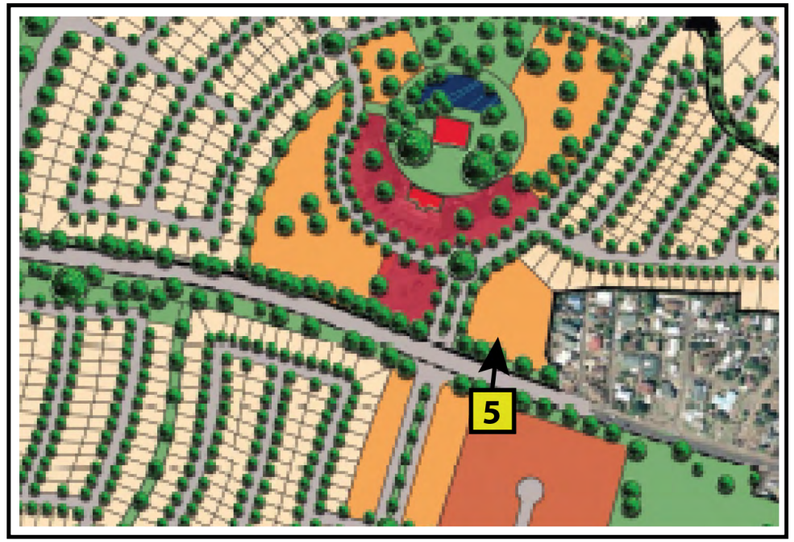


Figure 40 E:
Visual Simulation of Pre- and Post Project Views

WAIKAPŪ COUNTRY TOWN

HAWAII LAND DESIGN

PLANNING CONSULTANTS HAWAII, LLC

7. Agricultural Resources

Existing Conditions. In July 2013 Planning Consultants Hawai'i, LLC prepared an Agricultural Impact Assessment (AIA) to assess the long-term impact of the project on the State's and County's agricultural industries (**See:** Appendix G, "Agricultural Impact Assessment").

The scope of the study included the following tasks:

- Assessment of the current status of Hawai'i's agricultural industry;
- Assessment of the current availability of agricultural lands;
- Analysis of existing agronomic conditions within the project site;
- Description of the recent agricultural history of the property;
- Assessment of the impact of the project on current agricultural operations; and
- Analysis of the project's consistency with State and County agricultural policies.

The project area encompasses approximately 14 acres of State Urban District land and 1,562 acres of State Agricultural District land (**See**: Figure No. 5, "State Land Use Designation"). The existing MTP retail shops, restaurant, convention hall, tropical gardens and lagoon are on the urban designated land. In order to implement the Master Plan, approximately 485 acres will be re-designated from the State Agricultural District to the State Urban and Rural Districts.

Current Status of Hawai'i's Agricultural Industry

While agriculture, predominantly sugar and pineapple, dominated Hawai'i's economy from the late 1800s through the 1950s, its overall significance has declined dramatically since the advent of mass market tourism. In 1927, sugar alone created 56,600 jobs throughout the State, whereas in 2011 the entire agricultural industry employed just 6,900 workers. [xi] In 2011, agriculture employed 1,600 Maui County workers, which was 2.4% of the 67,200 wage and salary jobs in the County.[xii]

Hawai'i farmers face stiff competition in local, national, and international markets. In the Hawai'i market, off-shore suppliers dominate the market for most fresh fruits, vegetables, dairy, meat, and poultry products. It has been estimated that 85% of all food consumed in Hawai'i statewide is imported.

In the U.S. Mainland market, Hawai'i growers have sustained the value of their sales in recent years, but have lost significant export value of sales to Japan. Significant impediments to agricultural development in Hawai'i include high labor costs, high transportation costs, high energy costs and high land costs.

Despite major challenges, Hawai'i's growers are competitive in many niche products and opportunities are available. Because 85% of food consumed in Hawai'i is imported, a significant market exists for farmers who can find creative ways to displace imports. Moreover, Hawai'i's seed crop industry has demonstrated that Hawai'i agriculture can have significant comparative advantage in some sectors. Substituting locally grown biofuels for imported petroleum may also provide opportunities for Hawai'i farmers over the coming decades.

State and County Agricultural Lands

Since 1960, there has been a release of approximately 316,590 acres from crop farming, primarily sugar and pineapple. [xiii] While some of these lands have been absorbed by urban development and other agricultural uses, much is fallow and available for agricultural use on Oahu, Maui, Moloka`i, Lana`i and Kauai.

The County of Maui has approximately 402,354 acres within the State Agricultural District. Of these lands, approximately 244,088 acres, or 61%, is located on Maui. [xiv] Using the LSB rating system, Maui alone has approximately 82,592 acres that are classified "A", "B", or "C".[xv] Since 1960, there has been a release of approximately 64,150 acres from crop farming, primarily sugar and pineapple, within the County.[xvi] While some of these lands have been absorbed by urban development and other agricultural uses, much is fallow and available on the islands of Maui, Moloka`i, and Lana`i. Moreover, in January 2016 HC&S announced that its sugar plantation on Maui would be closed after a final harvest. This event will release approximately 33,000 acres from sugarcane production, which will dramatically increase the supply of land available for diversified agriculture on Maui.

Although there is an abundant supply of productive agricultural land throughout the State, access to affordable agricultural lots offering long-term tenure remains an impediment to

agricultural development in Hawai'i. The current shortage of available State and County agricultural park lots is symptomatic of this issue.

WCT, including its adjoining agricultural lands, comprises approximately 1,576 acres, 14 acres of which are within the State Urban District. Over 90% of the project's agricultural lands are rated "A" or "B" by the Land Study Bureau and "Prime" by the Agricultural Lands of Importance to the State of Hawai'i rating systems (**See:** Figure Nos. 41 ~~36~~ and 42 ~~37~~, "Land Study Bureau Map" and "ALISH Map"). WCT agricultural lands are of very high quality and it has been determined that these lands are important resources to the State of Hawai'i.

Potential Impacts and Mitigation Measures. The Project will result in the urbanization of approximately 485 acres of prime agricultural land. This represents a very small percentage of agricultural lands statewide and on Maui. There are approximately 2 million acres in the State Agricultural District. The subject development represents just .024% of this area. On Maui, there are approximately 82,582 acres of agricultural lands rated by the LSB as A, B, or C. The subject development represents just 0.59% of these lands. Within Maui County, approximately ~~64,150~~ 97,483 acres, which includes the HC&S lands that are being taken out of production, has been released from crop production since 1987. The subject development represents just ~~0.76%~~ 0.50 percent of these lands. Thus, the urbanization of the subject 485 acres should have minimal long-term impact on the availability of agricultural land within the County and/or State since an abundance of other land, of a similar or higher quality, is currently fallow and available for production elsewhere. As noted, the MTP Master Plan's agricultural component includes nearly 1,077 acres of land that will remain in agricultural use. Of these lands, approximately 800 acres will be permanently dedicated to agricultural use with no residential structures to be permitted. The remaining 277 acres may be subdivided into as many as five large agricultural lots where a farm dwelling may be permitted. Within the agricultural lands, several hundred acres may be developed as a public and/or private agricultural park to help facilitate Maui's agricultural development.

There are currently ~~three~~ four commercial farms farming MTP lands. These include Kumu Farms, Hoaloa Farms, Makani Olu Ranch, and Beef and Bloom. ~~Hawai'i Taro LLC, and HC&~~S. The

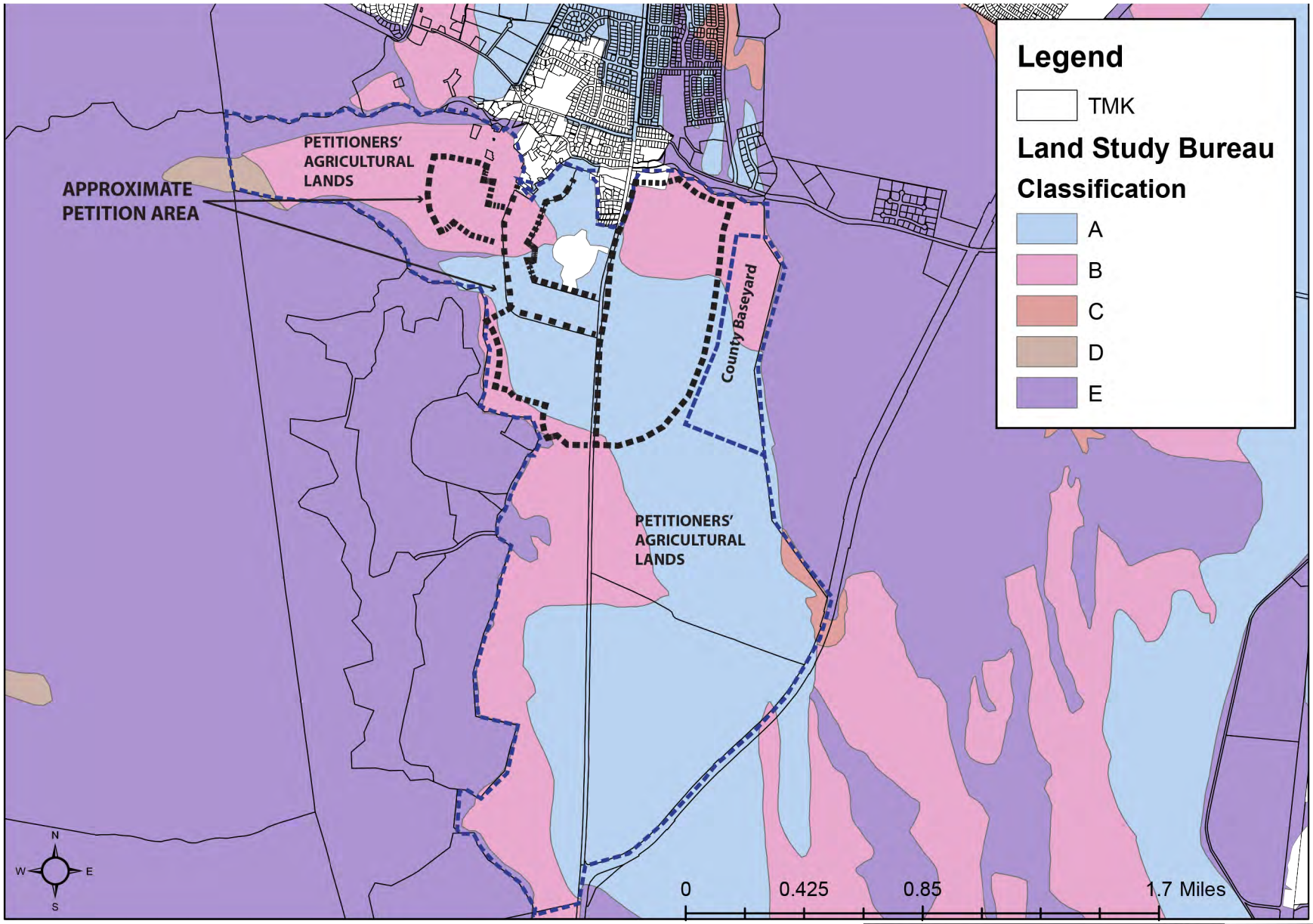


Figure 41
LAND STUDY BUREAU
DETAILED LAND CLASSIFICATION

Not to Scale

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

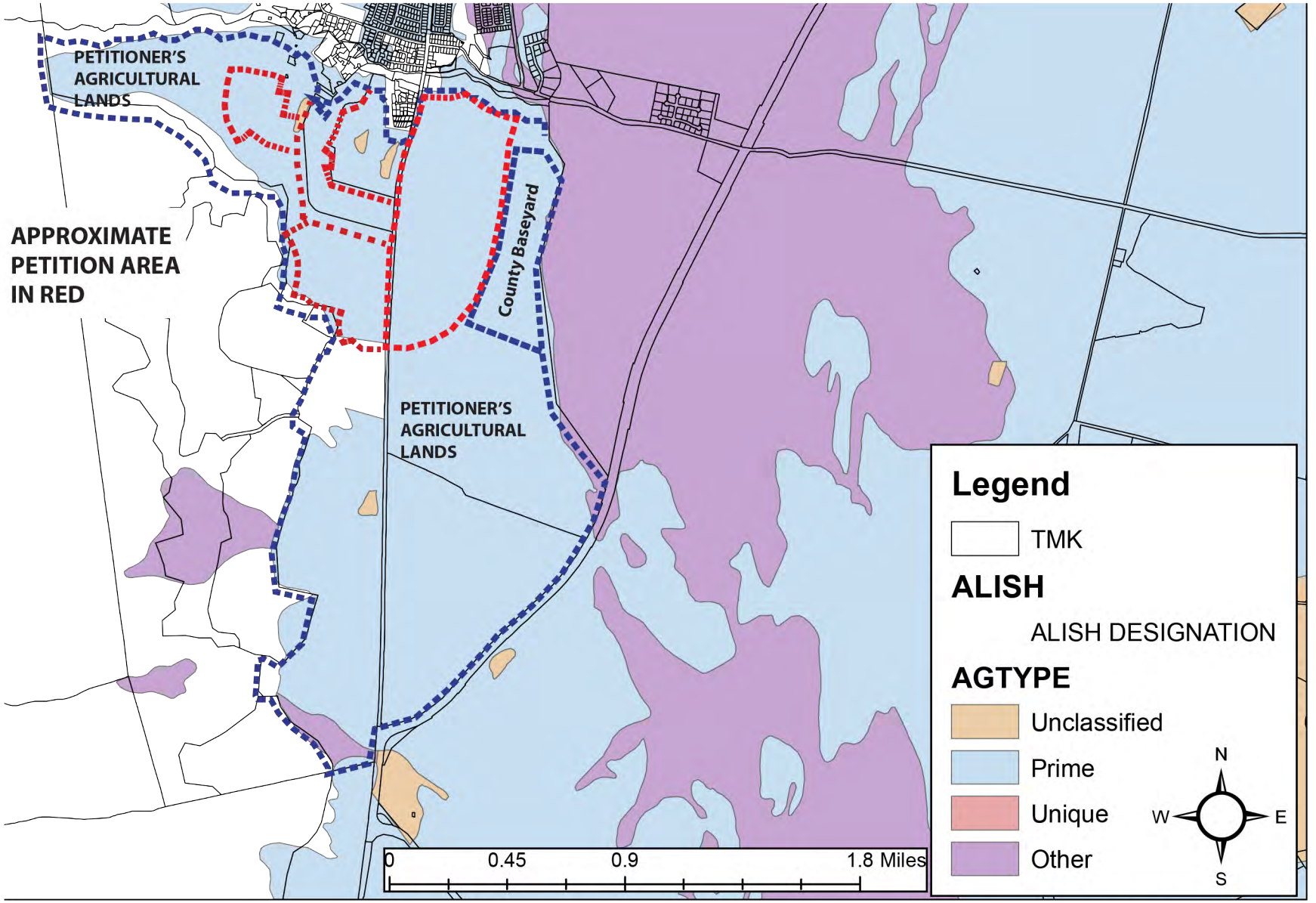


Figure 42

AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAII

Not to Scale

WAIKAPŪ COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

proposed urbanization will require both Kumu Farms and Hoaloa Farms ~~Hawai'i Taro~~ to relocate their agricultural operations to the proposed agricultural park and other suitable agricultural lands within the Project's agricultural district. ~~The Project will also impact a portion of the current lands being leased by HC&S.~~

~~It is anticipated that these lands will gradually begin to be impacted in about three to five years. Over the long-term, HC&S may lose approximately 330 acres to urbanization and some additional acres to a private agricultural park. According to HC&S General Manager, Mr. Rick Volner, HC&S would desire to continue farming its MTP lands to maximize its current economy of scale in production. However, Mr. Volner acknowledged that HC&S has additional lands available that are currently fallow and that urbanization of a portion of its MTP leased lands will not significantly impact the Plantation's long-term economic viability.~~

It has been noted that a significant impediment to agricultural development on Maui, and throughout the state, is the scarcity of agricultural land that is both readily available and affordable for long-term lease to diversified farmers. The establishment of a centrally located agricultural park, with productive lands and affordable irrigation water, should help Maui farmers compete in local, mainland and international markets.

Consistency with State and County Agricultural Policies

The Hawai'i State Plan and State Functional Plans establish policy to protect the viability of the sugar and pineapple industries, protect agriculturally suitable lands for future agricultural needs, and promote the growth of diversified agriculture.

The Maui County General Plan (County-wide Policy Plan, Maui Island Plan, and Wailuku-Kahului Community Plan) seek to preserve productive agricultural lands and facilitate agricultural self-sufficiency in food production. The General Plan also recognizes the need to provide sufficient land areas to accommodate future population growth. Goal 7.1.1.f of the MIP states, "Strongly discourage the conversion of productive and important agricultural lands (such as sugar, pineapple, and other produce lands) to rural or urban use, unless justified during the General Plan update, or when other overriding factors are present."[xvii]

The subject land was placed into an Urban Growth Boundary during the General Plan 2030 update, when other overriding factors were present. These factors included the forecasted demand for additional urban lands to accommodate projected population growth, the development suitability of the subject land, as well as its proximity to existing employment, infrastructure, public facility systems and existing urban development. Moreover, as documented in the Agricultural Impact Assessment, the urbanization of the subject lands will not significantly impact the future viability of the sugar or pineapple industries or the growth of diversified agriculture on Maui or throughout the State.

The proposed action has been carefully analyzed for its short- and long-term impacts upon the agricultural industry. While the proposed action will result in the loss of prime agricultural lands, it will not significantly impact the short- or long-term viability of agriculture in Hawai‘i since an abundance of currently fallow former sugar and pineapple land is currently available elsewhere. The project will, however, help to address the current shortage of agricultural park lots by establishing an approximate 800-acre agricultural preserve that will be used to establish a new private and/or public agricultural park within Central Maui.

~~As described in the AIS (Appendix G), agricultural operations can produce nuisance impacts to neighboring residential communities. The Applicant is committed to identifying appropriate counter measures to reduce potential impacts to future homeowners while providing assurances to farmers that their operations will be protected from such complaints. Some measures that can help to minimize these conflicts include:~~

- ~~Advising prospective homeowners in advance of purchasing property that neighboring lands are in agricultural use, that nuisance impacts may occur, and that agricultural uses are protected under HRS Chapter 165, the Hawaii Right to Farm Law.~~
- ~~Establishing appropriate buffers between actively used agricultural lands and homes.~~
- ~~Planting windbreaks planting within the buffer areas to further mitigate agricultural impacts to homeowners.~~
- ~~Locating residential communities upwind of agricultural operations.~~

- ~~Where feasible, locating the least noxious agricultural activities in closer proximity to urban uses while locating the more noxious activities further away.~~
- ~~Requiring farmers to implement agricultural best management practices to reduce the potential for overspray from the use of pesticides and to implement erosion control measures to reduce dust and agricultural runoff from impacting neighboring properties.~~

Agricultural Nuisances, Air Quality, and Chemical Application BMP's

As described in the AIS (Appendix G), agricultural operations can produce nuisance impacts to neighboring residential communities. The Applicant is committed to identifying appropriate counter measures to reduce potential impacts to future homeowners while providing assurances to farmers that their operations will be protected from such complaints. All future prospective homeowners and leases will be advised in advance of purchasing or leasing property that neighboring lands are in agricultural use, that nuisance impacts may occur, and that agricultural uses are protected under HRS Chapter 165, the Hawai'i Right-to-Farm Law. Moreover, pursuant to Section 205-4.6, the farmers will be informed that the Project's agricultural lands will not be subject to restrictions that limit the types of agricultural uses that may be conducted on these lands.

The proposed urban and rural development will be bound by agricultural lands along the Project's southern and western boundaries. This is a common pattern of development in Hawai'i. Historically, villages and small towns were established throughout Hawai'i to support the pineapple, sugar and livestock industries. These agricultural land uses invariably came into close proximity of agricultural operations. In comparison to sugarcane, it is expected that air pollution emissions will be significantly reduced. Unlike sugarcane, there will be no burning of the sugarcane fields every two years, and there would be no large sugarcane haul trucks generating significant amounts of fugitive dust. Moreover, it is expected that much of the agricultural areas are expected to engage in and promote organic farming, which may reduce or prohibit pesticide use. In addition, the bulk of the WCT's agricultural preserve is located to the south of the WCT's urban development. This allows for the predominant northeast trade winds to carry dust and any agricultural chemicals or pesticides away from the proposed development.

However, during Kona or southwest winds, agricultural dust and chemical emissions could be carried over the Project's residential areas. The proposed elementary school is located approximately one-mile to the northeast of the agricultural fields. The closest residential and rural residences are located in close proximity to WCT's agricultural lands. Airborne dust generated by agricultural activities can cause nuisance and health impacts to neighboring residences if not property mitigated through BMPs. Likewise, the improper application of pesticides may cause drift that could negatively impact environmental and human health. The Applicant will work closely with its farmers to develop appropriate BMPs to help mitigate airborne dust and chemical drift from potentially impacting neighboring land uses. BMPs that are often implemented by farmers to mitigate windblown dust include:

- Establishing appropriate buffers between actively used agricultural lands and homes.
- Planting windbreaks planting within the buffer areas to further mitigate agricultural impacts to homeowners.
- Locating residential communities upwind of agricultural operations.
- Where feasible, locating the least noxious agricultural activities in closer proximity to urban uses while locating the more noxious activities further away.
- Limiting vehicle speeds on unpaved access roads within the agricultural area.
- Requiring farmers to implement agricultural best management practices and erosion control measures to reduce dust and agricultural runoff from impacting neighboring properties.

BMPs that are often implemented by farmers to mitigate pesticide drift include:

- Instituting a dust and chemical drift education and management program to ensure that farmers are properly trained in BMP's that can reduce airborne emissions from their activities.
- Establishing suitable buffer zones between agricultural lands where pesticides might be applied and sensitive environments that could be negatively impacted.
- Establishing windbreaks to capture windblown emissions and to slow the movement of wind.

- Conducting spraying and other nuisance related activities when winds are blowing away from sensitive environments and limiting spraying to periods of low wind speeds to reduce drift distance.
- Ensuring that nozzles used in the application of pesticides and/or herbicides produce the largest or coarsest size droplets possible.
- Encouraging the use of the lowest end of the pressure range when spraying pesticides.
- Following all pesticide application directions as shown on the product labels.
- Using drift control additives, when needed, to increase the size of droplets in order to reduce drift.
- Directing recreation uses, such as off-road biking, hiking and jogging, to the perimeter of agricultural areas where chemical drift would not be a concern.

B. SOCIO-ECONOMIC ENVIRONMENT

1. Population

The resident population of Maui County has experienced rapid growth. According to census figures the resident population of Maui County has grown by approximately 56% since 1990, from 100,504 to 156,764 in 2011.[xviii] These robust growth rates are expected to continue through 2040. According to the State of Hawai'i, Department of Business, Economic Development, and Tourism, "Population and Economic Projections for the State of Hawai'i to 2040", the County's population is expected to reach 232,863 by 2040, which is an increase of 46%.[xix]

Wailuku-Kahului is the island's largest population and employment center. In 2010 the region's population was approximately 53,456[14], which was about 37% of the island's 2010 population of 144,444. Like the rest of Maui, the Wailuku-Kahului region has experienced high growth rates. In 1990 the region's population was 32,816 and by 2010 it had grown to approximately 53,456, which is an increase of 63% over 20 years. Between 2010 and 2030 the region's population is projected to grow to 65,616, which is a much more modest increase of 21%. As of mid-year

[14] Includes Census Designated Places of Kahului, Waihe`e-Waiehu, Waikapū, and Wailuku

2015, there were approximately 57,616 residents in the Wailuku-Kahului region and projections of the resident population by 2035, based on County and State Forecasts range from circa 78,800 to 97,100 as shown below:

Table 29 ~~26~~: Projected Wailuku-Kahului Population

	Year-End	Projected Wailuku-Kahului Population				
Scenario	**2013**	**2015**	**2020**	**2025**	**2030**	**2035**
One: Minimum Based on Adjusted Planning Department Baseline Population Forecasts						
Residents	56,919	57,618	62,642	67,909	73,269	78,764
Two: Maximum Based on Planning Department Historical Trend Run Population Forecast						
Residents	56,919	60,114	68,010	76,850	86,679	97,080

Source: Hallstrom Appraisal Group | CBRE, Inc.

Kahului is home to the island's only major airport and commercial harbor. The Central Maui Wastewater Treatment Facility is located in Kahului. Kahului is also home to the 78-acre University of Hawai'i Maui College, which offers Associate, Bachelor and Master Degree programs to more than 4,400 full- and part-time students. Several "Big Box" retail stores are also located in Kahului, including Costco, Walmart, Lowes, Target, K-Mart and Home Depot.

Wailuku is the island's civic center. Most State and County offices are located in Wailuku, along Main and High Streets. The Wailuku Police Station, which services Central and Upcountry Maui, is located in Wailuku as is the Maui Memorial Hospital. Maui Memorial Hospital is the island's sole hospital, offering 240 inpatient beds. The island's only State Correctional Facility, Maui Community Correctional Center (MCCC), is also located in Wailuku, along Wai`ale Road. A small "main street" commercial district that dates to the 1880s is located in Wailuku along Main, Market, Vineyard and Church Streets. Both Wailuku and Kahului have supporting shopping centers, parks, recreation facilities, educational facilities, libraries, industrial districts and residential districts.

Potential Impacts and Mitigation Measures. A Market Study and Economic and Fiscal Impact Assessment report was prepared by the Hallstrom Appraisal Group | CBRE, Inc. (**See**: Appendix

A, Market Study, Economic Impact Analysis and Public Fiscal Assessment). The report estimates that at buildout the de facto population of the Project will be approximately ~~3,511~~ 4,085 persons[15], comprised of ~~3,362~~ 3,921 full-time residents and some ~~148~~ 163 part-time residents and second home owners.[16] The Project's resident population ~~project population~~ represents from approximately ~~8.40%~~ 9.93 percent to ~~15.40%~~ 18.51 percent of the region's projected resident population growth to 2035. It is not expected there will be meaningful in-migration to Maui as a direct result of the operating components of the project. The project population will create short- and long-term economic impacts and will generate an increase in demand for public infrastructure and facilities. These impacts are documented in Sections V.C and V.D of the ~~DEIS~~ FEIS.

2. **Housing**

Existing Conditions. Median home prices on Maui, like in most other regions of the Country, rose sharply between 1998 and 2006 and then fell precipitously between 2007 and 2010. In January 1998 the median sales price of a fee simple condominium on Maui was $160,000 and a single-family residence was $258,068. By 2006 the median sales price of a fee simple condominium had increased by over 300% to $505,000 and a single-family residence by 269% to $693,000. By December 2012, prices had come down from their peak by about 32% for single-family homes to $470,000 and by 28% for fee simple condominium units to $366,086. However, by December 2012 prices for single-family residences were still over 88% higher than prices in 1998, and for fee simple condominiums the prices were over 228% higher than in 1998.

Like the rest of Hawai'i, housing affordability on Maui is a significant concern. It is generally recommended that no more than 30% of monthly income be spent on rent. However, nearly

[15] Assumes 85% of single- and multi-family units are occupied by residents and the remaining 15% are occupied by part-time residents. It is assumed that part-time residents occupy their units 25% of the time. The population multiplier per single-family unit is 3.2 persons per unit and for multi-family units it is 2.6 persons per unit. It is assumed that all Ohana units are occupied by residents at 1.5 persons per unit. As such the calculation was made as follows: [(1050 * .85)*3.2] + [(1050 * (.15)*(3.2)*(.25)] + [383*.85)*2.6] + [(383*(.15)*(2.6) *(.25)] + (146*1.5)

[16] See Appendix A, Exhibit III-Table 5 of the Market Study, Economic Impact Analysis and Public Fiscal Assessment for the methodology used to calculate the Project's population

half of all Maui residents exceed this threshold and, compared to the other counties, Maui residents spend more of their monthly income on housing. In 2011, 18% of Maui residents spent between 30 and 40% of their household income on shelter and 30.2% spent over 40%, while only 40.8% spent less than 30% of their income on shelter. By comparison, 54.1% of Oahu residents and 49.1% of Hawai'i County residents spent less than 30% of their income on shelter. According to the US Census Bureau, 2007-2011 American Community Survey 5-Year Estimates, 65% of renters in Wailuku spend over 30% of their income on gross rent and 44% spend over 50% of their income on gross rent.[xx]

According to the County of Maui, Department of Housing and Community Concerns, Affordable Sales Price Guidelines, in February 2014 a Maui family earning 100% of the median income ($75,800 as determined by the United States Department of Housing and Urban Development), could afford a $393,700 three-bedroom single-family residence at a 4.5% interest rate. The median single-family sales price in Central Maui between January and September 2014 was $433,787 (Realtors Association of Maui). Maui County's 2014 Affordable Sales Price Guidelines for a 1-bedroom condominium for a family earning 100% of the median income is $248,010. The median fee simple condominium sales price in Central Maui between February and September 2014 was $267,655.

According to the MIP (December 2012), there will be a demand for an additional 29,589 housing units on Maui through 2030. Of these units, approximately 10,845 are expected to be built on lands not currently entitled for urban development.[xxi]

Potential Impacts and Mitigation Measures. The WCT proposes the development of up to 1,433 residential dwelling units, plus the potential for up to 146 Ohana units, targeted at the full spectrum of workers in the development. It will offer a mix of single and multi-family housing types to address the diverse housing needs of Maui residents. The project will comply with the County's workforce housing ordinance, which will require that at least twenty percent of the Project's housing to be sold to low, low-moderate and gap groups in accordance with sales price and resale restrictions enumerated in Chapter 2.96, MCC. Chapter 2.96, MCC also prescribes how Residential Workforce Housing is be marketed, who may qualify to purchase the subject housing and the selection process (See: Appendix O, MCC Chapter 2.96 "Workforce Housing

Policy). The Applicant intends to comply with the County's Residential Work Force Housing Policy by selling or renting residential units within the Project. Relevant sections of Chapter 2.96 that will direct the quantity and pricing of the Project's Residential Workforce Housing includes the following:

"2.96.040 - Residential workforce housing requirements.

A. Developers shall be required to provide a number of residential workforce housing units equivalent to at least twenty-five percent, rounding up to the nearest whole number, of the total number of market rate lots, lodging units, time share units, or dwelling units, excluding farm labor dwellings or a second farm dwelling, as defined in section 19.04.040 of this code, created. If a developer satisfies the requirements of this chapter through subsection (B) (3) and the units shall remain available only to income-qualified groups in perpetuity, the developer shall provide at least twenty percent, rounding up to the nearest whole number, of the total number of market rate lots, lodging units, time share units, or dwelling units, excluding farm labor dwellings or a second farm dwelling, as defined in section 19.04.040 of this code, created.

B. Prior to final subdivision approval or issuance of a building permit for a development subject to this chapter, the department shall require the developer to enter into a residential workforce housing agreement. The agreement shall set forth the method by which the developer satisfies the requirements of this chapter. The requirements may be satisfied by one or a combination of the following, which shall be determined by the director and stated in the agreement:

1. Offer for sale, single-family dwelling units, two-family dwelling units, or multi-family dwelling units as residential workforce housing within the community plan area;

2. Offer for rent, multi-family dwelling units as residential workforce housing units within the community plan area; …"

Regarding income restrictions, Chapter 2.96.040.C "Income Distribution" stipulates that for sale and rental units be distributed as follows:

> *"C. Income group distribution.*
>
> *1. Unless an exemption is granted by the director, the percentage of ownership units within each income group shall be as follows:*
>
> *a. Thirty percent of the ownership units shall be for "below-moderate income" residents.*
>
> *b. Fifty percent of the ownership units shall be for "moderate income" residents.*
>
> *c. Twenty percent of the ownership units shall be for "above-moderate income" residents.*
>
> *2. Unless an exemption is granted by the director, the percentage of rental units within each income group shall be as follows:*
>
> *a. One-third of the rental units shall be for "very low income" and "low income" residents.*
>
> *b. One-third of the rental units shall be for "below-moderate income" residents.*
>
> *c. One-third of the rental units shall be for "moderate income" residents."*

Pursuant to the ordinance requirements, the Applicant will be required to enter into a Residential Workforce Housing Agreement with the County prior to Final Subdivision Approval. Assuming that the Applicant decides to commit twenty percent of the units to Residential Workforce Housing and that half would be for sale 3-bedroom single-family units and half would be for rent 1-bedroom multi-family units the pricing structure would be as follows:

Table 30: For Sale Residential Workforce Housing Units by Income Category

Single-Family For Sale Residential Workforce Housing Units (WFH)[17]			
Income Category	Percent of WFH Units	Number of Units	Price Range
Below-Moderate	30	43	$392,400 - $436,000
Moderate	50	71	$479,600 - $523,200
Above Moderate	20	30	$566,800 – 610,400

Table 31: For Rent Residential Workforce Housing Units by Income Category

Multi-Family For Rent Residential Workforce Housing Units (WFH)[18]			
Income Category	Percent of WFH Units	Number of Units	Price Range per Month
Very Low	33	48	Up to $764
Below Moderate	33	48	Up to $1528
Moderate	33	48	Up to $1834

Moreover, because of the Project's Central Maui location and proposed lot and unit size configurations, the Applicant expects that about 80 percent of the Project's market priced housing will be sold at prices deemed affordable to Maui County residents earning between 100 and 140 percent of the County's median income as determined by the United States Department of Housing and Urban Development. Housing types are expected to include multi-family condominiums, live-work units, small cottage homes on small lots with common open spaces, 'Ohana dwellings[19], traditional single-family lots within a variety of home and lot size

[17] Prices based on County of Maui Affordable Sales Price Guidelines for 2016. Prices assume a 3-bedroom unit with a 4.25% interest rate.

[18] Rents based on County of Maui Affordable Rent Price Guidelines for 2016. Rents assume a 1-bedroom unit with utilities included.

[19] For planning purposes, it is assumed that about ~~15~~ 14 percent of single-family and rural homeowners may decide to build an Ohana unit. The Ohana units may be developed concurrently with the primary residence or at some undetermined future date by the property owner. Through the Project District Ordinance the total number of Ohana units can be regulated by lot size, through a restriction to the permitted uses, requirement of special use permit, or by a quota. However, since Ohana units generate an important source of affordable housing, the infrastructure and public facility impacts of additional Ohana units beyond those addressed in the FEIS may also be addressed through Project District Ordinance stipulations and the building permit processes.

configurations, rental apartments, townhomes and larger estate rural lots. The goal is to serve the demands of all Maui residents. When developed, the Project will accommodate approximately 4.8 percent of the projected housing demand through 2030.

3. **General Economy**

Existing Conditions. Tourism is the predominant component of Maui County's economy. In 2011 there was an annual average job count of 62,900 on Maui. At 29% of all jobs, the Accommodations and Food Service Industry accounts for the largest proportion of jobs on the island. This is followed by federal, state, and county government at 14%. The retail trade, also highly dependent upon tourism, ranks third at 13%. Professional and business services ranks fourth at 10%.[xxii] Agriculture generates just 2.1% of Maui County jobs but is disproportionately important for its historic and cultural legacy and its contribution to the island's scenic beauty and quality of life.

According to the Economic Development Issue Paper (October 2007) prepared for the County of Maui, Department of Planning, in support of the Maui County General Plan 2030 update, Maui County is much more dependent upon tourism than other Hawai'i Counties. Of Maui County's Gross County Product (GCP), 39 percent is attributed to tourism, versus a range of 19-29% for the other counties (Economic Development Issue Paper, 2007). The Economic Development Issue Paper further notes that most Maui households support themselves on two or more jobs. Based on a living wage study of Maui County, a family of four (two adults, two children) would have needed an annual income of $61,650 to support itself in 2005. A corresponding analysis of 2005 jobs and wage data for Maui found that the average wage of 78 occupations – representing 54 percent of all jobs – fell below the $30,800 living wage standard.[xxiii]

Maui County had 2,446,084 visitor arrivals in the year 2011 and hotels on Maui Island experienced a 70.1 percent occupancy rate.[xxiv] In June of 2013 Maui's occupancy rate was 69.1 percent. In the aftermath of the great recession, Maui County's unemployment rate rose to a high of 9.5% in June 2009 but has decreased to a currently level of about 4.2 percent. In Central Maui, economic activity centers on wholesale and retail trade, transportation services, business

and professional services, education and government. HC&S is also a major employer in Central Maui.

According to the Economic Development Issue Paper (October 2007), diversifying Maui's economy has been a key, longstanding County policy. Chapter 4, Economic Development, of the MIP, December 2012, states the following in its analysis of the island's challenges and opportunities:

> *The Island of Maui, like the County as a whole, faces two fundamental challenges in economic development: (1) diversification; and (2) increasing the number and proportion of living wage jobs. There is a subset of more specific challenges, such as the high cost of housing and the need to strengthen public education.*[xxv]

Potential Impacts and Mitigation Measures. The WCT is expected to indirectly support Maui's existing economic base activities by providing much needed housing to serve the island's workforce. The WCT is intended to provide housing along with supporting commercial, employment and institutional uses that will allow for Maui's economic base industries to grow, diversify and become more sustainable - including the island's agricultural industry. By providing much needed housing in a format that will create a high quality of life for Maui's working families, and by generating both short- and long-term employment in the construction, trade and agricultural industries, the project is directly supportive of the State and County's economic development. Development of WCT is expected to generate short-term economic benefits in the form of construction-related employment, as well as long-term benefits that include increased permanent employment and tax revenues. Short- and long-term economic benefits will be more thoroughly analyzed in the following sections of the ~~DEIS~~ FEIS.

4. **Project Induced Economic Impacts[20]**

A market study and economic and fiscal impact assessment was conducted by the Hallstrom Appraisal Group | CBRE, Inc. and is included as Appendix A. The Economic Impact Assessment (EIA) constructs a model depicting the economic impact of the WCT project on the Maui and Statewide community during the course of the Project's "lifespan" from anticipated ground-breaking in 2016, through build-out and full absorption (2026-27), and reaching full "stabilization" by 2030. The model builds on the absorption estimates and data contained in the market study.

The following are the expected short- and long-term economic impacts documented in the EIA:

- The WCT development will bring in ~~$609.1~~ $644.1 million[21] of new capital investment into the Maui economy.
- The construction of the WCT components will directly create an estimated ~~2,320~~ 2,476 "worker-years" of employment (the equivalent of 52 work weeks at 40 hours per week) in the trades and associated businesses during build-out~~,~~ an average of 165 Full Time Equivalent (FTE) positions per year for the 15 years of building. Most of these positions will not be new jobs for new businesses, but work flowing to existing contractors and suppliers. ~~averaging about 193 worker years annually, with an estimated $188.3 million in wages (averaging about $15.7 million per year).~~
- The 169,000 square feet of new commercial operation will generate some 4,251 FTE worker years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions. These jobs will be new positions in the Maui economy. This total does not include the employment, wages or business activity contributions of the existing 29,250 square feet of commercial space in the Maui Tropical Plantation which will be retained.
- The Project will require an estimated 66 worker years of maintenance and common area element employment on a continual basis, and will generate some ~~1,750~~ 1,789 worker

[20] The Hallstrom Appraisal Group | CBRE, Inc. updated the methodology used to determine the Project's economic and fiscal impacts. The change to the methodology is explained in detail on pages 8 and 9 of the Market Study, Economic Impact Analysis, and Public Fiscal Assessment incorporated into the FEIS. (See: Appendix A).

[21] Estimates shown are in constant 2015 dollars.

years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions.

- In aggregate, during the development of the WCT ~~8,750~~ 8,946 worker years of employment will be created during construction and operations, on-site/direct and off-site/indirect, with stabilized employment after completion of 746 jobs.
- During the 15 years projection period, WCT will have a base economic impact on Maui of some $817.1 million in new monies with a stabilized annual benefit of $32.1 million thereafter.
- ~~During the 15 years projection period, WCT will have a base economic impact of $1.3 billion with a stabilized annual benefit of $137.3 million thereafter~~.

~~The above-referenced figures do not include the direct and off-site employment, wages and business activity generated by the in-place 29,000 square feet of the MTP commercial spaces, or the potentials associated with the possible 'Ohana units envisioned in the master planning concept.~~ Table 32 ~~27~~ summarizes WCT's employment impacts during the construction and operation phases:

Table 32 ~~27~~: WCT Projected Employment Impacts

~~WCT Employment Impacts~~			
	~~Construction Period (12 Years)~~		~~Stabilization 2030 +~~
~~Employment Multiplier~~	~~Construction Jobs/Year~~	~~Operations Jobs/Year~~	~~Operations Jobs/Year~~
~~Direct~~	~~193~~	~~314~~	~~597~~
~~Indirect~~	~~149~~[22]		~~149~~

WCT Employment Impacts		
	Construction Period (15 Years)	Stabilization 2030 +

[22] Indirect off-site jobs created through the modelling period from construction and operations

Employment Multiplier	Construction Jobs/Year	Operations Jobs/Year	Operations Jobs/Year
Direct	165	312	597
Indirect	119[23]		149

Table 33 ~~28~~ summarizes the Project's cumulative economic impacts during the projection period (2016-2030) and stabilized thereafter. The column on the left summarizes the cumulative impacts during the initial 15-year projection period (2016-2030) covering build-out/absorption and ramp-up to stabilization, and the right hand column the annual impacts after stabilization.

Table 33 ~~28~~: Summary of Economic Impacts

~~SUMMARY COMPARISON OF MAJOR ECONOMIC IMPACTS All Amounts Expressed in Constant, Uninflated 2015 Dollars~~		
~~Analysis Item~~	~~Cumulative During Projection Period 2016-2030~~	~~Stabilized Annually Thereafter~~
~~Direct Capital Investment~~	~~$609,097,502~~	
~~Local Contractor's Profits~~	~~$60,909,750~~	
~~Local Supplier's Profits~~	~~$24,363,900~~	
~~Worker Years of Jobs~~	~~8,750~~	~~746~~
~~Employee Wages~~	~~$451,200,219~~	~~$27,096,572~~
~~Resident Population~~		~~3,362~~
~~Full-Time Resident Household Income~~	~~$1,290,464,422~~	~~$147,857,819~~
~~De Facto Population Expenditures (On & Off Site)~~	~~$684,361,379~~	~~$78,260,291~~
~~Total Operating Gross Receipts~~	~~$778,598,969~~	~~$106,061,686~~
~~Outside Patronage Expenditures~~	~~$424,077,299~~	~~$59,019,756~~
~~Total Maui "Base" Economic Impact~~	~~$1,348,042,748~~	~~$137,280,047~~

[23] Indirect off-site jobs created through the modelling period from construction and operations

SUMMARY COMPARISON OF MAJOR ECONOMIC IMPACTS
All Amounts Expressed in Constant, Uninflated 2015 Dollars

Analysis Item	Cumulative During Projection Period 2016-2030	Stabilized Annually Thereafter
Direct Capital Investment	$644,304,552	
Local Contractor's Profits	$64,430,455	
Local Supplier's Profits	$25,772,182	
Worker Years of Jobs	8,949	746
Employee Wages	$495,899,240	$27,096,572
Resident Population		3,921
Full-Time Resident Household Income	$1,334,332,822	$156,629,499
De Facto Population Expenditures (On & Off Site)	$675,920,535	$78,314,749
Total Operating Gross Receipts	$172,813,024	$32,090,792
Total Maui "Base" Economic Impact	$817,117,576	$32,090,792

Application of the State Input-Output Model macro multipliers depicting direct, indirect and induced economic impacts arising from development of the WCT results in significantly higher economic out-flow indicators than those from the direct, subject-specific micro model developed by the Hallstrom Appraisal Group | CBRE, Inc. The total State economic impact from construction of the project would reach ~~$1.28~~ $1.37 billion, there would be ~~8,424~~ 8,911 total worker-years of jobs created, and the total increase in earnings statewide would be ~~$371.5~~ $406.1 million.

The State model also estimates that the total annual economic output from business operations within WCT would be more than double the gross revenues at ~~$221.7~~ $67.1 million annually on a stabilized basis, the total number of worker years attributable to the subject dollars flowing through the economy would be ~~2,015~~ 609 positions annually, and the increase in direct earnings would be ~~$51.2~~ $21.2 million per year.

5. Project Induced Fiscal Impacts[24]

A market study and economic and fiscal impact assessment (FIA) was conducted by the Hallstrom Appraisal Group | CBRE, Inc. and is included as Appendix A.

The following are the conclusions of the FIA:

- The County of Maui will realize Real Property Taxes ($27.7 million) ~~($28.3 million)~~, other secondary receipts, and impact fees of ~~$48.8~~ $47.9 million during the 15-year projection period (2016-2030), and ~~$5.0~~ $4.9 million annually on a stabilized basis thereafter. After new per capita costs for services are considered the County will earn a net "profit" $42.2 million during build-out and $4.2 million annually after stabilization. In addition, the WCT includes approximately 32.5 acres of active and passive park land within the project site, of which at least 16.5 acres will be dedicated to the County.

- The State of Hawai'i will receive Gross Excise and Income taxes, secondary revenues, and impact fees of ~~$228.0~~ $95.4 million during the 2016-2030 period, and ~~$20.0~~ $4.4 million per year thereafter. Overall, after new per capita governmental costs are deducted, the State will generate net benefits of $82.6 million during build-out and $2.9 million annually on a stabilized basis. The WCT will also be providing a 12-acre elementary school site to the State.

~~As is typical of a residential-focused master planned community, with limited commercial components, and having a significant percentage of affordably-priced housing units for local families, the expense to the State and County from a "per capita basis" of all governmental operating costs perspective may exceed the specific on-site tax/fee revenue benefits. However, given~~ Given the existing emergency services and social services infrastructure available in nearby Wailuku and Kahului, the provision of a school site within WCT, payment of impact fees, and young age of the project components, it is ~~unlikely~~ likely the "actual" public cost burden associated with the project would be less than the per capita assessment or independently

[24] The Hallstrom Appraisal Group | CBRE, Inc. updated the methodology used to determine the Project's economic and fiscal impacts. The change to the methodology is explained in detail on pages 8 and 9 of the Market Study, Economic Impact Analysis, and Public Fiscal Assessment incorporated into the FEIS. (See: Appendix A).

require the need for major new public facilities. ~~exceed the revenues generated or independently require the need for major new public facilities.~~

C. PUBLIC SERVICES

1. Recreational Resources

Existing Conditions. The MIP (December 2012) notes that Wailuku-Kahului has approximately 186 acres of sub-regional park land and 377 acres of regional park land. In projecting future park needs, the County used a standard of 10-acres of sub-regional park land per 1,000 persons and 15-acres of regional park land per 1,000 persons. This standard was adapted from standards recommended by the National Recreation and Parks Association (NRPA), Urban Land Institute, and the City and County of Honolulu. Using these standards, the MIP states that Wailuku-Kahului is currently deficient in sub-regional park land by approximately 322-acres and that future projections to 2030 indicate the deficit will increase to 541-acres. However, the MIP also acknowledges that the NRPA's updated 1996 guidelines recommend that communities develop individualized Level-of-Service standards and the MIP notes that LOS standards that recognize Maui's unique "assets, conditions, and resources" may "more accurately reflect the island's park land and facility needs". It should be noted that based on the mid-year 2015 Wailuku-Kahului population of 57,616, there are just 3.22 acres of sub-regional park land per 1,000 persons and 6.54 acres of regional park land per 1,000 persons.

There is a diverse selection of both active recreational parks and beach parks in Central Maui. Table No. 34 ~~29~~ identifies select sub-regional active recreation parks within proximity of the project site.

Table 34 ~~29~~: Sub-Regional Parks within Proximity of the WCT

Central Maui Regional Parks				
Park	Acres	Location	Facilities	Approx. Miles to WCT
Waikapū	2.4	Waikapū	Community Center; softball; basketball;	0.5

Central Maui Regional Parks				
Community Center & Park			restroom	
Kahului Community Center	31	Kahului	Community Center; soccer, baseball, tennis, playground, walking and jogging paths	5
Kahului Park	7.1	Kahului	Baseball, basketball, softball	5.5
Maui High School	13	Kahului	Baseball; multi-purpose fields	5.75
Pomaika`i	4.7	Kahului	Open fields	3.5
Wai`ale	3	Wailuku	Baseball, softball, basketball, tot lot	2.75
Wailuku Elementary	3.9	Wailuku	Baseball, basketball, playground	2.75
Wailuku Gymnasium	0.8	Wailuku	Basketball, gymnasium, weights, pool	3.0
Wailuku Heights	1.4	Wailuku	Playground, picnic areas	2.75
Wells Community Complex	6.6	Wailuku	Tennis courts, basketball courts, baseball	3.0

Table No. 35 ~~30~~ identifies select regional active recreation parks within proximity of the project site.

Table 35 ~~30~~: Regional Parks within Proximity of the WCT

Central Maui Regional Parks				
Park	Acres	Location	Facilities	Miles to WCT
War Memorial Complex	51	Wailuku	Football and baseball stadiums, aquatic center, tennis courts, gymnasium	3.0
Keopuolani	110	Wailuku	Softball, soccer, playground, walking and jogging paths	3.0

Table No. 36 ~~31~~ identifies select beach parks within proximity of the project site.

Table 36 ~~31~~: Central Maui Beach Parks within Proximity of the WCT

Central Maui Beach Parks				
Park	Acres	Location	Facilities	Miles to WCT
Ho'aloha Park	2	Kahului	Beach Park with Canoe Hale; Restroom; volleyball, exercise facility	5.0
Kanahā Beach Park	94	Kahului	Beach park with canoe hale; volleyball; picnic areas; camping; windsurfing, kite surfing and surfing destination	7.0

Moreover, the County of Maui recently acquired 209 acres in Waikapū, near the project site, for a regional park. According to the Mayor's proposed 2013 capital improvement plan, the park will include soccer, baseball, and softball fields and will be built out in phases. This park would be located within approximately one-half mile of the project site.

A central Maui sports complex is also being planned in Waikapū on 65 acres by the State of Hawai'i. The complex will be built in phases and may include a full-sized baseball field, a quad of softball fields, a little league baseball quad, an area for soccer fields, comfort stations, concession buildings, and new infrastructure.[xxvi] This facility would be located about two miles from the WCT.

Potential Impacts and Mitigation Measures. The resident population of Wailuku-Kahului as of mid-year 2015 was 57,616. According to County and State Forecasts, the 2035 resident population of Wailuku-Kahului may range from 78,764 to 97,080 persons. This is an increase in population of 21,148 to 39,464, which is an increase of 36.7% to 68.5%. The projected resident population of the Project is 3,921 persons, ~~which projected project population is expected to be about 3,511 persons~~, which represents from ~~16.6%~~ 18.51 percent to 9.93 percent ~~8.9%~~ of the projected resident population growth through 2035.

As noted in Section V.B.1 "Population", the project will generate a defacto population of approximately ~~3,511~~ 4,085 persons. The population generated by the development will produce

an increase in demand for park facilities. Using the standard of 10-acres of sub-regional park land per 1,000 persons and 15-acres of regional park land per 1000 persons, the project would need to incorporate approximately ~~35-acres~~ 40.85 acres of sub-regional park land and approximately ~~52-acres~~ 62.17 acres of regional park land to accommodate the project population.

If the WCT is to provide 3.22 acres of sub-regional park land per 1,000 persons and 6.54-acres of regional park land per 1,000 persons, which is the ratio of park land to population that currently exists within Wailuku-Kahului, then the project should provide approximately ~~11-acres~~ 13.15 acres of sub-regional park land and about ~~23-acres~~ 26.72 acres of regional park land.

In order to comply with the County's park land dedication requirement of 500 square feet of park land per unit (not including the initial three units), the project would be required to dedicate approximately ~~16.5-acres~~ 18-acres of land for park use. The WCT proposes to dedicate approximately 32.5 acres of sub-regional park land. This land will comprise a variety of park types including mini-parks, neighborhood parks and a community park. The parks are strategically located to provide easy pedestrian and bicycle access from the project's single- and multi-family residential neighborhoods and the school site to these facilities (See Section III.B.4 of the ~~DEIS~~) FEIS. The project will also provide approximately 50-acres of greenways and open-space, which will include pedestrian and bicycle paths and will create additional opportunities for passive recreation. Moreover, within the abutting 1,077-acres of agricultural lands owned by the Applicant, opportunities for various forms of open-land recreation such as horseback riding, mountain biking, trail running, hiking and community gardening may also exist. With the incorporation of the proposed on-site passive and active park facilities, the WCT should produce minimal impact upon existing park facilities within Wailuku-Kahului.

2. Medical Facilities

Existing Conditions. Maui Memorial Medical Center, located in Wailuku approximately 4 miles from the WCT, is the island's only acute care hospital. It is an approximate 251-bed hospital that is part of the Hawai'i Health System Corporation, which is supported by the State. The Maui Memorial Medical Center provides 24-hour emergency services. It also provides intensive care, oncology, maternity and other specialized units.

Various private medical offices and facilities are located throughout Wailuku-Kahului. These facilities provide non-emergency medical care. Kaiser Permanente has clinics in Wailuku and in Maui Lani and Maui Medical Group has offices in Wailuku.

Potential Impacts and Mitigation Measures. The resident population of Wailuku-Kahului as of mid-year 2015 was 57,616. According to County and State Forecasts, the 2035 resident population of Wailuku-Kahului may range from 78,764 to 97,080 persons. This is an increase in population of 21,148 to 39,464, which is an increase of 36.7% to 68.5%. The projected project population is expected to be about ~~3,511~~ 4,085 persons, which represents from ~~16.6%~~ 19.32 percent to ~~8.9%~~ 10.35 percent of the projected population growth through 2035.

The projected increase in Wailuku-Kahului's population will produce a demand for additional medical facilities. An estimate of the increase in demand for hospital facilities can be calculated based on the existing level-of-service. For acute and critical care, 0.0809 beds are needed to maintain the current level-of-service for every 100 persons on Maui Island. Based on this standard, the WCT would generate a demand for about of ~~2.84~~ 3.30 beds.

To maintain current levels of ambulatory service, 0.0045 ambulances would be needed per 100 persons. Therefore, about ~~.157~~ .184 additional ambulances, with staffing, would be required to service the project population.

3. Police Protection

Existing Conditions. The Waikapū area falls within the MPD's District I. This police district is served by the Wailuku (Central) Station, which houses the MPD headquarters for the entire County. The Central Station is located approximately 4 road miles from the project site.

The Police Department includes the following four programs:

- *The Administration Program*. The Administrative Program is responsible for recruitment of personnel; compliance with The Commission on Accreditation for Law Enforcement Agencies (CALEA) standards; and addressing personnel matters.
- *Technical and Support Services Program.* The Technical and Support Services Program conducts recruit training, maintains reliable radio communications; promotes the use of

technology to improve law enforcement services; and promotes community involvement and crime prevention.

- *Investigative Services Program.* Conducts juvenile crime prevention; investigates vice and drug activities, prepares for a responds to critical incidents; conducts specialized and detailed criminal investigations; and investigates domestic violence incidents.
- *Uniformed Services Program*. Suppresses drug trafficking; conducts DUI enforcement; issues traffic citations; and enforces laws and ordinances.

Table No.37 ~~32~~ identifies full time equivalent personnel identified for each program in the County's adopted fiscal year 2015 budget.

Table 37 ~~32~~: Full-time Equivalent Police Department Personnel

Program	Full Time Equivalent Personnel	
	2012 Adopted	2015 Adopted
Administration Program	23.0	24.0
Investigative Services Program	89.0	106.0
Technical and Support Services Program	110.5	104.5
Uniformed Patrol Services Program	295.1	290.5
Department Total	517.6	525

Potential Impacts and Mitigation Measures. The de facto population of the County of Maui as of July 2012 was 201,870. Therefore, the level-of-service for Police Department Personnel in 2012 was one Police Department personnel per 390 persons.

The resident population of Wailuku-Kahului as of mid-year 2015 was 57,616. According to County and State Forecasts, the 2035 resident population of Wailuku-Kahului may range from 78,764 to 97,080 persons. This is an increase in population of 21,148 to 39,464, which is an increase of 36.7% to 68.5%. The projected resident population of the Project is 3,921 persons, ~~which projected project population is expected to be about 3,511 persons~~, which represents from ~~16.6%~~ 18.51 percent to 9.93 percent ~~8.9%~~ of the projected resident population growth through 2035. Using a standard of one Police Department personnel per 390 persons, the

project population would generate a need for about ~~9~~ 10.47 personnel and accessory facilities. As noted in the Fiscal Impact Assessment prepared for the project (Appendix A), after new per capita costs for services are considered the County will earn a net "profit" of $4.2 million annually after stabilization. ~~A portion of these revenues should be allocated to help address the increase in demand for police protection services generated by the project.~~

4. Fire Protection

Existing Conditions. The Department of Fire and Public Safety includes the following five programs:

- The Administration and Maintenance Program;
- The Training Program;
- The Fire/Rescue Operation Program; and
- The Fire Prevention Program.

There are two fire stations that are within a five road mile service area of Waikapū. These include Wailuku Station at 21 Kinipopo Road and the Kahului Fire Station at 200 Dairy Road. The Wailuku Station is an Engine Company. The Kahului Fire Station is an Engine, Tanker and Rescue Company.

The County uses a distance standard of 2 to 3 miles to provide adequate coverage to residential districts. Waikapū is approximately 3 road miles from the Wailuku Fire Station and 4.5 road miles from the Kahului Fire Station.

In order to reduce response times for both fire and medical emergencies, construction of a new fire station is planned in Waikapū. According to the Mayor's proposed 2013 capital improvement program, the fire station will be situated on approximately 5 acres of the 100 acres recently acquired in Waikapū to accommodate a County campus for various departments, police and fire stations. The CIP states that the 5-acre fire station will be located along the proposed Waiko Road Extension. The development of a fire station within Waikapū will bring the proposed project well within the County's desired response time standard.

Potential Impacts and Mitigation Measures. The de facto population of the County of Maui as of July 2012 was 201,870. Therefore, the County-wide level-of-service for Fire Department Personnel in 2012 was one Fire Department personnel per 518 persons.

The resident population of Wailuku-Kahului as of mid-year 2015 was 57,616. According to County and State Forecasts, the 2035 resident population of Wailuku-Kahului may range from 78,764 to 97,080 persons. This is an increase in population of 21,148 to 39,464, which is an increase of 36.7% to 68.5%. The projected resident population of the Project is 3,921 persons, ~~which projected project population is expected to be about 3,511 persons~~, which represents from ~~16.6%~~ 18.51 percent to 9.93 percent ~~8.9%~~ of the projected resident population growth through 2035. Using a standard of one Fire Department personnel per 518 persons, the project population would generate a need for ~~7~~ 7.89 personnel and accessory facilities. As noted in the Fiscal Impact Assessment prepared for the project (Appendix A), after new per capita costs for services are considered the County will earn a net "profit" of $4.2 million annually after stabilization. ~~the project will generate approximately $3.1 million in real property tax receipts on a stabilized basis following build-out of the project. A portion of these revenues should be allocated to help address the increase in demand for fire protection services generated by the project.~~

5. Schools

Existing Conditions. Maui schools are organized into complexes and complex-areas. A complex consists of a high school and all of the intermediate/middle and elementary schools that flow into it. Groups of two to four complexes form a "complex area" that is under the supervision of a complex area superintendent.

The WCT is located within the State Department of Education's Baldwin-Kekaulike-Maui Complex-Area. The Complex is comprised of the schools shown in Table 38 ~~33~~:

Table 38 ~~33~~: Baldwin-Kekaulike-Maui Complex Area Schools

Baldwin-Kekaulike-Maui Complex Area			
Name	Grades	2013 Enrollment	Approx. Road Miles from WTC
Pu'u Kukui Elementary	K - 5	541	2
Waihe'e Elementary	K - 5	775	6
Wailuku Elementary	K - 5	740	2.75
ʻĪao Intermediate	6 - 8	886	3
Baldwin High School	9 - 12	1538	3.5

Current and projected enrollment and capacities for area schools were provided by the Planning Section of the Department of Education's Facilities Development Branch and are shown in Table 39 ~~34~~, "DOE School Enrollment & Capacity" below.

Table 39 ~~34~~: DOE School Enrollment & Capacity

DOE School Enrollment & Capacity					
Schools	2013 Enrollment	2013 Capacity	Surplus / Deficit	2018 Projected Enrollment	**2018 Surplus / Deficit**
Wailuku Elementary	740	958	218	695	**263**
Pu'u Kukui Elementary	541	550	9	603	**-53**
ʻĪao Intermediate	886	999	113	972	**27**
Baldwin High School	1538	1809	271	1606	**203**
Kahului Elementary	1064	915	149	992	**-77**
Lihikai Elementary	943	1036	93	933	**103**
Pōmaikaʻi Elementary	550	760	210	545	**215**
Maui Waena Intermediate	1095	1276	181	1197	**79**
Maui High School	**1908**	**2035**	**127**	**1394**	**641**

Potential Impacts and Mitigation Measures. The resident population of Wailuku-Kahului as of mid-year 2015 was 57,616. According to County and State Forecasts, the 2035 resident population of Wailuku-Kahului may range from 78,764 to 97,080 persons. This is an increase in population of 21,148 to 39,464, which is an increase of 36.7% to 68.5%. The projected project population is ~~3,511~~ 4,085 persons, which represents from 19.32 percent ~~8.9%~~ to ~~16.6%~~ 10.35 percent of the projected population growth through 2035.

The projected increase in Wailuku-Kahului's population will produce a demand for additional educational facilities. Pursuant to Act 245, the State Department of Education adopted Impact Fees to develop funding for educational facilities required to support new residential development. The Board of Education has designated Central Maui as one of four School Impact Districts. The DOE uses the following student generation rates for Central Maui.

Table 40 ~~35~~: DOE Student Generation Rate Multipliers

DOE Student Generation Rate Multipliers		
Type of School	Generation Rate Per Unit	
	S.F.	M.F.
Elementary	0.23	0.13
Middle	0.11	0.04
High	0.15	0.05

Based upon these standards, the WCT would increase the student population as shown in Table 41 ~~36~~. Expected WCT construction cost impact fees are shown in Table 42 ~~37~~ and land dedication requirements in Table 43 ~~38~~.

Table 41 ~~36~~: WCT Projected Student Generation

WCT Projected Student Generation					
Type of School	Generation Rate Per Unit		WCT Residential Units		Student Generation
	S.F.	M.F.	S.F.	M.F.	

Elementary	0.23	0.13	241.5	49.79	291
Middle	0.11	0.04	115.5	15.32	131
High	0.15	0.05	157.5	19.15	177

Table 42 ~~37~~: WCT Construction Cost Impact Fee

WCT Construction Cost Impact Fee							
Type of School	Fee (dollars)		No. Units		Amount		TOTAL
	SF	MF	SF	MF	SF	MF	
Elementary School	791	447	1050	383	830550	171201	$1,001,251
Middle School	405	147	1050	383	425250	56301	$481,551
High School	957	319	1050	383	1004850	122177	$1,124,027
TOTAL							**$2,606,829**

Table 43 ~~38~~: WCT DOE Land Dedication Requirement

WCT Land Dedication Requirement							
Type of School	Land (acres)		No. Units		Acres		TOTAL
	SF	MF	SF	MF	SF	MF	
Elementary School	.003588	.002028	1050	383	3.767	0.777	4.544
Middle School	.00121	.00044	1050	383	1.271	0.169	1.44
High School	957.00459	.00153	1050	383	4.820	0.586	5.406
TOTAL ACRES							**11.39**

The WCT will comply with State DOE impact fee requirements, which will mitigate the Project's impacts upon State educational facilities. The Applicant is in the process of finalizing an Educational Contribution Agreement (ECA) with the DOE that confirms the applicable construction cost and land dedication impact fees required of the Project. The elementary school is proposed to be constructed in the Phase I development, which is between 2017 and 2021 (See Section 3.B.7). The State Department of Education's Facilities Planning Branch is managing and coordinating the education facilities needs of the region, including the facilities

that will be required of the Project and the neighboring Wai'ale development proposed by A&B Properties.

6. Solid Waste

Existing Conditions. The Central Maui Landfill services the residential waste stream for Central Maui, including Waikapū. The privately owned and operated Decoite Landfill services the island's construction and demolition waste stream. According to the County of Maui's Integrated Solid Waste Management Plan (ISWMP) (February 2009), the amount of waste generated in 2006 was 345,000 tons of which 124,000 tons was diverted for recycling.[xxvii] In 2006, the Central Maui Landfill received 213,993 tons of residential waste, the Maui Construction and Demolition Landfill (Decoite Landfill) received 50,000 tons of construction waste, and the Eco Compost Facility received 54,243 tons of yard waste. It is projected that by 2030 the total generated waste on Maui will be 499,381 tons per year (TPY) of which approximately 31 percent, or 147,309 TPY, would be recycled. Thus, by 2030 it is projected that approximately 353,632 TPY of solid waste would be entering the island's landfills. In comparing planned capacity versus projected solid waste generation, the ISWMP projects that the planned capacity is sufficient to accommodate demand through 2026.

The County of Maui is currently assessing the feasibility of developing a waste-to-energy facility in Central Maui, on land near the Central Maui Landfill. The facility could have the potential to divert up to 80% of the waste generated on Maui with the byproduct used as a renewable fuel. Such a capital improvement would significantly mitigate the need for additional landfill space to accommodate the projected population growth.

The ISWMP also uses residential and commercial waste generation rates for its projections. The residential generation rate in tons per household per year for Maui (excluding Hana) is 2.3. The Commercial Generation Rate (tons per employee per year) for Maui (excluding Hana) is 1.58.

Potential Impacts and Mitigation Measures. The resident population of Wailuku-Kahului as of mid-year 2015 was 57,616. According to County and State Forecasts, the 2035 resident population of Wailuku-Kahului may range from 78,764 to 97,080 persons. This is an increase in population of 21,148 to 39,464, which is an increase of 36.7% to 68.5%. The projected resident

population of the Project is 3,921 persons, ~~which projected project population is expected to be about 3,511 persons~~, which represents from ~~16.6%~~ 18.51 percent to 9.93 percent ~~8.9%~~ of the projected resident population growth through 2035.

The projected increase in Wailuku-Kahului's population will produce a demand for solid waste disposal. Waste generated by site preparation will primarily consist of vegetation, rocks and debris from clearing, grubbing, and grading. Very little demolition material is expected, as the site is essentially vacant.

During the construction phase, construction activities will require the disposal of the existing on-site waste, as well as cleared vegetation and construction-related solid waste. Using a 2003 publication by the Environmental Protection Agency (EPA) entitled "Estimating 2003 Building-Related Construction and Demolition Materials Amounts", factors of 4.39 pounds per square feet of construction for residential and 4.34 pounds per square feet of construction for commercial buildings were used to determine potential construction waste generated by the Project. Using these factors, it is estimated that during the construction phase (2017-2026) residential construction waste might total approximately 8.7 million pounds or 4,350 tons of waste. The commercial component would generate approximately 736,000 pounds or 368 tons of waste through 2026.

A solid waste management plan will be coordinated with the County's Solid Waste Division for the disposal of onsite and construction-related waste material. The Developer will work with the contractor to minimize the amount of solid waste generated during the construction of the project. Using the ISWMP's residential generation rate of 2.3 tons per household per year and the commercial generation rate of 1.58 tons per employee per year, total solid waste generated during the operation phase of the project at stabilization in 2026 is ~~3,715~~ 4,051 tons per year. Using a diversion rate of 31 percent, total waste from the project site is estimated to be approximately ~~2,563~~ 2,795 tons per year.

The WCT will support the County's recycling, reuse and composting activities. In addition, the Applicant will explore the opportunity for establishing a community composing facility where the recycled by product could be made available to WCT's farmers. The ISWMP provides

strategies for diverting solid waste from landfills to reduce landfill dependency, save landfill capacity and improve operational efficiency. The WCT will implement these strategies by providing options for recycling, such as collection systems and bin space, within the project, and promoting sound recycling strategies among residents and businesses.

D. INFRASTRUCTURE

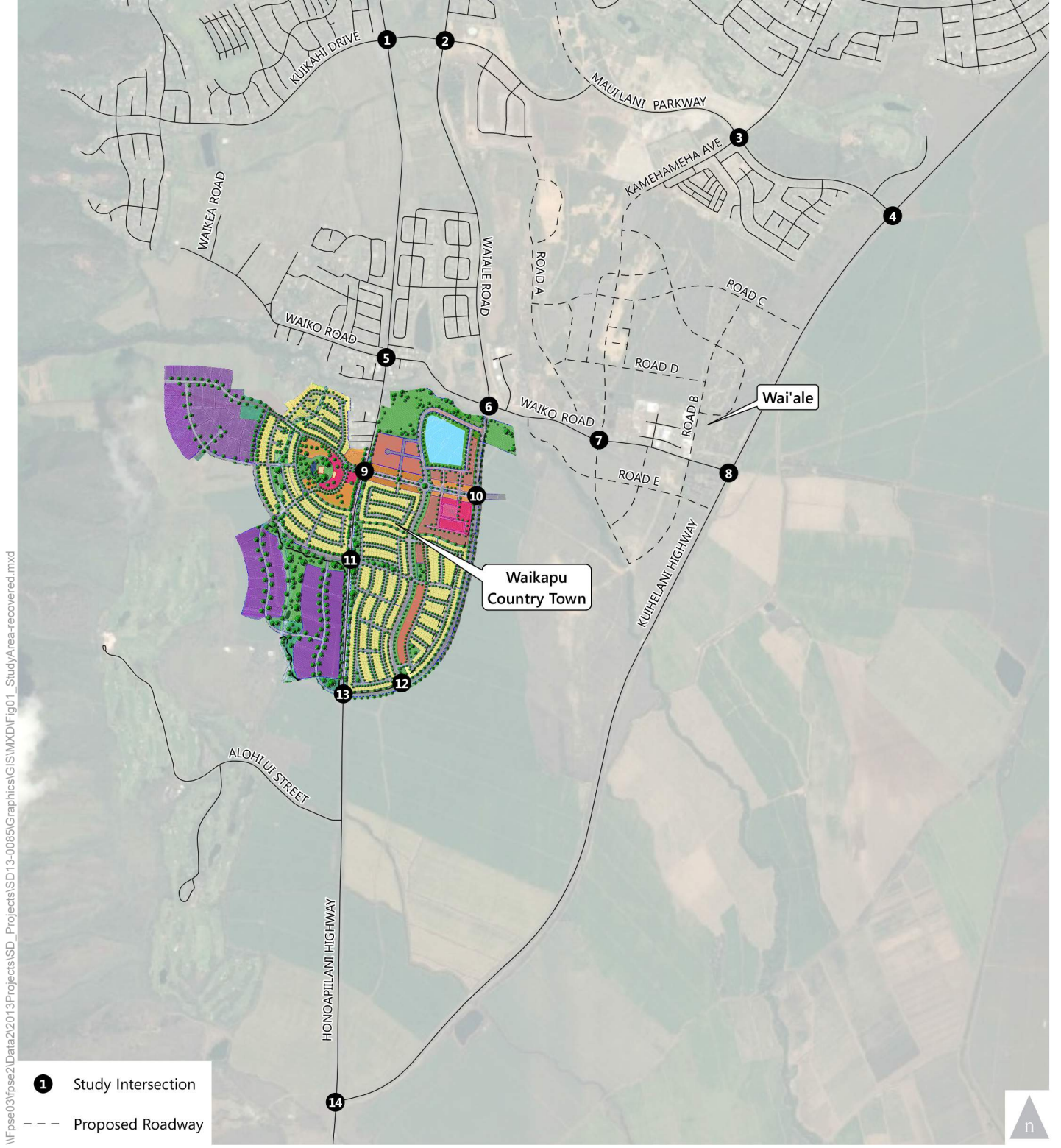
1. Roadways and Traffic

Existing Conditions. Existing regional roadway conditions are described in detail in the Preliminary Engineering Report, Appendix H, prepared by Otomo Engineering and in the Traffic Impact Analysis Report (TIAR), Appendix I, prepared by Fehr & Peers.

Figure No. 43 ~~38~~ shows the location of regional roadways that serve the project area. The primary regional access to the Waikapū area is provided by Honoapi'ilani Highway, Highway 30, (Figure 42 ~~37~~, Location 1), which traverses through the project site. Honoapi'ilani Highway divides the project site into the mauka and makai sections. It is a two-lane undivided State Highway which runs in the north-south direction into Wailuku. The speed limit is 30 miles per hour (mph) in the vicinity of the project site and Waiko Road. The Waiko Road intersection is signalized with existing left turn pockets into East and West Waiko Road. There is a left turn pocket on Honoapi'ilani Highway at its intersection with the driveway for the existing MTP.

Kūihelani Highway, Highway 380, (Figure 42 ~~37~~, Location 7) is located immediately east of the project site. It is a two-way, four-lane divided State arterial highway which also runs in a north-south direction. The posted speed limit on Kūihelani Highway at Waiko Road is 55 mph. There is an existing traffic signal at the Kūihelani Highway-Waiko Road intersection. The southern terminus of Kūihelani Highway is its intersection with Honoapi'ilani Highway. The northern terminus is at its intersection with Pu`unēnē Avenue, where it turns into Dairy Road.

Waiko Road (Figure 42 ~~37~~, Location 2 and 3) is a two-lane County-owned collector roadway that runs in an east-west direction and connects Honoapi'ilani Highway and Kūihelani Highway. The posted speed limit on Waiko Road is 20 mph. Immediately east of Honoapi'ilani Highway, Waiko



\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig01_StudyArea-recovered.mxd

Figure 43:
Study Area and Analyzed Intersections

Road provides access to the Waikapū Gardens residential community. Further east, Waiko Road provides access to industrial and livestock land uses. There is a weight limit of 10,000 pounds for vehicles entering and exiting Waiko Road from Honoapi'ilani Highway.

Wai`ale Road (Figure 43 ~~38~~, Location 5) is a north-south, undivided collector road that starts as an extension of Lower Main Street and terminates at Waiko Road. The roadway provides two travel lanes (one in each direction) and serves as the only access road for residents of the Waikapū Gardens neighborhood located between Kuikahi Drive and Waiko Road. The posted speed limit is 20 mph. The section of Wai`ale Road from Waiko Road to Kuikahi Drive is privately owned. The segment from Kuikahi Drive to Lower Main Street is County owned and used as a collector road.

Kuikahi Drive (Figure 43 ~~38~~, Location 6) is an east-west collector road. West of its intersection with Honoapi'ilani Highway, Kuikahi Drive passes through the Wailuku Heights Subdivision and terminates in a cul-de-sac at the top of the subdivision. Approximately 1,000 feet east of Honoapi'ilani Highway, it intersects with Wai`ale Road. The eastern terminus of Kuikahi Drive is at its intersection with Maui Lani Parkway.

Kamehameha Avenue (Figure 43 ~~38~~, Location 7) is a County-owned north-south collector road. It is a two-lane roadway which begins at its intersection with Hana Highway and extends southward through the Maui Lani development with its terminus just south of Pomaika`i Elementary School.

Maui Lani Parkway (Figure 43 ~~38~~, Location 8) is a two-lane, east-west collector road with a raised median. It connects Kūihelani Highway with Kuikahi Drive. When completed, Maui Lani Parkway will extend to Kaahumanu Avenue near Baldwin High School. Upon completion of Maui Lani Parkway, it will connect Kūihelani Highway and Kaahumanu Avenue. The mauka side of the Project at the MTP is accessible from Honoapi'ilani Highway. The makai side of the property is undeveloped and in sugar cane cultivation.

Access to the makai land is from Honoapi'ilani Highway, East Waiko Road and Kūihelani Highway from cane haul roads. Access for the proposed project will be from the roadway connections on

Honoapi'ilani Highway for both the mauka and makai development sites, as well as the future Wai`ale Road extension for the makai development.

Traffic Impact Analysis Report (TIAR)

~~As noted, a~~ A TIAR was prepared by Fehr & Peers in December 2014 to document the traffic impacts of the project and to propose mitigation measures (**See**: Appendix L ~~I~~, "Traffic Impact Analysis Report"). The TIAR was incorporated into the DEIS and transmitted to agencies for comment. The County Department of Public Works (DPW) commented in their May 23, 2016 letter (**See**: Appendix S, DEIS Agency and Community Comment and Response Letters) that the timing of the Wai'ale Bypass is uncertain and that the Applicant should assume that the roadway may not be constructed.

In response to the DPW's letter, the Applicant contracted with Fehr & Peers to conduct an analysis of the Project's traffic impacts at full buildout without the Wai'ale Bypass Road. Feher & Peers completed the analysis in October 2016. The "No Wai'ale Bypass Scenario" analysis demonstrates that even under a worst-case scenario where the subject roadway isn't in place, the Project can achieve an acceptable level-of-service through off-site intersection improvements. The "No Wai'ale Bypass" analysis is summarized in this section of the FEIS, following the summary of the December 2014 TIAR, and is also included in the FEIS as Appendix M (**See**: Exhibit M, Fehr & Peers Memorandum dated October 17, 2016).

The December 2014 TIAR analyzed the typical weekday AM and PM traffic conditions under existing conditions and potential project-related traffic impacts at partial buildout in 2022 and at full buildout in 2026. The analysis evaluated the operations at eight existing and six future intersections (a total of 14 study intersections) in the vicinity of the proposed project. The analyzed intersections are shown in Figure 44 ~~39~~ and are listed below.

1. Honoapi'ilani Highway (Highway 30)/Kuikahi Drive
2. Wai`ale Road/Kuikahi Drive
3. S. Kamehameha Avenue/Maui Lani Parkway
4. Kūihelani Highway (Highway 380)/Maui Lani Parkway
5. Honoapi'ilani Highway (Highway 30)/Waiko Road
6. Wai`ale Road/Waiko Road

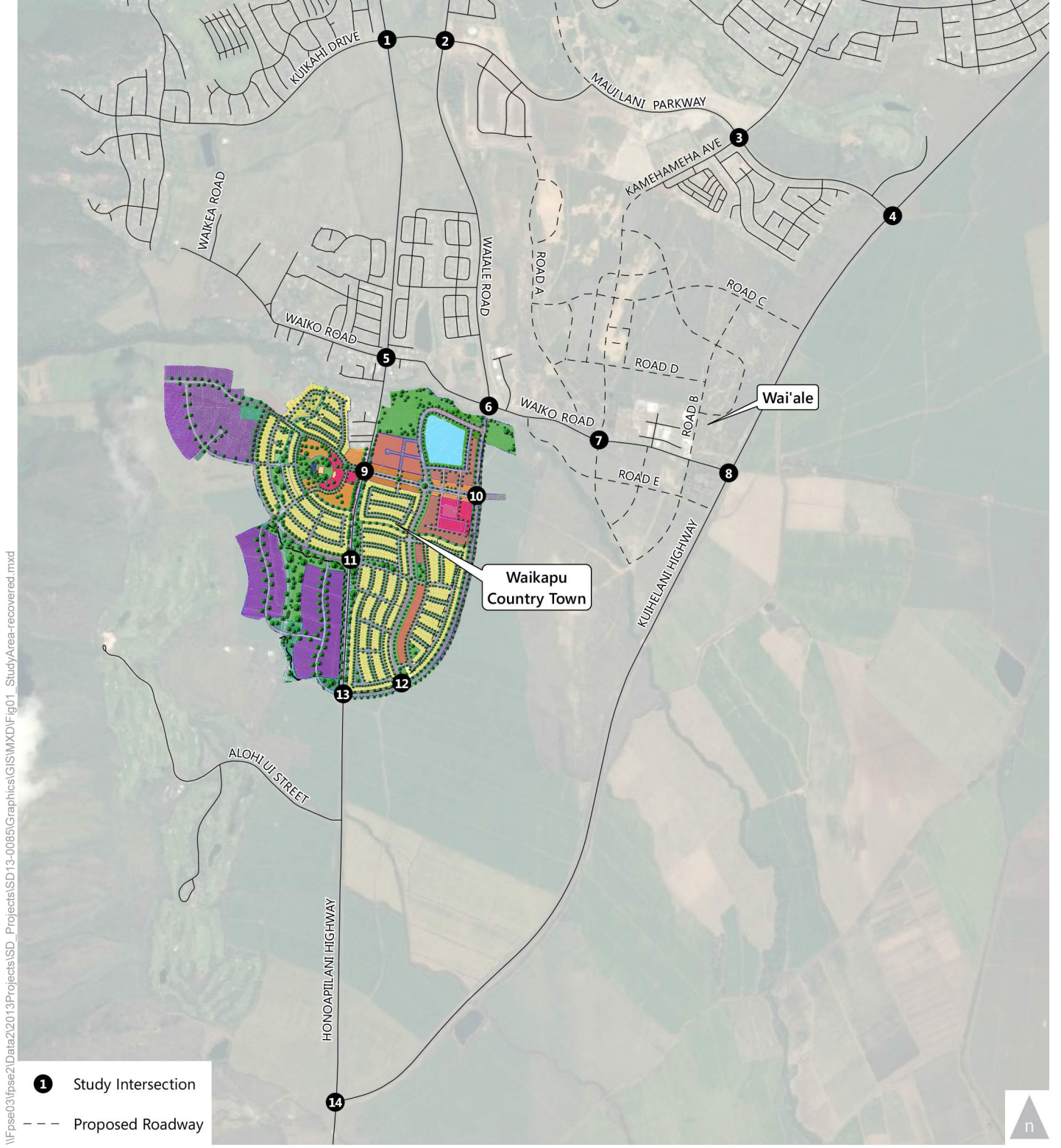


Figure 44:
Study Area and Analyzed Intersections

*7. S. Kamehameha Avenue/Waiko Road**

8. Kūihelani Highway (Highway 380)/Waiko Road

*9. Honoapi'ilani Highway (Highway 30)/Main Street**

*10. Wai`ale Road/Main Street**

*11. Honoapi'ilani Highway/East-West Residential Street**

*12. North-South Residential Street/ Wai`ale Road**

13. Honoapi'ilani Highway (Highway 30)*/Wai`ale Road**

14. Honoapi'ilani Highway (Highway 30)/Kūihelani Highway (Highway 380)

**Future intersection*

Existing Levels of Service (LOS)

The TIAR evaluated operations of the eight existing study intersections during weekday morning (6:00 to 9:00 AM) and evening (3:00 to 6:00 PM) peak-period conditions. Traffic counts were collected during the weekday AM and PM peak periods at the study intersections in September 2013, when local schools were in session. Existing lane configurations and signal controls were obtained through field observations. Figure 3, A-B of the TIAR (Append I) presents the existing AM and PM peak-hour turning movement volumes, corresponding lane configurations and traffic control devices. Traffic count data sheets are provided in Appendix A of the TIAR. Existing peak-hour volumes and lane configurations were used to calculate levels of service for each of the study intersections. The results of the existing LOS analysis are presented in Table 44 ~~39~~ and the corresponding LOS calculation sheets are included in Appendix B of the TIAR.

Table 44 ~~39~~: Existing Intersection Level of Service

Existing Intersection Level-of-Service				
Intersection	**Traffic Control**	**Peak Hour**	**Delay (sec/veh)1**	**LOS2,3**
1. Honoapi'ilani Highway (Highway 30) / Kuikahi Drive	Signalized	AM PM	25.2 23.3	C C
2. Wai`ale Road / Kuikahi Drive	Signalized	AM PM	26.4 24.7	C C
3. S. Kamehameha Avenue / Maui Lani Parkway	AWSC	AM PM	48.3 54.4	E F
4. Kūihelani Highway / Maui Lani Parkway	Signalized	AM	21.4	C

		PM	21.9	C
5. Honoapi'ilani Highway (Highway 30) / Waiko Road	Signalized	AM PM	13.3 11.9	B B
6. Wai`ale Road / Waiko Road	SSSC	AM PM	12.4 10.9	B B
7. S. Kamehameha Avenue / Waiko Road4	N/A	AM PM	Does not exist	
8. Kūihelani Highway (Highway 380) / Waiko Road	Signalized	AM PM	14.5 11.2	B B
9. Honoapi'ilani Highway (Highway 30) / Main Street4	N/A	AM PM	Does not exist	
10. Wai`ale Road / Main Street4	N/A	AM PM	Does not exist	
11. Honoapi'ilani Highway / East-West Residential Street4	N/A	AM PM	Does not exist	
12. North-South Residential Street / Wai`ale Road4	SSSC	AM PM	Does not exist	
13. Honoapi'ilani Highway (Highway 30) / Wai`ale Road4	N/A	AM PM	Does not exist	
14. Honoapi'ilani Highway (Highway 30) / Kūihelani Highway (Highway 380)	Signalized	AM PM	15.2 12.4	B B
Source: Fehr & Peers, 2014.				
Notes:				
** Indicated oversaturated conditions. Delay cannot be calculated				
AWSC = All-way stop-controlled intersection				
SSSC = Side-street stop-controlled intersection				
1 Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized and all-way stop-controlled intersections. The vehicular delay for the worst movement is reported for side street stop-controlled intersections.				
2 LOS calculations performed using the *2000 Highway Capacity Manual (HCM)* method.				
3 Undesirable LOS highlighted in bold. 4 Future intersection				

The results of the LOS calculations indicate that all of the existing study intersections operate at an overall acceptable service level (LOS D or better), with the exception of the following location:

- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway. This intersection operates at LOS E – AM peak hour and LOS F – PM peak hour. The poor operating conditions result from the all-way stop-control and high eastbound and westbound volumes traversing through a shared left/through/right configuration. This contributes to the relatively high eastbound and westbound approach delays and overall poor operating peak levels of service at this intersection.

Potential Impacts and Mitigation Measures. Refer to Appendix I, "Traffic Impact Analysis Report", for a complete presentation of the TIAR. To evaluate the potential impact of traffic generated by the proposed project on the surrounding street system, the TIAR developed estimates of future traffic conditions in the area both with and without the project. Future traffic conditions without the proposed project reflect traffic increases due to general regional growth and development, as well as traffic increases generated by other specific developments near the project site. These conditions are referred to as the cumulative base condition (i.e., no project conditions). The sum of the cumulative base and project-generated traffic represents the cumulative plus project conditions. Tables 43 ~~38~~ and 44 ~~39~~ document the LOS conditions for post project conditions in 2022 and 2026. The TIAR identifies counter measures to mitigate the Project's traffic impacts.

2022 Post Phase I LOS Conditions

As shown in Table 45 ~~40~~, the proposed project will contribute to cumulative impacts (LOS E or F conditions) during one or both peak hours at five study intersections:

- Intersection 1: Honoapi'ilani Highway (Highway 30) & Kuikahi Drive will operate at LOS F during the AM peak hour.
- Intersection 2: Wai`ale Road & Kuikahi Drive will operate at LOS F during the AM peak hour and LOS E during the PM peak hour.
- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway will operate at LOS F during the AM peak hour and PM peak hour.
- Intersection 4: Kūihelani Highway (Highway 380) & Maui Lani Parkway will operate at LOS F during the AM peak hour and LOS E during the PM peak hour.
- Intersection 7: S. Kamehameha Avenue & Waiko Road will operate at LOS F during the AM peak hour and PM peak hour.

In addition, a project-specific impact has been identified at Intersection 1: Honoapi'ilani Highway & Kuikahi Drive during the PM peak hour. At Intersection 1, the addition of project-generated traffic would cause the overall intersection operations to degrade from LOS D to LOS E.

2026 Post Phase II LOS Conditions

Table 45: Year 2022 Levels of Service – Phase I

Intersection	Traffic Control	Peak Hour	Year 2022 No Project Conditions		Year 2022 with Partial Development (Phase 1) Conditions		Delay Change	Mitigation Required?	Mitigated to:			
			Del/Veh1	LOS2,3	Del/Veh1	LOS2,3			Pre-Project or Better Conditions (≤ LOS D)		LOS D or Better Conditions	
									Del/Veh1	LOS2,3	Del/Veh1	LOS2,3
1. Honoapiilani Highway / Kuikahi Drive	Signal	AM	67.3	**E**	92.5	**F**	25.2	**YES**	43.2	D	Same as Pre-Project Mitigation	
		PM	38.6	D	66.1	**E**	27.5	**YES**	35.2	D		
2. Waiale Road / Kuikahi Drive	Signal	AM	73.5	**E**	108.2	**F**	34.7	**YES**	61.9	**E**	39.8	D
		PM	48.6	D	73.6	**E**	25.0	**YES**	34.8	C	31.3	C
3. S. Kamehameha Avenue / Maui Lani Parkway6	AWSC	AM	> 180	**F**	> 180	**F**	**	**YES**	131.5	**F**	30.5	C
		PM	> 180	**F**	> 180	**F**	**	**YES**	133.1	**F**	36.0	D
4. Kuihelani Highway / Maui Lani Parkway	Signal	AM	78.0	**E**	101.6	**F**	23.6	**YES**	22.7	C	Same as Pre-Project Mitigation	
		PM	57.9	**E**	79.9	**E**	22.0	**YES**	26.4	C		
5. Honoapiilani Highway / Waiko Road	Signal	AM	18.6	B	34.5	C	15.9	NO	No Mitigation Required			
		PM	17.5	B	29.8	C	12.3	NO				
6. Waiale Road / Waiko Road4,9	Signal	AM	8.1	A	8.8	A	0.7	NO	No Mitigation Required			
		PM	7.3	A	7.5	A	0.2	NO				
7. S. Kamehameha Avenue / Waiko Road6,7	SSSC	AM	> 180	**F**	> 180	**F**	**	**YES**	8.1	A	Same as Pre-Project Mitigation	
		PM	169.9	**F**	> 180	**F**	**	**YES**	7.4	A		
8. Kuihelani Highway / Waiko Road	Signal	AM	38.7	D	43.2	D	4.5	NO	No Mitigation Required			
		PM	17.9	B	18.6	B	0.7	NO				
9. Honoapiilani Highway / Main Street5,8	Signal	AM	Only built with project		9.0	A	9.0	NO	No Mitigation Required			
		AM			10.4	B	10.4	NO				
10. Waiale Road / Main Street5	Roundabout	AM	Only built with project		6.6	A	6.6	NO	No Mitigation Required			
		PM			7.1	A	7.1	NO				
11. Honoapiilani Highway / East-West Residential Street	N/A	AM	Only built with Phase 2 of project									
		PM										
12. North-South Residential Street /Waiale Road	N/A	AM	Only built with Phase 2 of project									
		PM										
13. Honoapiilani Highway / Waiale Road9	Signal	AM	5.9	A	7.4	A	1.5	NO	No Mitigation Required			
		PM	12.9	B	17.9	B	5.0	NO				
14. Honoapiilani Highway / Kuihelani Highway	Signal	AM	22.2	C	23.1	C	0.9	NO	No Mitigation Required			
		PM	20.3	C	22.2	C	1.9	NO				

Source: Fehr & Peers, 2014

** Indicated oversaturated conditions. Delay cannot be calculated.

AWSC = All-way stop-controlled intersection

SSSC = Side-street stop-controlled intersection

1 Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized and all-way stop-controlled intersections. The vehicular delay for the worst movement is reported for side street stop-controlled intersections.

2 LOS calculations performed using the 2000 Highway Capacity Manual (HCM) method.

3 Unacceptable LOS highlighted in **bold.**

4 With the construction of the Waiale Bypass under future conditions, the intersection will include a fourth (south) leg and is assumed to be signalized.

5 Intersection provides access to the project site.

6 The proposed mitigation measure at this location is signalization and the delay and LOS displayed under this condition is based on the average control delay for the intersection as a whole.

7 Intersection is or is assumed to be controlled by stop signs on the minor approach(es).

8 The project intersection is assumed to be signalized in 2022.

9 Intersection assumed to be signalized as part of the Waiale Bypass project.

Table 46: Year 2026 Levels of Service – Phases I and 2

Intersection	Traffic Control	Peak Hour	Year 2026 No Project Conditions		Year 2026 with Phase 1 & 2 Conditions		Delay Change	Mitigation Required?	Mitigated to:			
			Del/Veh1	LOS2,3	Del/Veh1	LOS2,3			Pre-Project or Better Conditions (≤ LOS D)		LOS D or Better Conditions	
									Del/Veh1	LOS2,3	Del/Veh1	LOS2,3
1. Honoapiilani Highway / Kuikahi Drive	Signal	AM	75.3	**E**	111.1	**F**	35.8	**YES**	50.3	D	Same as Pre-Project Mitigation	
		PM	46.3	D	77.0	**E**	30.7	**YES**	37.7	D		
2. Waiale Road / Kuikahi Drive	Signal	AM	87.8	**F**	149.2	**F**	61.4	**YES**	81.8	**F**	46.6	D
		PM	55.3	**E**	99.4	**F**	44.1	**YES**	41.5	D	33.3	C
3. S. Kamehameha Avenue / Maui Lani Parkway 6	AWSC	AM	> 180	**F**	> 180	**F**	**	**YES**	> 180	**F**	30.2	C
		PM	> 180	**F**	> 180	**F**	**	**YES**	167.9	**F**	19.4	B
4. Kuihelani Highway / Maui Lani Parkway	Signal	AM	105.0	**F**	139.5	**F**	34.5	**YES**	27.2	C	Same as Pre-Project Mitigation	
		PM	75.9	**E**	100.1	**F**	24.2	**YES**	31.2	C		
5. Honoapiilani Highway / Waiko Road	Signal	AM	18.6	B	46.9	D	28.3	NO	No Mitigation Required			
		PM	18.5	B	37.8	D	19.3	NO				
6. Waiale Road / Waiko Road4,9	Signal	AM	9.0	A	15.0	B	6.0	NO	No Mitigation Required			
		PM	7.5	A	8.9	A	1.4	NO				
7. S. Kamehameha Avenue / Waiko Road6,7	SSSC	AM	**	**F**	**	**F**	**	**YES**	10.1	B	Same as Pre-Project Mitigation	
		PM	> 180	**F**	**	**F**	**	**YES**	8.1	A		
8. Kuihelani Highway / Waiko Road	Signal	AM	41.6	D	58.2	**E**	16.6	**YES**	25.2	C	Same as Pre-Project Mitigation	
		PM	17.1	B	19.7	B	2.6	NO	15.6	B		
9. Honoapiilani Highway / Main Street5,8	Signal	AM	Only built with project		9.8	A	9.8	NO	No Mitigation Required			
		AM			11.6	B	11.6	NO				
10. Waiale Road / Main Street5	Roundabout	AM	Only built with project		9.9	A	9.9	NO	No Mitigation Required			
		PM			10.3	B	10.3	NO				
11. Honoapiilani Highway / East-West Residential Street	Signal	AM	Only built with project		8.3	A	8.3	NO	No Mitigation Required			
		PM			6.1	A	6.1	NO				
12. North-South Residential Street /Waiale Road	SSSC	AM	Only built with project		17.4	C	17.4	NO	No Mitigation Required			
		PM			19.2	C	19.2	NO				
13. Honoapiilani Highway / Waiale Road9	Signal	AM	6.0	A	12.9	B	6.9	NO	No Mitigation Required			
		PM	15.5	B	30.2	C	14.7	NO				
14. Honoapiilani Highway / Kuihelani Highway	Signal	AM	22.5	C	24.0	C	1.5	NO	No Mitigation Required			
		PM	22.4	C	25.2	C	2.8	NO				

Source: Fehr & Peers, 2014

Notes:

** Indicated oversaturated conditions. Delay cannot be calculated. AWSC = All-way stop-controlled intersection; sssc = Side-street stop-controlled intersection.

1 Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized and all-way stop-controlled intersections. The vehicular delay for the worst movement is reported for side street stop-controlled intersections.

2 LOS calculations performed using the 2000 Highway Capacity Manual (HCM) method.

3 Unacceptable LOS highlighted in **bold.**

4 With the construction of the Waiale Bypass under future conditions, the intersection will include a fourth (south) leg and is assumed to be signalized.

5 Intersection provides access to the project site.

6 The proposed mitigation measure at this location is signalization and the delay and LOS displayed under this condition is based on the average control delay for the intersection as a whole.

7 Intersection is or is assumed to be controlled by stop signs on the minor approach(es).

8 The project intersection is assumed to be signalized in 2022.

9 Intersection assumed to be signalized as part of the Waiale Bypass project.

As shown in Table 46 ~~41~~, the proposed project would contribute to cumulative impacts (LOS E or F conditions) during one or both peak hours at six study intersections:

- Intersection 1: Honoapi'ilani Highway (Highway 30) & Kuikahi Drive will operate at LOS F during the AM peak hour.
- Intersection 2: Wai`ale Road & Kuikahi Drive will operate at LOS F during the AM peak hour and PM peak hour.
- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway will operate at LOS F during the AM peak hour and PM peak hour.
- Intersection 4: Kūihelani Highway (Highway 380) & Maui Lani Parkway will operate at LOS F during the AM peak hour and PM peak hour.
- Intersection 7: S. Kamehameha Avenue & Waiko Road will operate at LOS F during the AM peak hour and PM peak hour.

In addition, project-specific impacts have been identified at intersections where the addition of project-generated traffic would cause their overall intersection operations to degrade below LOS D in the peak hours. The project-related impacts identified are:

- Intersection 1: Honoapi'ilani Highway (Highway 30) & Kuikahi Drive, which would experience a cumulative and project-specific impact.
- Intersection 8: Kūihelani Highway (Highway 380) & Waiko Road which would operate at LOS E during the AM peak hour.

Potential Traffic Improvements to Mitigate Project Impacts

Potential traffic improvements were developed to increase the capacity and/or efficiency of the roadway system at the locations where the addition of project-related traffic would cause or contribute to poor operating conditions. The emphasis was to identify physical and/or operational improvements that could be implemented within the existing or planned roadway rights-of-way. The potential intersection improvement measures are illustrated in Appendix L ~~I~~ of the TIAR (See Appendix I). Tables 43 ~~38~~ and 44 ~~39~~ summarize the projected LOS in 2022/2026 at the impacted locations with these proposed measures in place.

With implementation of the proposed improvements, each of the identified impacts would be reduced such that future operations would be at the minimum desired LOS (LOS D) for the overall intersection with the project in place. Although HDOT also strives to maintain LOS D or better conditions at the movement level, measures to improve turning movement conditions would only be proposed where feasible and appropriate from a traffic engineering perspective since adding lanes just to achieve the desired LOS for a particular movement also has secondary negative impacts to the environment and to active transportation modes.

Moreover, the scope of corresponding improvements for this type of mitigation process can be well beyond the project's actual impact, and could effectively eliminate existing or cumulative deficiencies, which should not be the project's responsibility consistent with State of Hawai'i law.

Therefore, in addition to developing improvements that will result in LOS D or better operations, measures that only return operations to pre-project levels have also been identified (i.e., under Year 2022 No Project Conditions and Year 2026 No Project Conditions). This is especially important where the addition of project traffic alone would not degrade operations below LOS D, but would contribute to projected poor levels of service caused by the addition of traffic from other cumulative developments (e.g., Pu'unani Residences, Wai`ale Development, etc.).

The full-range of improvements that address both project-related and/or cumulative traffic impacts for each impacted intersection is discussed in detail in the TIAR (See Appendix L ~~I~~). The following only describes the specific improvements that are proposed to be fully addressed by the WCT.

Proposed Project Improvements

WCT improvements are proposed at intersections identified as significantly impacted under Year 2026 with Project Conditions. In the past, development projects would make a fair share financial contribution for each mitigation measure to the appropriate governing agency (i.e., the County or HDOT). However, providing just partial funds for a variety of different improvements does not ensure construction of any individual improvement.

More recently, HDOT has indicated a preference for development projects like WCT to fully design and build improvements at a select set of locations to ensure their implementation. Accordingly, a mitigation program for WCT was developed that would require construction of improvements at intersections closer to the project site where the project contributes to, but does not directly cause a significant impact. Note that the mitigation program described below is a preliminary recommendation based on project proximity to intersections and without planning level cost estimates. As such, it is subject to change as the planning process continues.

The project proposes to fully fund mitigation measures that would return operations to pre-project levels at the following intersections:

- **Intersection 1: Honoapi`ilani Highway & Kuikahi Drive**

  The impact at Intersection 1 could be reduced by widening the westbound approach from a shared through/left- turn lane and right-turn lane to a left-turn lane, a through lane, and a right-turn lane, and widening the southbound approach from a left-turn lane, a through lane, and a right-turn lane to two left-turn lanes, a through lane, and a right-turn lane. Additionally, to complement the addition of a second southbound left-turn lane, the east leg would need to be widened to provide a second departure lane and the northbound and southbound left-turn phasing would need to be converted to protected left turns. This improvement would result in LOS D operations, and no other measure is feasible that would only mitigate the operations to pre-project levels.

  Although the measures described above would improve the Year 2022 AM and PM peak hour impacts at the overall intersection level, half of the left-turn movements are projected to continue to operate at LOS E or F in both peak hours. The volumes and V/C ratios for the left-turn movements are as follows:

  - AM Peak Hour
    - Westbound: single left-turn lane with 330 vehicles and a V/C ratio of 1.09
    - Southbound: dual left-turn lanes with 440 vehicles and a V/C ratio of 0.98
  - PM Peak Hour
    - Westbound: single left-turn lane with 384 vehicles and a V/C ratio of 0.98
    - Southbound: dual left-turn lanes with 370 vehicles and a V/C ratio of 0.94

- **Intersection 8: Kūihelani Highway & Waiko Road**

  The impact at Intersection 8 could be reduced by widening and restriping the eastbound approach to provide a left-turn lane and a right-turn lane. No changes are proposed to the signal timing. No other improvement is feasible that would only mitigate operations to pre-project levels.

  The measure described above would improve the Year 2026 PM peak hour impact so that the overall intersection and intersection movements or approaches would operate at acceptable LOS D or better. For the Year 2026 AM peak hour impacts, however, the measure would only mitigate the impact at the overall intersection level. During the AM peak hour, the northbound left-turn movement is projected to operate at LOS E with 90 vehicles and a V/C ratio of 0.80. Based on HCM provisions for double left-turn lanes, the northbound left-turn movement does not warrant the provision of a second left-turn lane from a volume standpoint and the V/C ratio is within the acceptable range. Therefore, no further improvements are proposed for this approach.

- **Intersection 13: Honoapi'ilani Highway & Wai`ale Road**

  Although this intersection is not significantly impacted under Year 2026 with Project Conditions, the project may also be responsible for funding intersection improvements necessary to provide access to the project site (i.e., a fourth/west leg).

For the remaining impacted intersections listed below, it is assumed that other development projects adjacent or in closer proximity to these impacted locations would be responsible for implementing the necessary intersection improvements as described in the TIAR (Appendix L ~~I~~).

- Intersection 2: Wai`ale Road & Kuikahi Drive
- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway
- Intersection 4: Kūihelani Highway & Maui Lani Parkway
- Intersection 7: S. Kamehameha Avenue & Waiko Road

Mitigation Funding

For a project such as WCT that will be constructed in phases over an extended period of time, it is appropriate to identify the proposed project's share for the cost of the intersection

improvements. Fair-share calculations for developer contributions were made for the intersections impacted by project-generated traffic. The estimates were developed by calculating the increase in traffic volumes from existing conditions to the Year 2026 with Project conditions. The increase establishes the total amount of projected growth at each location. Next, the WCT project-only volumes are divided by the total volume increase at each impacted intersection. This step determines the amount of traffic that the WCT project is contributing to the intersection and the approximate proportional contribution towards funding each potential proposed improvement.

The fair share calculations were performed for both the AM and PM peak hours, as shown in Table 45 ~~40~~, Year 2026 Fair Share Intersection Traffic Contribution. For all but one location, the range of maximum project contribution is between 15.4% and 33.8%. At one location, the calculated maximum fair share does not accurately reflect the cause of the impacts at the intersection (i.e., the WCT causes the intersections to degrade from LOS D or better to LOS E or F). Based on the intersection analysis, the impact at Intersection 8, Kūihelani Highway & Waiko Road, is project- specific (rather than a cumulative impact to which the project would make a fair-share contribution), and therefore WCT should make a 100% contribution at this location. As noted, while the project's fair-share contributions and the planning-level cost estimates for each element of the recommended mitigation program has not yet been finalized, the project proposes to fully fund mitigation measures as described above.

No Wai'ale Bypass Mitigation Analysis

When preparing the TIAR, the Applicant assumed that the Wai'ale Bypass would be constructed by 2022. This assumption was predicated upon extensive pre-consultation with the County Department of Public Works (DPW) as well as review of the Final Environmental Assessment prepared for the Wai'ale Road Extension and East Waiko Road Improvements, and review of the County's 2016 6-year Capital Improvement Program, which had included funding for the improvement. However, in response to the DEIS, DPW informed the Applicant by letter dated May 23, 2016 (**See**: Appendix S, DEIS Agency and Community Comment and Response Letters) that the timing of the Wai'ale Bypass is uncertain and that the Applicant should assume that the roadway may not be constructed.

Table 47: Year 2026 Project Fair Share Intersection Traffic Contribution

	AM Peak Hour					PM Peak Hour					
Impacted Intersection	Existing Traffic	2026 Projected Traffic	Total New Traffic	Project Only Traffic	Project % of New Traffic	Existing Traffic	2026 Projected Traffic	Total New Traffic	Project Only Traffic	Project % of New Traffic	Maximum Contribution
1. Honoapiilani Highway/ Kuikahi Drive **	2,073	3,238	318	1,156	27.3%	1,928	3,184	424	1,256	33.8%	33.8%
2. Waiale Road/Kuikahi Drive*	1,935	3,786	436	1,851	23.6%	1,849	3,627	507	1,778	28.5%	28.5%
3. S. Kamehameha Avenue / Maui Lani Parkway**	1,700	3,428	298	1,728	17.2%	1,593	3,173	353	1,580	22.3%	22.3%
4. Kuihelani Highway / Maui Lani Parkway**	1,856	4,013	273	2,157	12.7%	2,011	4,150	330	2,139	15.4%	15.4%
5. S. Kamehameha Avenue / Waiko Road*	0	1,709	229	1,709	13.4%	0	1,629	289	1,929	17.7%	17.7%
6. Kuihelani Highway/Waiko Road**	1,336	2,258	105	949	11.1%	1,407	2,242	122	835	14.6%	**100%1/**

Source: Fehr & Peers, 2014
*County of Maui jurisdiction
**State HDOT jurisdiction
1/ Based on Table 17, the impact of the intersection is directly attributable to the project. Therefore, the maximum contribution is assumed for this intersection.

As such, the Applicant contracted with Fehr and Peers to conduct an analysis of the Project's traffic impacts at full buildout in 2026 without the Wai'ale Bypass Road. Fehr & Peers completed the analysis in October 2016 (**See**: Exhibit M, Fehr & Peers Memorandum dated October 17, 2016).

Fehr & Peers estimates of the future traffic conditions were derived using the Maui Travel Demand Forecasting Model. Particularly, the same 2026 model developed for the TIAR; however, the Wai'ale Bypass (north of the intersection of the Project's planned north-south residential [Study Intersection #12]) was excluded from the roadway network. A comparison of the 2026 No Project peak hour volumes with and without the Wai'ale Bypass showed that the traffic projected to use the Wai'ale Bypass would shift to use Honoapi'ilani Highway and Kuihelani Highway.

Using the same trip generation and overall trip distribution pattern presented in the TIAR, the project trips were assigned to the 2026 roadway network without the bypass. The trip assignment differs from the TIAR as trips to/from land uses on the makai side that were originally using Wai'ale Road were re-routed to use the site's internal roadways (i.e., Main Street, E-W Residential Road, and N-S Residential Road) and Honoapi'ilani Highway. The Project generated traffic volumes were then added to the 2026 base traffic projection to develop 2026 with Project traffic forecasts for the no-bypass scenario.

The intersection operations analysis compares the projected levels of service at each study intersection under cumulative conditions for 2026 with and without the proposed project and without the Wai'ale Bypass to determine the potential impacts. Results of this analysis are presented in Table 48. The Project would contribute to cumulative impacts (LOS E or LOS F conditions) during one or both of the peak hours at the seven study intersections. In addition, project-specific impacts have been identified at intersections where the addition of project-generated traffic would cause their overall intersection operations to degrade below LOS D in one or both peak hours. The project-related impacts identified are:

- Intersection 1: Honoapi'ilani Highway & Kuikahi Drive (cumulative and project-specific impact)
- Intersection 2: Wai'ale Road & Kuikahi Drive (cumulative and project-specific impact)

Table 48: Traffic Impact With and Without the Project and Without the Wai`ale Bypass

Intersection	Traffic Control	Peak Hour	Year 2026 No Project, No Bypass Conditions		Year 2026 with Project Without Bypass Conditions		Delay Change	Mitigation Required?	Impacted in the DEIS?	Mitigated to: Pre-Project or Better Conditions (≤ LOS D)		Mitigated to: LOS D or Better Conditions	
			Del/Veh[1]	LOS[2,3]	Del/Veh[1]	LOS[2,3]				Del/Veh[1]	LOS[2,3]	Del/Veh[1]	LOS[2,3]
1. Honoapi'ilani Highway & Kuikahi Drive	Signal	AM	85.5	**F**	116.5	**F**	31.0	**YES**	**YES**	51.2	D	Same as Pre-Project Mitigation	
		PM	35.1	D	86.2	**F**	51.1	**YES**	**YES**	37.7	D		
2. Waiale Road & Kuikahi Drive	Signal	AM	62.1	**E**	86.7	**F**	24.6	**YES**	**YES**	46.7	D	Same as Pre-Project Mitigation	
		PM	51.0	D	85.4	**F**	34.4	**YES**	**YES**	36.4	D		
3. S. Kamehameha Avenue & Maui Lani Parkway	Roundabout	AM	> 180	**F**	> 180	**F**	**	**YES**	**YES**	167.4[4]	**F**[4]	23.8	C
		PM	> 180	**F**	> 180	**F**	**	**YES**	**YES**	163.4[4]	**F**[4]	15.7	B
4. Kuihelani Highway & Maui Lani Parkway	Signal	AM	112.0	**F**	125.5	**F**	13.5	**YES**	**YES**	25.8	C	Same as Pre-Project Mitigation	
		PM	86.4	**F**	92.8	**F**	6.4	**YES**	**YES**	33.4	C		
5. Honoapi'ilani Highway & Waiko Road	Signal	AM	40.6	D	> 180	**F**	**	**YES**	NO	33.3	C	Same as Pre-Project Mitigation	
		PM	22.8	C	156.0	**F**	133.2	**YES**	NO	51.3	D		
6. Waiale Road & Waiko Road	SSSC	AM	> 180	**F**	>180	**F**	**	**YES**	NO	23.9	C	Same as Pre-Project Mitigation	
		PM	48.5	**E**	>180	**F**	**	**YES**	NO	16.3	B		
7. S. Kamehameha Avenue & Waiko Road	SSSC	AM	> 180	**F**	**	**F**	**	**YES**	**YES**	10.9	B	Same as Pre-Project Mitigation	
		PM	80.1	**F**	**	**F**	**	**YES**	**YES**	8.3	A		
8. Kuihelani Highway & Waiko Road	Signal	AM	70.5	**E**	113.1	**F**	42.6	**YES**	**YES**	32.3	C	Same as Pre-Project Mitigation	
		PM	21.0	C	26.6	C	5.6	NO	NO	18.6	B		
9. Honoapi'ilani Highway & Main Street	Signal	AM	Only built with project		46.3	D	46.3	NO	NO	No Mitigation Required			
		AM			44.9	D	44.9	NO	NO				
10. Waiale Road & Main Street	Roundabout	AM	Does not exist without the Waiale Bypass										
		PM											
11. Honoapi'ilani Highway & East-West Residential Street	Signal	AM	Only built with project		13.1	B	13.1	NO	NO	No Mitigation Required			
		PM			9.2	A	9.2	NO	NO				
12. North-South Residential Street & Waiale Road	SSSC	AM	Only built with project		8.9	A	8.9	NO	NO	No Mitigation Required			
		PM			8.6	A	8.6	NO	NO				
13. Honoapi'ilani Highway & Waiale Road	SSSC	AM	Only built with project		>180	F	>180	**YES**	NO	14.9	B	Same as Pre-Project Mitigation	
		PM			>180	F	>180	**YES**	NO	9.7	A		
14. Honoapi'ilani Highway & Kuihelani Highway	Signal	AM	21.3	C	22.8	C	1.5	NO	NO	No Mitigation Required			
		PM	23.4	C	26.7	C	3.3	NO	NO				

Source: Fehr & Peers, 2016

Notes:

** Indicated oversaturated conditions. Delay cannot be calculated. AWSC = All-way stop-controlled intersection; SSSC = Side-street stop-controlled intersection.

[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized and all-way stop control intersections. The vehicular delay for the worst movement is reported for side street stop-controlled intersections.

[2] LOS calculations performed using the 2000 Highway Capacity Manual (HCM) method.

[3] Unacceptable LOS highlighted in **bold.**

[4] The mitigation needed to have the intersection operate better than pre-project conditions is installing signal control and having the existing intersection configuration (i.e., a shared left/through/right lane on the eastbound and westbound approaches and a left-turn lane and a shared through/right-turn lane on the northbound and southbound approaches) in place.

- Intersection 5: Honoapi'ilani Highway & Waiko Road (LOS F in the AM and PM peak hour)
- The results of the no-bypass analysis shows that Intersection 5: Honoapi'ilani Highway & Waiko Road and Intersection 6: Wai'ale Road & Waiko Road are new impacts not identified in the in the December 2014 TIAR. Additionally, when comparing these results to the 2026 intersection operations analysis results presented in the TIAR, the impact type at the following locations change:
- Intersection 2: Wai'ale Road & Kuikahi Drive would also have a project-specific impact in the PM peak hour.
- Intersection 8: Kuihelani Highway & Waiko Road would be identified as a cumulative impact instead of a project-specific impact under the 2026 with Project without Bypass Condition.
- Intersection 13: Honoapi'ilani Highway & Wai'ale Road would have a project-specific impact in the AM and PM peak hours.

Potential Traffic Improvements

Physical mitigation measures developed in the in the December 2014 TIAR were first applied to the impacted locations and others were investigated as necessary. The emphasis was to identify physical and/or operational improvements that could be implemented within the existing or planned roadway rights-of-way. Table 48 summarizes the projected LOS in 2026 at the impacted locations with these proposed measures in place.

While three more study intersections would be significantly impacted under this scenario than in the "with Bypass" scenario analyzed in the December 2014 TIAR, LOS D can be achieved at the impacted locations with an expanded program of roadway improvements as mitigation. The full range of improvements that address both project-related and/or cumulative traffic impacts are discussed in detail below.

Intersection 1: Honoapi`ilani Highway & Kuikahi Drive – The mitigation presented in the TIAR is not sufficient to mitigate the impact under the no-bypass scenario. Thus, the impact at this intersection could be reduced by widening the northbound approach from a left-turn lane, a through lane, and a right-turn to a left-turn lane, a through lane, and two right-turn lanes,

widening the southbound approach from a left-turn lane, a through lane, and a right-turn lane to two left-turn lanes, a through lane, and a right-turn lane, and widening the westbound approach from a left-turn lane, a through lane, and a right-turn lane to two left-turn lanes, a through lane, and two right-turn lanes. Additionally, to complement the addition of a second southbound left- turn lane and a second westbound left-turn lane, the east and south legs of the intersection would each need to be widened to provide a second departure lane. Signal modifications at this intersection would include protected phasing on all approaches and right-turn overlap phasing on the westbound and northbound approaches. Additional right-of-way would be needed on both Honoapi'ilani Highway and on Kuikahi Drive to fully implement this improvement, which would result in LOS D operations at an overall intersection level.

Intersection 2: Wai'ale Road & Kuikahi Drive – The impact at this intersection could be mitigated using a reduced version of the improvements proposed in the TIAR for this location. The improvements needed to mitigate the impacts identified under the no-bypass scenario include widening the eastbound and westbound approaches to provide a left-turn lane, two through lanes, and a right-turn lane. To complement the widening of the eastbound and westbound approaches, both the eastbound and westbound departures would also need to be widened to each provide a second receiving lane. This improvement would result in LOS D operations at an overall intersection level.

Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway – The impact at this intersection could be mitigated by implementing the improvements presented in the TIAR, which is signalization of the intersection and maintaining the existing lane configuration (i.e., a shared left/through/right lane on the eastbound and westbound approaches and a left-turn lane and a shared through/right-turn lane on the northbound and southbound approaches). It should be noted, however, that the updated 2026 No Project Condition now assumes that the intersection would be configured as a single-lane roundabout.

As discussed in the TIAR, the pre-project improvement is install a traffic control signal with permitted phasing at all approaches. For LOS D or better operations at an overall intersection level, not only would a traffic signal need to be installed, but the eastbound and northbound approaches would need to provide a left-turn lane and a shared through/right-turn lane and the

westbound and southbound approaches to provide a left-turn lane, a through lane, and a right-turn lane.

Intersection 4: Kuihelani Highway & Maui Lani Parkway – The impact at this intersection could be mitigated by implementing the improvements presented in the TIAR, which is to widen the eastbound approach to provide a left-turn lane, a shared through/left-turn lane, and a right-turn lane. In addition to the change in configuration, the eastbound and westbound left-turn phasing would need to be modified to split phasing. This improvement would result in LOS D operations at an overall intersection level.

Intersection 5: Honoapi`ilani Highway & Waiko Road – This intersection is a new impact not previously identified in the TIAR. Thus, the impact at this intersection could be reduced by widening the northbound approach from a left-turn lane and a shared through/right-turn lane to provide a left-turn lane, a through lane, and a shared through/right-turn lane, and widening the eastbound and westbound approaches to provide a left-turn lane and a shared through/right- turn lane. The northbound departure of the highway would require widening for a minimum of approximately 250 feet to provide a second receiving lane, which would transition back into the existing single northbound lane. Additional right-of-way may be needed on both Honoapi'ilani Drive and Waiko Road to fully implement this improvement, which would result in LOS D operations at an overall intersection level.

Intersection 6: Wai'ale Road & Waiko Road – The impact at this intersection is a new impact not previously identified in the TIAR. It could be mitigated with the installation of a traffic signal, which was assumed to be in place in the Cumulative, pre-project condition in the TIAR due to its key location on the planned Wai'ale Bypass. This improvement would result in LOS D operations at an overall intersection level and the turning movement level.

Intersection 7: S. Kamehameha Avenue & Waiko Road – The impact at this intersection could be mitigated using the improvement presented in the TIAR, which is installing a traffic signal with permitted phasing at all approaches. This improvement would result in LOS D or better operations at both the overall intersection level and the turning movement level.

Intersection 8: Kuihelani Highway & Waiko Road – The impact at this intersection could be mitigated using the improvement presented in the TIAR, which is widening and restriping the eastbound approach to provide a left-turn lane and a right-turn lane. This improvement would result in LOS D or better operations at an overall intersection level.

Intersection 13: Honoapi'ilani Highway & Wai'ale Road – The impact at this intersection is a new impact not previously identified in the TIAR. It could be mitigated with the installation of a traffic signal, which was assumed to be in place in the Cumulative, pre-project condition in the TIAR due to its key location on the planned Wai'ale Bypass. This improvement would result in LOS D or better operations at an overall intersection level and the turning movement level.

Construction Phase Traffic Mitigation

During the construction phase operating conditions along Honoapi'ilani Highway could be impacted by heavy equipment and other construction vehicles turning into and existing from the Project site. To address this concern, the Applicant will prepare and implement a construction phase traffic management plan to ensure safe vehicular ingress and egress from the Honoapi'ilani Highway.

2. Electric, Telephone and Cable TV

Existing Conditions. Electric, telephone and cable TV service for the MTP is brought in underground from the overhead utilities along Honoapi'ilani Highway. There is an existing overhead 69 kv utility line which traverses through the property along the Waihe'e Ditch.

Potential Impacts and Mitigation Measures. Electric, telephone and cable TV service will be provided by the existing facilities in the area. The project's electrical engineering consultant will coordinate the required improvements with the utility companies to determine the required onsite and offsite improvements to support the project. If approved by MECO, it is anticipated that the power poles will be relocated underground fronting the project site along Honoapi'ilani Highway. Within the WCT, utility poles will be placed underground within the road right-of-way. It is expected that the project will create a total demand of about 10 megawatts of electricity. The WCT intends to promote the use of renewable energy. The installation of photovoltaic systems will be encouraged on residential and commercial buildings. If forty

percent of residential and commercial buildings install photovoltaic systems (generating approximately 11.9 GWh per year), demand for carbon-based fuels could be reduced by roughly 50 percent. Moreover, the WCT desires to install a limited number of solar farms in appropriate locations within the agricultural lands. If two solar farms of approximately 5-acres (0.75 MW each) each are developed, the electricity generated would be about 2.6 GWh per year, which could service approximately 236 residential units. Thus, the WCT could potentially generate about 70 percent of its energy consumption through renewables. However, the installation of such systems will depend upon the technical and financial viability of such systems at the time the project is being constructed.

3. Drainage

Existing Conditions. A Preliminary Engineering and Drainage Report was prepared by Otomo Engineering. The report analyzes current conditions, including drainage patterns, existing improvements, and runoff totals (**See**: Appendix H, "Preliminary Engineering and Drainage Report). The following summarizes existing drainage conditions on the property.

Figure No. 45 ~~40~~ shows existing drainage pattern across the project site. Onsite runoff generally sheet flows in a west to east direction. Currently there are seven (7) diversion berms along the upper most portion of the mauka site, which intercept surface runoff and divert it into Waikapū Stream. The diversion berms were constructed when the lot was used for pineapple cultivation. These lands will not be developed and will remain in agricultural use and the berms will remain in place and function as they are presently doing. The berms are protected by various grasses and weeds, which help to maintain a low runoff velocity as well as filter sediments that are carried by the runoff. Based on a 50-year, 1-hour storm, the existing diversion berms intercept approximately 140,509 cubic feet of storm runoff and divert it into Waikapū Stream. These diversion berms prevent runoff from sheet flowing into the proposed development areas. In addition, some existing runoff sheet flows into the Waiheʻe Ditch, which traverses along the western boundary of T.M.K.: (2) 3-6-005: 007. The ditch flows in a southerly direction toward Māʻalaea and supplies water to existing agricultural reservoirs.

Runoff from the areas below the existing diversion berms generally sheet flows in a west to east direction toward Honoapi'ilani Highway. There are several small culverts that divert runoff

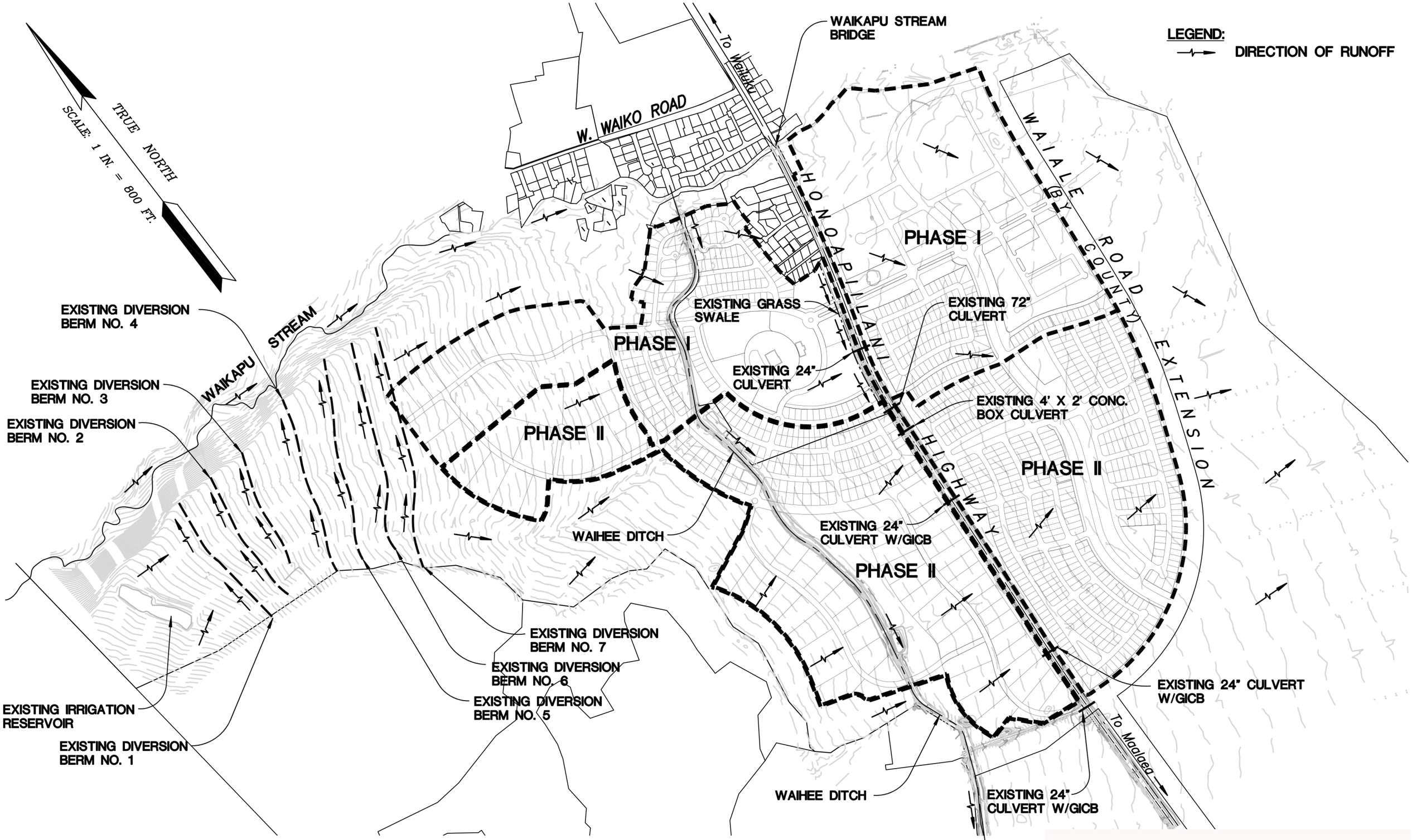


Figure 45:
Existing Drainage Pattern

across Honoapi'ilani Highway and discharges it into the existing cane fields on the makai side of the highway.

There is an existing grass swale traversing across the MTP site parallel to Honoapi'ilani Highway from the northeast corner of the project site to approximately 1,000 feet south of the project driveway. Runoff sheet flowing across the mauka side of the project site is captured by the grass swale and diverted in a southerly direction and across Honoapi'ilani Highway by the existing 72-inch culvert located 1,000 feet to the south of the project driveway. Runoff within the grass swale is conveyed across the project driveway by a 30-inch culvert. The estimated existing 100-year, 24-hour storm runoff from the Phase I and Phase II project sites mauka and makai of Honoapi'ilani Highway are shown in Table Nos. 49 ~~43~~ and 50 ~~44~~.

Table 49 ~~43~~: Phase I Existing Runoff from Mauka and Makai Project Sites

Phase I Existing Runoff from Mauka and Makai Project Sites		
Phase I	Existing Runoff (CFS)	Runoff Volume (CF)
Mauka	452	2,418,629
Makai	373	2,133,808

Table 50 ~~44~~: Phase II Existing Runoff from Mauka and Makai Project Sites

Phase II Existing Runoff from Mauka and Makai Project Sites		
Phase II	Existing Runoff (CFS)	Runoff Volume (CF)
Mauka	447	2,916,206
Makai	361	2,062,681

Presently, onsite runoff sheet flows across the project site in a west to east direction, across Honoapi'ilani Highway and into the existing sugar cane fields towards Kūihelani Highway and eventually discharges into Keālia Pond in North Kīhei.

Potential Impacts and Mitigation Measures. The Drainage Report analyzes anticipated changes in stormwater runoff and identifies improvements necessary to comply with County drainage requirements. In general, the drainage design criteria are to minimize any alteration to the

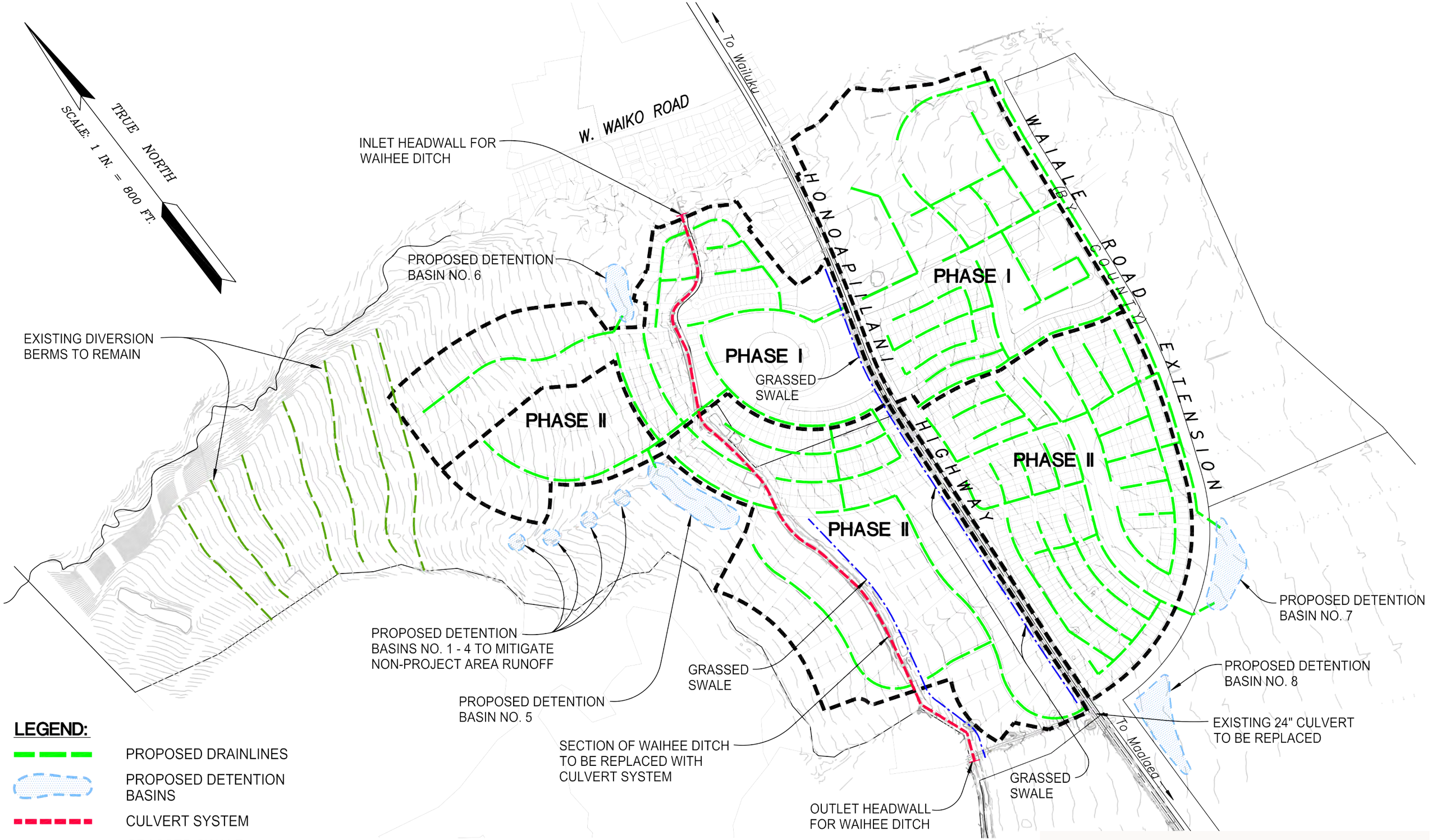


Figure 46:
Proposed Drainage System Improvements

existing drainage patterns and volumes. Figure No. 46 ~~41~~ identifies the proposed drainage system improvements. The system will accommodate the increase in runoff generated by the project. Table Nos. 51 ~~45~~ and 52 ~~46~~ compare pre- and post-development runoff conditions.

Table 51 ~~45~~: Phase I Pre- and Post-Development Runoff from Mauka and Makai Project Sites

Phase I Pre- and Post-Development from Mauka and Makai Project Sites						
Phase I	Pre-Development Runoff (CFS)	Pre-Development Runoff (CF)	Post Development Runoff (CFS)	Post Development Runoff (CF)	Increase (CFS)	Increase (CF)
Mauka	452	2,418,629	497	2,567,545	45	148,916
Makai	373	2,133,808	639 ~~634~~	2,905,771	261	771,963

Table 52 ~~46~~: Phase II Pre- and Post-Development from Mauka and Makai Project Sites

Phase II Pre- and Post-Development from Mauka and Makai Project Sites						
Phase II	Pre-Development Runoff (CFS)	Pre-Development Runoff (CF)	Post Development Runoff (CFS)	Post Development Runoff (CF)	Increase (CFS)	Increase (CF)
Mauka	447	2,916,206	507	3,131,436	60	215,230
Makai	361	2,062,681	506	2,454,808	145	392,127

The drainage system will be designed to accommodate the increase in surface runoff volume from a 100-year, 24-hour storm created by the project and the volume required to meet the post construction water quality standards. In addition to the detention basins, large grassed swales will be constructed within the open space areas to divert runoff to designated outlets. The drainage plan includes the development of eight detention basins, which are shown on Figure No. 46 ~~41~~ and described in the Preliminary Engineering and Drainage Report in Appendix H.

In accordance with the County's *"Rules for the Design of Storm Drainage Facilities",* the Phase I development mauka of Honoapi'ilani Highway will be required to mitigate an increase in runoff of 45 cfs and provide a minimum storage volume of 148,916 cubic feet and the Phase I

development makai of Honoapi'ilani Highway will be required to mitigate an increase in runoff of 266 cfs and provide a minimum storage volume of 771,963 cubic feet.

The Phase II development mauka of Honoapi'ilani Highway will be required to mitigate an increase in runoff of 60 cfs and provide a minimum storage volume of 215,230 cubic feet. Phase II makai of Honoapi'ilani Highway will be required to mitigate an increase in runoff of 145 cfs and provide a minimum storage volume of 392,124 cubic feet.

After the development of the proposed project, there will be no change in the volume of runoff diverted to Waikapū Stream from the upper agricultural preservation area. The existing diversion berms will continue to divert runoff from the areas mauka of the project site into Waikapū Stream.

In accordance with the County's *"Rules for the Design of Storm Water Treatment Best Management Practices",* the design of the stormwater system will include water quality treatment to reduce the discharge of pollutants to the maximum extent practicable. Some examples of stormwater best management practices (BMP) are:

Grassed Swales will be implemented within the landscaped areas where practical. Grass and groundcover provides natural filtration and allows for percolation into the underlying soils.

Open Space and Parks will be maintained with grass or other landscape materials, thereby reducing the amount of impervious surfaces which promotes infiltration.

Stormwater Detention serves to collect stormwater allowing some of the suspended solids to settle out. The stored runoff will infiltrate into the underlying soils and recharge groundwater.
In accordance with the County's *"Rules for the Design of Storm Drainage Facilities",* the design of the drainage systems with retention basins shall be based on the following design conditions:

> *"In areas where the existing drainage systems are inadequate, the existing system shall be upgraded to handle runoff from the new project area or a new system shall be provided to connect to an adequate outlet. When there is no existing drainage system or adequate outlet to connect to, the additional runoff*

generated by the development may be retained on-site in a temporary retention basin with the following design conditions:

A. Storage volume of an infiltration basin, infiltration trench piping, or retention basin shall equal at least the total additional runoff volume for the appropriate storm intensity.

B. Soil percolation shall not be used in satisfying required storage volumes.

C. Fifty percent (50%) of voids within the rock envelope for subsurface drains may be used in satisfying required storage volume provided that filter fabric is installed around the pipe and at the interface of the rock envelope and soil.

D. Sumps, detention and retention facilities will remain private.

E. Detention or retention ponds with embankment heights equal to or in excess of 50 acre-feet shall conform to all state and federal requirements relative to dams".

Runoff from Agricultural Lands into the Waikapū Stream. The Applicant is working with Waikapū community stakeholders to address concerns regarding stormwater runoff from the agricultural lands that may be contributing to sedimentation of the Waikapū Stream. The implementation of on-site low impact development techniques (LID's) may help to mitigate these concerns. LID's that may be feasible along the upper reaches of the Waikapū Stream include: 1) a landscaped buffer and or riparian zone adjacent to the stream that is planted with vegetation to promote filtration and infiltration; 2) grass swales; and 3) bio-retention systems. All of these techniques are proven to promote infiltration and filtration of groundwater.

Post-Construction Water Quality Goals and Standards. The Project's drainage system will be designed to meet the County's drainage and water quality standards. The project will also be required to comply with Ordinance 3902, which requires subdivisions to comply with Section 18.20.130 Post Construction Storm Water Quality Best Management Practices of the Maui County Code. The criteria for sizing of storm water quality facilities are:

"(a) The criteria can be met by:

(1) Either detaining storm water for a length of time that allows storm water pollutants to settle (detention treatment from such methods as extended detention wet and dry ponds, created wetlands, vaults/tanks, etc.);

(2) By use of filtration or infiltration methods (flow-through based treatment from such methods as sand filters, grass swales, other media filters, and infiltration);

(3) Short-term detention can be utilized with a flow-through based treatment system (e.g., a detention pond designed to meter flows through a swale of filter) to meet the criteria; or

(4) Upstream flow-through treatment and detention treatment can be utilized.

(b) Other proposals to satisfy the water quality criteria may be approved by the director if the proposal is accompanied by a certification and appropriate supporting material from a civil engineer, licensed in the State of Hawai'i, that verifies compliance with one of the following (by performance or design):

(1) After construction has been completed and the site is permanently stabilized, reduce the average annual total suspended solid ("TSS") loadings by eighty percent. For the purposes of this measure, an eighty percent TSS is to be determined on an average annual basis for the two-year/twenty-four hour storm.

(2) Reduce the post development loadings of TSS so that the average annual TSS loadings are no greater than predevelopment loadings."

BMPs will consist of grassed swales and retention basins sized adequately to promote infiltration and filter pollutants to meet water quality standards. Other Low Impact Development Techniques (LID's) will also be explored to help reduce runoff volumes, promote infiltration and filtration of groundwater. Some of these measures may include promoting rain gardens, the use of rain barrels, developing green roofs, and use of permeable paving surfaces, where appropriate, within residential, commercial, and institutional developments. The Applicant will also explore the opportunity of utilizing bio-retention swales with native plantings at appropriate locations within the street network to reduce and filter stormwater runoff and to take advantage of natural drainage for irrigation.

A maintenance plan will also be developed for the stormwater BMPs. The plan will include the requirements for removal of the accumulated debris and sediment, maintaining vegetation, and performing inspections to insure that the BMPs are functioning properly.

Temporary erosion control measures will be incorporated during the construction period to minimize dust and soil erosion. Additional controls will be implemented to protect Waikapū Stream. Temporary BMPs include the construction of diversion berms and swales, dust fences, silt fences, stabilized construction entrances, truck wash down areas, inlet protection, temporary grassing of graded areas, and slope protection. Additional construction phase BMP's will include: preventing toxic substances such as oil, fuel, cement products from leaching into the water; avoiding application of fertilizers and biocides during periods of rainfall; and stabilizing denuded areas by sodding or planting as soon as possible.

Water trucks and temporary sprinkler systems will be used to minimize dust generated from the graded areas. A National Pollution Discharge Elimination System (NPDES) permit will be required by the Department of Health prior to approval of the grading permit.

The drainage design criteria will be to minimize any alterations to the drainage pattern of the existing onsite surface runoff. No additional runoff will be allowed to sheet flow toward Keālia Pond.

4. Water

Existing Conditions. The Preliminary Engineering Report documents existing sources of water and infrastructure improvements that service the property (**See**: Appendix H, "Preliminary Engineering and Drainage Report).

Water service in the vicinity of the project site is provided by the County's water system consisting of a 12-inch waterline from the 300,000 gallon tank near the mauka terminus of Waiko Road. The storage tank is at an elevation of 764 feet.

The existing 12-inch waterline crosses Honoapi'ilani Highway and terminates to the east of Waikapū town in the vicinity of the industrial area. A 4-inch waterline connects to the 12-inch

waterline on Honoapi'ilani Highway and traverses in a southerly direction and ends near the northerly boundary of the MTP. The MTP site is currently being serviced by two 5/8-inch water meters located at the northeast corner of the mauka property.

Fire protection for the MTP is presently provided by a private system consisting of a gravity fire line from the existing lagoon located immediately to the west of the MTP restaurant. Non-potable water from the lagoon is fed to fire pumps located on the exterior of the existing buildings and supplies water to the fire sprinkler systems in the buildings. There are also fire hydrants located on the grounds of the MTP. However, the fire hydrants may not have adequate pressure and capacity.

Potential Impacts and Mitigation Measures. The Preliminary Engineering Report (Appendix H) analyzes anticipated increases in water demand and proposes improvements to meet the projected demand. Water and fire protection for the project will be provided from a private onsite water system (**See**: Figure 47 ~~42~~, "Private Water System"). The private water system is being designed in accordance with the Department of Water Supply's rules and standards in order to allow it to be dedicated by the Applicant to the County at a future undetermined date. Since the facility it will be operated as a private system, it will be subject to State of Hawai'i, Department of Health water quality standards. The County of Maui's Department of Water Supply has been consulted on several occasions regarding the Project's proposed private water system. In responding to the Applicant's DEIS the Department stated the following:

> *"A private water system will be utilized for the entire development. Our Department has no jurisdiction to impose requirements over subdivisions served by water systems that are not owned and operated by the County. Please note that any proposal to dedicate this water system to the County should reference compliance with the department's rules and regulations, the Maui County Code, and Water System Standards in the FEIS."*

The County of Maui's Department of Water Supply is in the process of updating the Maui Island Water Use and Development Plan and is aware of the details of the Applicant's proposed private water system.

TRUE NORTH

SCALE: 1 IN. = 800 FT.

WELL NO. 5
(NON-POTABLE)

MONITORING WELL

W. WAIKO ROAD

To Wailuku

WELL NO. 4
(NON-POTABLE)

HONOAPILANI HIGHWAY

WAILEY ROAD (COUNTY) EXTENSION

PHASE I

PHASE II

PHASE I

PHASE II

WELL NO. 3
(POTABLE)

WELL NO. 2
(POTABLE)

STORAGE TANK(S)
1.1 MG TOTAL

WELL NO. 1
(POTABLE)

To Maalaea

LEGEND:

- 8" WATERLINE
- 12" WATERLINE
- 16" WATERLINE

Figure 47, A:
Private Potable Water System Improvements

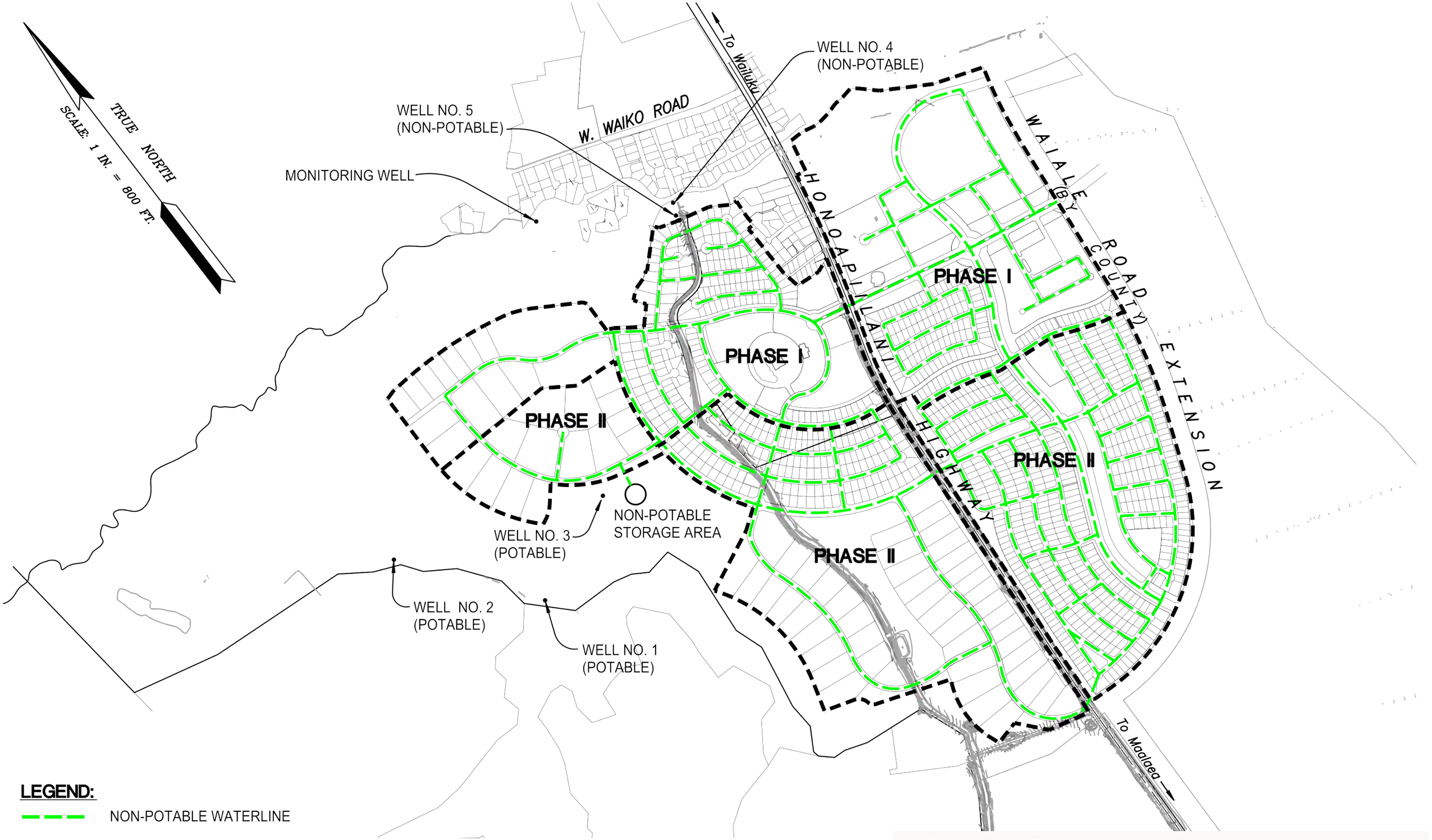


Figure 47, B:
Proposed Non-Potable Water System Improvements

~~Five (5) wells have been drilled on the site. Three (3) wells have been designated for potable use and two (2) for non-potable purposes. All of the wells are located within the Waikapū Aquifer. The three potable water wells have been approved by the State of Hawai'i, Commission on Water Resource Management for a total pumping capacity of 2,300 gallons per minute (gpm). Water pumped from the non-potable wells will be discharged into the Waihe'e Ditch or lined onsite reservoirs and used for irrigation purposes for the residential lots, agricultural farming, parks and open areas.~~

Six (6) wells have been drilled on the site. Waikapū Country Town Well No. 1 (State Well No. 5030-01) was drilled at a ground elevation of approximately 654 feet above mean sea level (MSL) and will be used as a potable water source. It has a rated capacity of 500 gpm. Waikapū Country Town Well No. 2 (State Well No. 5131-02) was drilled at a ground elevation of approximately 778 feet above MSL and will be used as a potable water source. It has a rated capacity of 700 gpm. Waikapū Country Town Well No. 3 (State Well No. 5131-04) was drilled at a ground elevation of approximately 523 feet above MSL and will be used as a potable water source. It has a rated capacity of 1,000 gpm.

A 10-day pump test was conducted from April 26, 2016 to May 6, 2016 for Potable Wells 1, 2 and 3 by Water Resource Associates (WRA). The results of the pump test at each well were:

Well 1 was pumped at a constant rate of 972 gpm (1.39 mgd) for 10 days for a total pumpage of 13,600,000 gallons. The chloride content varied from 41 mg/L to 47 mg/L (potable water limit is 250 mg/l). WRA suggested that Well 1 is capable of yielding 1.4 mgd with a static water level of 8.5 feet above mean sea level.

Well 2 was pumped at a constant rate of 720 gpm (1.03 mgd) for 10 days for a total pumpage of 10,238,400 gallons. The chloride content decreased from 132 mg/L to 100 mg/L. WRA suggested that Well 2 is capable of yielding 1.0 mgd with a static water level of 15.0 feet above mean sea level.

Well 3 was pumped at a constant rate of 747 gpm (1.07 mgd) for 10 days for a total pumpage of 10,487,8800 gallons. The chloride content varied from 25 mg/L to 109 mg/L. WRA suggested

that the sustainable capacity of Well 3 is less than 700 gpd, despite a static water level of 8.5 feet abovemean sea level. They recommended further testing at lower pumping rates and drawdowns to assess Well 3's sustainable pumping capacity with regard to chlorides.

The WRA report stated the following regarding water quality:

> *"The water quality parameter which is of most concern during a pumping test is chloride because it is an easily determined indicator of salt water intrusion. The potable water limit for chloride content is 250 mg/L, which indicates that Well 1 produces the freshest water at approximately 40 mg/L, followed close behind by basalt Well 2 at approximately 100 mg/L and alluvial Well 3 varying between 25 and 109 gm/L. In addition to the frequent tests for chlorides, representative water samples were carefully collected from Wells 1, 2 and 3 for testing by Eurofins Analytical, an approved lab, in accordance with the requirements of the Hawai'i Department of Health for new potable water sources. The results indicate that all three wells are capable of producing potable water of excellent quality. The chlorides are low and the tested inorganic constituents are well within the Federal maximum contaminant levels (MCL) of public water systems. Further, all volatile and non-volatile organic contaminants and pesticides analyzed were non-detectable."*

Two non-potable water wells were drilled as designated as Waikapū Country Town Wells No. 4 (State Well No. 5130-03) and No. 5 (State Well No. 5130-04). Well No. 4 was drilled at a ground elevation of approximately 459 feet above MSL and Well No. 5 was drilled at a ground elevation of approximately 482 feet above MSL. The capacity of Well No. 4 is 500 gpm and 650 gpm for Well No. 5. Both wells have preliminarily shown low salinity levels, and testing is being conducted to determine the viability of those wells for domestic use. If not viable for domestic use, it will be used for non-potable agricultural use. Water pumped from the non-potable wells will be discharged into the Waihee Ditch or lined onsite reservoirs and used for irrigation purposes for the residential lots, agricultural farming, parks and open areas. Well No. 6 is a monitoring well.

The estimated water demand for the project was determined from the Department of Water Supply's Water System Standards (DWSWSS), dated 2002, as follows:

Table 53 ~~47~~: Department of Water Supply Water System Standards, 2002

Department of Water Supply Water System Standards, 2002	
Use	Gallons per Day (GPD)
Single-Family	600 gallons per day (gpd) per unit
Rural Residential	1,000 gpd/unit
Multi-Family	560 gpd/unit
Country Town Mixed-Use (Dwelling)	560 gpd/unit dwelling
Country Town Mixed-Use (Commercial)	140 gallons/1,000 s.f.
Commercial/Employment	140 gallons/1,000 sq. ft.
Parks and Open Space	1,700 gallons/acre
School	1,700 gallons/acre

The Department of Water Supply (DWS) does not have water demand standards for a dual water system (both potable and non-potable). However, in discussions with the DWS, it was determined that the DWSWSS standards could be conservatively reduced by one-third if a dual water system was used for a project. Table 54 ~~48~~ identifies the estimated water demand for the project based on the use of a duel water system.

Table 54 ~~48~~: Estimated Demand for Potable Water Using a Dual Water System

Department of Water Supply Water System Standards, 2002	
Use	Gallons per Day (GPD)
Single-Family	400 gallons per day (gpd) per unit
Rural Residential	667 gpd/unit
Multi-Family	373 gpd/unit
Country Town Mixed-Use (Dwelling)	373 gpd/unit dwelling
Country Town Mixed-Use (Commercial)	93 gallons/1,000 s.f.
Commercial/Employment	93 gallons/1,000 sq. ft.

Department of Water Supply Water System Standards, 2002	
Parks and Open Space	0 gallons/acre
School	1,300 gallons/acre

Based on the water usage, the projected average daily water demand for Phase I is 311,033 gpd. In accordance with the DWSWSS, the maximum daily water demand is calculated as being 1.5 times the average daily demand, or 466,650. Based on the school and commercial uses, the maximum fire demand is 2,000 gpm (See Appendix B of the Preliminary Engineering and Drainage Report (~~DEIS~~ FEIS Appendix H) for Water Demand Calculations). The projected average daily water demand for Phase II is 334,475 gpd and the maximum daily water demand 501,713 gpd. Irrigation of parks and open spaces, including landscaping of residential and commercial lots, will be provided by the non-potable water system.

The maximum daily potable water demand for the entire Project, not including irrigation of urban open space and agricultural lands, is estimated to be 968,363 gallons per day (gpd), whereas the Waikapū Aquifer has a sustainable yield of 3 million gpd. Before drawing ground water from the Aquifer, a permit will be required from the Commission on Water Resource Management (CWRM) which has regulatory jurisdiction over the aquifer. The CWRM will ensure that the use of the aquifer will not exceed its sustainable yield.

Water conservation measures, such as low-flow toilets and shower heads, will be utilized throughout the Project, which will further decrease water demand. As noted, irrigation of the parks and open space will be from the non-potable water source, which will also decrease potable water demand.

The reservoir capacity is based on the DWSWSS Criterion 1 for Reservoir Capacity. Based on this criterion, the required storage volume for the two phases is 968,363 gallons. It is recommended that a 1.0 million gallon reservoir be constructed to accommodate the two phases of the project. As an alternative, the developer could construct two storage reservoirs, each with a storage volume of 0.50 million gallons. Each 0.50 million gallon reservoir could be constructed at the beginning of each phase. The two reservoir option would allow the second reservoir to be

constructed as the demand increases and allow for more flexibility during maintenance and repair should one of the reservoirs have to be taken out of service.

The 1.0 million gallons of water storage will be constructed mauka of Well No. 5 at an elevation of approximately 800 feet MSL. This will allow for the entire project to be serviced by gravity flow from the reservoir(s).

The Applicant will also implement the following well head protection BMP's, pursuant to the Department of Water Supply's comment letter dated June 20, 2016 (See Appendix S, DEIS Agency and Community Comment and Response Letters) in order to prevent pollutants from impacting the quality of the ground water aquifer:

- Inspect exposed parts of the well periodically for problems such as: cracked or corroded well casing, broken or missing well cap, damage to protective casing, settling and cracking of protective seals.
- Ensure that the area around the well is sloped so that the surface runoff drains away from the well.
- Provide a well cap or sanitary seal to prevent unauthorized use of or entry into the well.
- Provide for sediment removal or well cleaning as necessary.
- Have the well tested once a year for fecal coliform or other constituents that may be of concern.
- Keep accurate records of any well maintenance, such as disinfection or sediment removal, that might require use of chemicals in the well.
- Mixing or using pesticides, fertilizers, herbicides, degreasers, fuels, or other pollutants near the well is to be avoided.
- Do not locate any potentially polluting activity within 1000 feet of the well for well head protection.

Non-potable Water Demand and Proposed Supply

Irrigation of the Project's agricultural lands will be from surface water from the Iao Stream via the Iao-Waikapū Ditch and Waikapū Stream via the South Waikapū Ditch and Waihee Ditch,

which are operated by the Wailuku Water Company. This system has historically provided irrigation water to WCT's agricultural lands, which were used to grow kalo and other canoe crops and then later sugarcane and pineapple. These water sources, which are part of the larger surface water system known as the "Nā Wai 'Ehā", have been designated by the CWRM as a Surface Water Management Area. Before drawing water from the Nā Wai 'Ehā, surface water use permits will be required from the CWRM, which has regulatory jurisdiction over this Surface Water Management Area. The Applicant filed surface water permits with the CWRM in February 2016 for irrigation of TMK Numbers (2) 3-6-005:007, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-006:036. With the closure of HC&S and its announcement to the CWRM in July 2016 that it would not seek a surface water use permit from the CWRM for its Iao-Waikapū fields, the Applicant filed a request with the CWRM in July 2016 to be allowed to pursue the surface water use permit in lieu of HC&S. HC&S's Iao-Waikapū fields include the following parcels owned by the Applicant: TMK Number (2) 3-6-002:001 and TMK Number (2) 3-6-2:002:003.

In addition to Ditch water, the Applicant proposes agricultural wells to produce non-potable water that will be stored in agricultural reservoirs and also used for irrigation. The use of the agricultural wells will require a ground water use permit from the CWRM since the water would be drawn from the Waikapū Aquifer, which has been designated by the CWRM as a Ground Water Management Area. The agricultural wells would be pumped from the alluvial aquifer, whereas the potable wells would be drawing from the basalt aquifer. However, further testing is required to determine the interdependence of these two aquifers and if pumping from the alluvial aquifer would impact the sustainable yield from the basalt aquifer.

An additional source of non-potable irrigation water will be recycled wastewater from WCT's wastewater reclamation facility. At full build-out of the WCT development, the wastewater reclamation facility is expected to be able to generate approximately 650,000 gallons per day of reclaimed water. R-1 quality recycled water may be used for landscape and agricultural irrigation via spray, surface drip or subsurface drip irrigation. Table 53 ~~47~~ documents the potential supply of non-potable water versus the Project's potential demand for irrigation of its urban landscape planting areas and agricultural lands.

As is shown in Table 55, it is expected that sufficient non-potable irrigation water should be available to irrigate the agricultural lands as well as the urban and rural open space lands. Ground water from the Waikapū Aquifer and surface water the Nā Wai ʻEhā are managed and regulated by the CWRM, which should ensure that these resources are used sustainably and in a manner that is consistent with the Hawaiʻi State Plan and its Functional Plans.

Table 55: Estimated Demand for Non-Potable Water Irrigation Water

Non-Potable Water Source	Estimated Historical Supply in MGD	Estimated Future Supply in MGD	Estimated WCT Demand in MGD	Surplus / Deficit in MGD
Ditch Water[25]	5.82[26]	5.82		
Pumped Well Water	N/A	Unknown		
Reclaimed Wastewater	N/A	.650		
TOTAL	5.82	6.47	3.42[27]	+3.05

The Applicant intends to establish a private water company to manage, operate, and maintain its water and wastewater systems. The private water company will be responsible for the WCT's on-site non-potable and agricultural irrigation water sources, storage and distribution systems.

5. Wastewater

A Preliminary Engineering Report was prepared for the ~~DEIS~~ FEIS that assesses current wastewater system capacity and existing infrastructure to support the Project (**See**: Appendix,

[25] WCT's future use of ground water from the Iao and Waikapū Streams will require the issuance of a Surface Water Use Permit from the Commission on Water Resources Management. These permit requests have been filed but not yet issued.

[26] Based upon a water duty of 5408 gallons per acre per day (GAD) multiplied by WCT's 1077 acres of agricultural land. In the Nā Wai ʻEhā IIFS proceedings, the Commission on Water Resources Management determined that this was a reasonable daily water use requirement for sugarcane cultivation.

[27] Assumes a demand for 2.75 mgd to irrigate 1077 acres of agricultural lands based upon a water duty of 3400 GAD for diversified agriculture. This is the application rate used by the State Department of Agriculture for diversified crops. The estimate assumes that 75 percent of the crop land is being irrigated at any given time (1077*.75)*3,400 ≈ 2.75 MGD. Urban open space demand for non-potable irrigation water is estimated to be about 0.67 mgd.

H, "Preliminary Engineering Report"). In addition to the Preliminary Engineering Report, two wastewater reports were prepared to assist the Client with future planning and development of a private wastewater reclamation facility. Enviniti LLC conducted an analysis of a conventional wastewater reclamation facility. The Enviniti study identifies regulatory and design requirements for the planning, design, construction, operation, and maintenance of such a facility. The Enviniti study also documents the Project's projected wastewater generation and provides order of magnitude cost estimates for the facility (**See**: Appendix J). Mana Water LLC, in association with Kennedy/Jenks Consultants, prepared a wastewater report for a facility based on Organica's Food Chain Reactor (FCR) treatment technology. Organica was established in 1988 and is an international leader in utilizing Fixed-Bed Biofilm Activated Sludge (FBAS) technology for wastewater treatment. In a plant using FCR technology, as water flows from one reactor to the other it passes through different ecologies. These ecologies are comprised of plants and other natural microorganisms that break down the wastewater components using the nutrients as food. The sub-ecosystems utilized in an FCR system provide for enhanced removal efficiency while utilizing less energy and producing less sludge than a conventional treatment plant. The Mana Water and Kennedy Jenks report provides the following documentation:

- Projected wastewater flow from the Project;
- Estimated volume of recycled water generated by the facility at build-out;
- Estimated order of magnitude construction and operating costs for the facility;
- Facility operating revenues versus facility costs;
- Advantages of FCR facilities over more conventional treatment facilities;
- Conceptual site plan; and
- Conceptual architectural rendering. (**See**: Appendix K).

The Applicant conducted an analysis of wastewater treatment alternatives to determine the preferred method of treating the Project's wastewater (**See**: Chapter VIII of the FEIS). Based upon the analysis, it was determined that the preferred method of wastewater treatment is to construct a private wastewater reclamation facility within the subject property. The preferred wastewater treatment technology is Organica's FCR system. The Project's wastewater treatment plan is described in detail in Section III.B.8 of the FEIS).

Existing Conditions. The existing MTP is serviced by a private sewer system which connects to the County's sewer system on Waiko Road near Waikapū Town. The system is owned and maintained by the MTP. The system consists of a 6-inch sewerline and manholes from the existing buildings, crossing Honoapi'ilani Highway, to a sewer pump station located approximately 500 feet east of Honoapi'ilani Highway. A 4-inch forcemain conveys the wastewater from the sewer pump station through the cane fields, across Waikapū Stream, up to Waiko Road where it connects to a sewer manhole on Waiko Road east of Waikapū town. There is an 8-inch gravity sewerline from the existing sewer manhole which connects to a County-owned sewer manhole east of Waikapū Town.

The County's sewer system traverses from the manhole on Waiko Road through the Waikapū Gardens Subdivision, through privately owned properties, onto Wai`ale Road, down Lower Main Street and discharges into the Wailuku Sewer Pump Station near the intersection of Kahului Beach Road, Lower Main Street and Waiehu Beach Road. Sewer collected at the Wailuku Sewer Pump Station is pumped to the Kahului Wastewater Reclamation Facility (KWRF) in Kanahā.

According to the Wastewater Reclamation Division, County of Maui, as of July 31, 2014, the KWRF has a capacity of 7.9 million gallons per day (mgd). The average flow into the KWRF is 4.7 mgd and the allocated capacity is 6.33 mgd. The remaining wastewater capacity at the KWRF is approximately 1.57 mgd. In response to the Project's January 2016 DEIS, the Wastewater Reclamation Division notified the Applicant in its April 13, 2016 comment letter that the KWWRF does not have the capacity to accept flows from outside the current service area and that the collection system is unable to accept flows from the development without significant upgrades. The Division also stated that the Applicant shall work with the County and area developers to complete a master plan for a regional treatment solution and shall contribute its fair share towards its implementation (**See**: DEM letter dated April 13, 2016 and Applicant response dated October 25, 2016 in Appendix S, DEIS Agency and Community Comment and Response Letters).

Potential Impacts and Mitigation Measures. ~~In a letter dated July 16, 2013 (See Appendix I), the Department of Environmental Management (DEM) notes that the Kahului Wastewater Reclamation Facility, as of June 30, 2013, has capacity allocation remaining for approximately 1.11 mgd (3,000 dwelling units) and 0.54 mgd for other supportive uses to issue building~~

~~permits. The Department notes that most of this capacity is necessary to accommodate existing entitled projects at Kehalani, Waiolani Mauka, Waikapū Gardens Multi-Family and Maui Lani. The Department further notes that in order for the existing collection system to accept flows from the WCT, the following transmission system improvements will be required:~~

~~Table 49-43: Required Off-site Wastewater Transmission System Improvements~~

~~Required off-site Wastewater Transmission System Improvements~~		
~~Location~~	~~Description~~	~~No. Units Accommodated~~
~~Lower Main Street~~	~~Upgrade existing gravity sewer line in Lower Main Street from 12-inch to 15-inch. This segment stretches from ʻĀinahou Place to Hala Place (Manholes KA2OGE0100 to KA20GB0510) and is approximately 1,950 linear feet.~~	~~200~~
~~Waiko Road; Wailuku Pump Station~~	~~Upgrade approximately 2,750 linear feet of the 8-inch main trunk line from the force main daylight manhole in Waiko Road through Waikapū Gardens to 12-inch;~~ ~~Upsize the final two pipe segments prior to the Wailuku Pump station from 24-inch to 36-inch, which is approximately 150 linear feet with a major bypass operation.~~	~~450~~
~~TOTAL UNITS~~		~~650~~

~~The DEM further states that adding additional WCT residential units beyond 650 would require further analysis to determine the extent of Lower Main Street improvements.~~

~~The policy of the DEM is that wastewater capacity cannot be reserved until the project is ready to receive building permits. If capacity at the KWRF is available at the time building permits are ready to be issued for the project, the project proposes to temporarily connect to the County's sewer system and complete the upgrades to connect up to 650 units in the phase I development.~~

~~The DEM's long-term desire is for a wastewater treatment plant to be constructed in the Waikapū Area to accommodate future flows generated by development within the Waikapū region. The WCT will need to construct a stand-alone private wastewater treatment facility, or partner with other projects in the Waikapū area, such as A&B's Wai`ale project or the County of Maui to construct a regional wastewater treatment facility. The planning and design of a stand-alone or combined wastewater treatment facility will be coordinated with the availability of capacity within the County system. The Applicant is analyzing several package wastewater treatment options, including a conventional wastewater treatment facility and a facility using a Food Chain Reactor (FCR) configuration (See: Appendix H, "Preliminary Engineering and Drainage Report").~~

~~In addition, Brown and Caldwell Consultants were retained by the Department of Environmental Management to prepare the *"Central Maui Recycled Water Study".* The report dated April 2015, concluded that the major elements required for the Central Maui service area includes:~~

- ~~Three new WWPSs.~~
- ~~A wastewater conveyance system that includes gravity sewers and forcemains.~~
- ~~A new Central Maui WWRF to produce R-1 recycled water.~~
- ~~A soil aquifer treatment system for excess recycled water disposal.~~
- ~~A brackish groundwater well to provide supplemental water to the recycled water system.~~
- ~~A recycled water pump station and storage tank.~~
- ~~Recycled water transmission pipelines to the Tier 1 areas.~~

~~The study notes that the total cost for the system is estimated to be $91.4 million, or $20,300 per market-rate EDU.~~

~~The WCT could construct a stand-alone private wastewater treatment plant near the northeast corner of the project site after the maximum units is serviced by the County's wastewater system. However, the treatment plant will be needed in about 2017 and the developers will continue to work with the County and other projects within the Waikapū area on a collaborative wastewater treatment facility.~~

The Project will produce an increase in demand for wastewater treatment. Based on the *"Preliminary Wastewater Report"*, prepared by Enviniti LLC, dated March 2013 (**See**: Appendix J), the following were the determined average wastewater and design maximum flow rates[28] for the project:

AVERAGE FLOW ESTIMATES:

- Phase I – 395,000 gpd
- Phase II – 303,000 gpd
- Total Project – 698,000 gpd

DESIGN MAXIMUM FLOW ESTIMATES:

- Phase I – 1,548,652 gpd
- Phase II – 1,257,125 gpd
- Total Project – 2,449,819 gpd

If capacity at the KWWRF is available at the time building permits are ready to be issued for the Project, the Applicant may consider a temporary connection to the County's sewer system and complete the required upgrades for the connection in the Phase I development as described in this report. However, since the DEM stated in its letter dated April 13, 2016 that the Project

[28] The estimated flow rates were calculated using the conceptual phasing plan. Assumptions were made on the use and development of land classifications. The low rates will be refined as a more detailed development plan becomes available.

would not be allowed a connection to the KWWRF, the proposed private wastewater reclamation facility utilizing FCR technology, together with a collection system and pump stations will be constructed to service the Project's wastewater treatment demand. At full buildout of the Project, the wastewater reclamation facility is expected to process an average daily flow of about 0.65 million gpd. The peak flow into the facility is estimated to be approximately 1.3 million gpd. Wastewater processed at the facility will be reclaimed to R-1 standards, which will allow the non-potable recycled water to be used for above-ground irrigation of most agricultural crops and open space uses, including parks. The Agricultural Preserve as well as the Project's parks and open space elements are expected to be the facility's future reclaimed water users. The Project's wastewater treatment plan is described in detail in Section III.B.8 of the FEIS.

6. Airports

In the State Department of Transportation's response letter dated May 18, 2016 the Airports Division advised the Applicant that the Kahului Airport is within five (5) statute miles between the farthest edge of the Air Operations Area and land use activities within the WCT that could attract hazardous wildlife movement into or across aircraft approach or departure space (**See**: Appendix S, DEIS Agency and Community Comment and Response Letters). The DOT letter included as an attachment the FAA's Advisory circular 150/5200-33B, Hazardous Wildlife Attractants On or Near Airports. The letter also noted that the FAA recommends that stormwater detention ponds be designed, engineered, constructed, and maintained for a maximum of 48-hour detention period after the design storm and remain completely dry between storms.

The WCT's drainage system will be designed to accommodate the increase in surface runoff volume from a 100-year, 24-hour storm created by the project and the volume required to meet the post construction water quality standards. In addition to the detention basins, large grassed swales will be constructed within the open space areas to divert runoff to designated outlets.

The design of the detention basins will include an overflow pipe which will allow a minimal discharge during a storm event and fully drain the basin within 48 hours after each storm event.

Moreover, in recognition of the Airport's concerns the Applicant will consult with the FAA and the Airports Division and other applicable agency's to identify BMPs that will help to mitigate hazardous wildlife movement into and from the Project's proposed urban and agricultural infrastructure systems.

CHAPTER VI

Contextual Issues

VI. CONTEXTUAL ISSUES

A. RELATIONSHIP BETWEEN SHORT-TERM USES AND MAINTENANCE OF LONG-TERM PRODUCTIVITY

Short-term uses and long-term productivity consists of short-term construction activities related to the build-out of the Project and the long-term benefits of the development.

Construction activities would result in short-term impacts involving temporary and permanent alteration of land for grading, site work, infrastructure and building. Localized degradation of air quality and increased noise levels would also occur in the short-term due to construction-related activities. Many short-term impacts can be avoided or mitigated by implementation of construction BMPs. Applicable BMPs include implementing erosion control measures, directing storm water run-off to detention/retention basins, and preventing the release of fuel or other contaminants. The tradeoffs among these short-term impacts are the increase in employment and immediate economic benefits of construction-related activities. These short-term impacts and benefits are documented in Section V of the ~~DEIS~~ FEIS.

In the long-term, the infrastructure and building construction conforming to the goals, objectives and policies of the MIP would produce both housing and jobs designed to accommodate the County's projected population growth. The delivery of a diverse range of housing within County designated "urban growth boundaries" is an underlying objective of the County-wide Policy Plan and MIP.

Ultimately, the long-term build-out of the project area will produce impacts that must be weighed against the Project's benefits. Increased development will lead to an increase in population of the immediate area, both in the form of residents living within the WCT or employees commuting to the WCT during regular business hours. With the projected population

increases, the volume of traffic coming in and out of, and passing through Waikapū will increase. This will affect regional traffic conditions by increasing volumes on the region's existing roadway network. As documented in Section V.D.1 of the ~~DEIS~~ FEIS, creative strategies involving roadway improvements and upgrades, transportation demand-management counter-measures, and innovative urban design approaches are required to mitigate the Project's traffic impacts. Likewise, an increase in population will produce greater demands upon the island's potable water resources, wastewater systems and public facilities including parks, schools, police and fire. These impacts and the necessary mitigative counter-measures are thoroughly documented in Sections V.C and D of the ~~DEIS~~ FEIS.

With regard to long-term productivity, the Project's urban design embraces the principles of New Urbanism and Smart Growth. Urban development in the mauka development is directed into a village core that encompasses the existing MTP retail and commercial buildings, lagoon and tropical gardens. Live-work, multi-family, small lot single-family and rural lots encircle the village green, with easy pedestrian and bicycle access to retail, commercial, parks and open space.

The makai development focuses onto a pedestrian-oriented main-street that accommodates mixed-use retail-residential, higher density multi-family, attached and detached single-family and small-lot single-family connected by walking and biking paths to the 12-acre elementary school and adjacent community park. A unique feature of the community is the approximate mile long landscaped internal greenway that links the Project's residential neighborhoods to mini-parks, the commercial district, elementary school and community park with a separated pedestrian and bicycle path.

Surrounding the urban development are 1077-acres of agricultural lands that are to support diversified agricultural development, community gardens, open land recreation and renewable energy production.

The WCT site plan was developed following the guiding principles found in the MIP and well-documented best planning practices for developing mixed-use communities. The Project will accommodate from 9.93 percent to 18.51 percent of the region's projected growth in resident

population through 2035. ~~8.9% to 16.6% of the projected population growth through 2035.~~ The Project will create new employment on-site and will be conveniently located to the island's primary employment centers in Wailuku-Kahului and South Maui. The economic impacts associated with the short and long-term implementation of the development are thoroughly documented in Section V.B.3-4 of the ~~DEIS~~ FEIS. The market demand for the project is thoroughly documented in Section II.E of the ~~DEIS~~ FEIS. The fiscal impact of the project is thoroughly documented in Section V.B.5 of the ~~DEIS~~ FEIS.

B. CUMULATIVE AND SECONDARY IMPACTS

Cumulative impacts are defined as the impact on the environment, which results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions.

Secondary impacts are those that have the potential to occur later in time or farther in the future, but which are reasonably foreseeable. They can be viewed as actions of others that are taken because of the presence of the project. Secondary impacts from highway projects, for example, can occur because they can induce development by removing transportation impediments to growth.

The gradual build-out of the WCT will occur concurrently with population growth that is projected to occur within Wailuku-Kahului over the next several decades. Implementation of the Master Plan, when added to other adopted and proposed projects, may have a significant effect on a regional and island-wide scale.

As documented in Section II.D of the ~~DEIS~~ FEIS, the entire project area is located within the MIPs Small Town Growth Boundary. As described in Section V.B.1 of the ~~DEIS~~ FEIS, the resident population of Wailuku-Kahului as of mid-year 2015 was 57,616. According to County and State Forecasts, the 2035 resident population of Wailuku-Kahului may range from 78,764 to 97,080 persons. This is an increase in population of 21,148 to 39,464, which is an increase of 36.7% to 68.5%. The projected resident project population is ~~3,511~~ 3,921 persons, which represents from

18.51 percent to 9.93 percent ~~8.9%~~ to ~~16.9%~~ of the projected resident population growth through 2035. There are several other projects planned for Central Maui over the next decade, some of which are in close proximity of the proposed project.

Taken together, regional population growth will increase demand on natural resources, infrastructure and public facility systems. To better manage the island's growth and its related impacts, the MIP identifies appropriate locations for development to occur. The MIP is intended to facilitate better planning for and coordination of the delivery of infrastructure and public facility systems in response to forecasted population growth.

As a precursor to preparing the MIP, the County of Maui prepared the following infrastructure and public facility technical studies: Infrastructure and Public Facilities Issue Paper (September 2007), Public Facilities Assessment Update (March 2007) and Infrastructure Assessment Update (May 2003). These studies assess the impact of the projected population growth on the island's infrastructure and public facility systems. In general, the studies conclude that on-going public and private sector investment will be necessary to accommodate growth through 2030.

This section identifies secondary and cumulative impacts that may result from the phased development of the Project:

Impacts to Natural and Environmental Resources

Assuming that all BMPs and mitigation measures documented in the ~~DEIS~~ FEIS are implemented and all permit-induced requirements are complied with no cumulative or secondary impacts are anticipated on the natural environment.

Flora and Fauna. Development of the WCT, together with other area projects, could have cumulative and/or secondary impacts on rare or endangered species of flora and fauna if natural habitats and/or species are directly or indirectly disturbed. As documented in Section IV.A.4 of the ~~DEIS~~ FEIS, the Project will not impact rare or endangered flora and fauna species. Adjacent proposed developments will be required to conduct flora and fauna surveys prior to development. These surveys will be reviewed by the U.S. Fish and Wildlife Service and

mitigation counter-measures will be required if warranted. In consideration of existing State and Federal regulations to protect rare and endangered species, there should be no significant cumulative and/or secondary impacts to flora and fauna resources arising from planned growth in the area.

Coastal Water Quality. Development of the WCT, together with other area projects, could have significant cumulative impacts to coastal water quality if BMPs are not strictly adhered to. During the construction phase, BMPs must be implemented to mitigate runoff of bare soils and other construction contaminants into drainageways and culverts. If not properly mitigated, the cumulative impact of these contaminants could impact coastal water quality.

During the Project's operation phase, any increase in runoff will be maintained on site as required by the County's drainage rules (See: Section V.D.3) Directing runoff into designated detention basins, together with filtration of contaminants from runoff, will mitigate the Project's impact to coastal waters. Likewise, future developments in the area will be required to implement similar mitigation measures as part of their operation phase BMPs. Therefore the Project, together with other planned projects in the area, should not have a significant cumulative impact on coastal water quality if construction and operation phase BMPs are strictly adhered to.

Agricultural Lands. As documented in Section V.A.7 of the ~~DEIS~~ FEIS, development of the WCT, together with other planned developments in the area, including those projects listed in Table 56 ~~50~~, will result in the loss of agricultural lands to urban development. Table 56 ~~50~~ identifies approximately 1,824 acres in Central Maui that have either been recently redesignated from the State Land Use Agricultural District to the Urban District or are planned for redesignation. In May 2012 the State Land Use Commission granted a District Boundary Amendment (DBA) from Agricultural to Urban for the lands comprising the Wai`ale Planned Growth Area and the Wai`ale Work Force Housing Project. The Wai`ale lands were generally considered low quality for agricultural use and were comprised mostly of E rated lands by the Land Study Bureau (LSB) and designated "Other" lands by the ALISH rating system.

Table 56 ~~50~~: Planned Urbanization of Central Maui Agricultural Lands

Planned Urbanization of Central Maui Agricultural Lands				
Project	Acres	State Land Use	ALISH	LSB
Wai`ale Workforce Housing	50	Urban	N/A	N/A
Wai`ale Planned Growth Area	495	Urban	N/A	N/A
Pu'unani	209	Agriculture	Prime	A, B, E
Kāhili Rural Residential	218	Agriculture	Unclassified	E
Waikapū Country Town	502	Agriculture	Prime	A, B, E
Regional Park and Central Maui Facilities	350	Agriculture	Other	E, A, B
TOTAL	**1824**			

Maui County's proposed regional park and central Maui governmental facilities on 350 acres will also result in the loss of agricultural lands to urban use. However, these lands are also rated poorly for agricultural use. These lands are rated E by the Land Study Bureau and are designated "Other" lands by the ALISH rating system.

The proposed Kāhili rural residential development will also result in agricultural lands being reclassified to the State Rural District. However, these lands are also generally poorly suited to agricultural use. According to the Land Study Bureau, these lands are rated "E" and are "Unclassified" by the ALISH rating system.

The agricultural lands comprising the WCT and the proposed Pu`unani project's agricultural lands are both highly productive for agricultural use. Together, these two projects will result in the urbanization of 704 acres of prime agricultural lands (495 acres for the WCT and 209 acres for Pu`unani). Cumulatively, the 704 acres represents about 0.85% of the 82,582 acres of agricultural lands on Maui that are rated by the LSB as A, B or C. The Project, together with future urbanization of Pu`unani, will result in a relatively small loss of prime agricultural lands on Maui, especially in consideration of ~~.~~the significant transition of agricultural lands out of sugar and pineapple production, including the announced closure of HC&S in January 2016, which has made thousands of acres of agricultural lands available for alternative agricultural uses.

In regards to secondary impacts, urban development can impact agricultural land uses in two ways. First, in certain circumstances, urbanization of agricultural lands can cause agricultural

lands prices to go higher making it more cost prohibitive for farmers to buy or lease land to farm. Second, urban development can create use conflicts between farmers and urban residents. In regards to the first issue, the establishment of Urban Growth Boundaries in the MIP will help to create more predictable development patterns. This will create more certainty in the urban and agricultural land markets; thereby, mitigating the escalation of agricultural land values. In regards to the second issue, HRS, Chapter 165 "Hawai'i Right to Farm Act" protects farmers from lawsuits filed by residents living within close proximity of agricultural operations. Future residents of the WCT will be notified prior to the purchase of property that agricultural activities will occur on abutting agricultural lands. In addition, the WCT will establish landscape planting around the perimeter of the property with a buffer to mitigate potential agricultural use conflicts and will implement other BMP's to mitigate dust and air quality impacts.

As noted in Section V.A.7 of the ~~DEIS~~ FEIS, the WCTs agricultural component includes nearly 1,077 acres of land that will remain in agricultural use. Of these lands, approximately 800 acres will be permanently dedicated to agricultural use through a conservation easement. No residential structures will be permitted on these lands. The remaining 277 acres may be subdivided into as many as five large agricultural lots where a farm dwelling may be permitted. Within the agricultural lands, several hundred acres are proposed to be developed into a public and/or private agricultural park, which will help to facilitate Maui's agricultural development. As noted in Section V.A.7 of the ~~DEIS~~ (FEIS), a significant impediment to agricultural development on Maui, and throughout the state, is the scarcity of agricultural land that is both readily available and affordable for long-term lease to diversified farmers. The establishment of a centrally located agricultural park within the 800-acre reserve, with access to affordable irrigation water, should help Maui farmers develop economically viable farms that can compete in local, mainland and international markets.

Potable Water Resources. The Draft Maui County Water Use and Development Plan (WUDP), Central DWS District Update (November 2010) projects future water demand in Central Maui through 2030 based on projected population growth. The Draft Plan notes that water consumption for the DWS Central District System is projected to grow from about 25.5 MGD in 2015 to 34 MGD in 2030 (base case). As noted in previous sections of the ~~DEIS~~ FEIS, the WCT project population is estimated to be ~~3,511~~ 4,085 persons of which 3,921 will be residents. The

Project's projected resident population ~~which~~ represents from 18.51 percent to 9.93 percent ~~16.6%~~ to ~~8.9%~~ of the projected resident population growth through 2035.

In planning for future source delivery the Draft WUDP assesses several "final candidate" strategies, including:

- Northward Basal Groundwater Well Development;
- Eastward Basal Groundwater Development;
- Nā Wai 'Ehā Surface Water Treatment;
- Desalination of Brackish Groundwater; and
- Maximization of Water Conservation and Recycled Wastewater.

In order to meet the projected demand, the County of Maui will need to invest considerable capital into new source development, transmission, storage and treatment. Prior to making these investments, extensive environmental analysis and a robust community outreach effort will be required to determine the preferred alternatives. This process will occur through the final update of the WUDP.

As discussed in Section V.D.4 of the ~~DEIS~~ FEIS, water and fire protection for the project will be provided from a private onsite water system. Six (6) wells ~~Five (5) wells~~ have been drilled on the site. Three (3) wells have been designated for potable use. Two additional wells have preliminarily shown low salinity levels, and testing is being conducted to determine the viability of those wells for domestic use. If not viable for domestic use, they will be used for non-potable agricultural use. Well No. 6 is proposed to be a monitoring well. ~~and two (2) for non-potable purposes.~~ The three potable water wells have been approved by the State of Hawai'i, Commission on Water Resource Management, for a total pumping capacity of 2,300 gallons per minute (gpm) or 3.312 MGD. In order to conserve potable water resources, the WCT will install a dual water system for potable water and irrigation water uses. It is estimated that the dual water system will reduce the Project's potable water demand by up to one-third. Moreover, the Project will require the installation of low flow fixtures throughout the project, and to further reduce demand for non-potable water, drip irrigation and planting of drought tolerant landscaping will be encouraged throughout the project.

All of the WCT wells are located within the Waikapū Aquifer, which the DLNR, Commission on Water Resources Management (CWRM), has designated a sustainable yield of 3 MGD. It is estimated that the Project's average daily demand for potable water will be about 646,000 GPD. With an approved pumping capacity of approximately 2,300 gallons per minute (gpm) by the CWRM, the WCT will have additional potable water available to address other pressing community needs.

The development of the WCT is also not anticipated to negatively impact the County's potable ground waters. The Project's potable and non-potable water resources will be developed and managed in a manner that complies with all State and County laws. Moreover, in developing the property, BMPs will be implemented to mitigate potential impacts to the State's freshwater and estuarine environment.

Existing State and County water policies and plans are designed to protect Maui's water resources from over pumping. With these measures in place, significant cumulative and/or secondary impacts are not anticipated to threaten the long-term sustainability of the County's water resources.

Air Quality

The cumulative impact of the build-out of the WCT, together with other developments within the Waikapū area, may increase the amount of pollutants entering the atmosphere. These pollutants may be generated by an increase in demand for energy in the form of transportation fuels for automobiles and carbon-based fuels delivered by the Ma'alaea Power Plant. However, with the increasing cost-competitiveness of renewable energy, MECO has made significant strides in incorporating non-polluting renewable energy into its energy portfolio. This trend should be expected to continue as clean energy technologies improve and become cheaper overtime. Therefore, it is likely that even with greater demand for energy, ambient air quality will improve as cleaner energy sources are brought on-line.

Impacts to the Socio-Cultural Environment

The development of the WCT, together with other developments in Central Maui, will contribute to population growth, create jobs, and generate tax revenues. Together, the

population associated with these projects will increase demands on infrastructure and public facility systems both locally and island-wide.

According to the MIP (December 2012), there will be a demand for an additional 29,589 housing units on Maui through 2030. Of these units, approximately 10,845 are expected to be built on lands not currently entitled for urban development.[xxviii] According to the WCTs Market Study (See: Appendix A), it is estimated the demand for new residential units in the Wailuku-Kahului study area will be from 9,647 to 16,814 units over the next 21 years (through 2035); including allowances for non-resident purchasers and vacancies, with a mid-point demand of 13,230 units.

The continued build-out of Central Maui will also change the area's urban design character and sense of place. Today, Wailuku-Kahului is a developing community with a number of undeveloped infill parcels intermixed with lower and medium-density residential, strip commercial, industrial, resort and public facility uses. In the coming years, pursuant to the land-use policies contained in the MIP and Wailuku-Kahului Community Plan, urban development will likely become more compact, mixed-use and interconnected. Networks of open-space, parks, bikeways, trails and pedestrian-oriented streets will link districts and neighborhoods together. An increase in population, including population associated with the WCT, may increase demand for coastal and inland active and passive recreation lands. The County's Infrastructure and Public Facilities Issue Paper (September 2007) recommends a pro-active public-sector strategy to acquire additional shoreline and inland park lands to accommodate the increasing demand for recreation and shoreline-based cultural activities. The County of Maui and State of Hawai'i have aggressively pursued open land acquisition in recent years. These purchases have included coastal lands (Pali to Puamana; North Shore Greenway; and Lipoa Point) and large-scale acquisitions of inland lands near Waikapū (Central Maui Regional Park; Central Maui Sports Complex) for active and passive recreation.

Moreover, MCC Title 18.16.320 requires a park land dedication, or cash-in-lieu fee payment, to mitigate the impact of growth on park and recreation facilities.

Infrastructure and Public Facilities

The phased build-out of the WCT, together with other developments in Wailuku-Kahului, will increase population; thereby, increasing the demand for infrastructure and public facility systems, including water, wastewater, and roadways; solid waste, schools, and parks; and medical facilities, public transit and government offices. The County's Infrastructure and Public Facilities Issue Paper (September 2007) documents the impact of projected population growth on the County's infrastructure and public facility systems by region and identifies associated capital improvement projects to support this growth.

As documented in Section V.C-D of the ~~DEIS~~ FEIS, the WCT will mitigate its impact on infrastructure and public facility systems through a variety of on- and off-site infrastructure and public facility counter-measures. One such counter measure, as documented in Section V.D.5 of the ~~DEIS~~ FEIS, is the proposed development of an on-site private wastewater reclamation facility. ~~significant off-site improvements to the County's wastewater transmission infrastructure along Wai`ale Road and Lower Main Street~~. Property taxes generated by the development, together with other planned projects in the area, will help fund County operations and capital improvement projects.

Secondary impacts could also result from investments into infrastructure and public facility improvements to support the Project. For example, development of the additional water capacity in Central Maui may induce further growth within Central Maui, since water availability is a significant development constraint. However, new water source development within the region is supported by both the MIP and the Water Use and Development Plan.

C. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Build-out of the WCT will result in the irreversible and irretrievable commitment of certain natural and fiscal resources. Major resource commitments include the land and capital, construction materials, non-renewable resources, labor, and energy required for the Project's implementation. Impacts represented by the commitment of these resources must be weighed

against the positive socio-economic benefits that could be derived from the project versus the consequences of either taking no action or pursuing another less beneficial use of the area.

When fully built out, the Project will provide housing, create employment and deliver supporting infrastructure and public facilities to create a "complete community". While development of the site will result in the need to commit certain natural and fiscal resources, justification for these investments is found in the MIP's policy to develop these lands in accordance with the MIP's directed growth strategy and its goals, objectives and policies for the use of urban, rural and agricultural lands.

As with any construction activity, nonrenewable resources such as fossil fuel and construction material will be irrevocably committed. Labor will be required for planning, engineering, and construction. New residential, commercial, or employment uses will generate increases in the demand for water, electricity, and sewer services. Similar types of developments proposed on other parts of Maui will also generate demand for these resources. Chapters IV and V of the ~~DEIS~~ FEIS document the Project's short- and long-term impacts.

D. OFFSETTING CONSIDERATIONS OF GOVERNMENTAL POLICIES

The proposed project is consistent with State and County policies that identify the property for urban and rural expansion to accommodate the projected population growth in Central Maui. Other policies of the State and County promote the preservation of agricultural land. MIP Policy 7.1.1.f states:

> *Strongly discourage the conversion of productive and important agricultural lands (such as sugar, pineapple, and other produce lands) to rural or urban use, unless justified during the General Plan update, or when other overriding factors are present.*

The subject land was placed into a Small Town Growth Boundary during the General Plan 2030 update, when other overriding factors were present. These factors included the forecasted

demand for additional urban lands to accommodate projected population growth and housing demand, the development suitability of the subject land, as well as its proximity to existing employment, infrastructure, public facility systems and existing urban development.

As documented in Section V.A.7 of the ~~DEIS~~ FEIS, the proposed action has been carefully analyzed for its short- and long-term impacts upon the agricultural industry. While urbanization of the project site will result in the loss of prime agricultural lands, it will not significantly impact the short- or long-term viability of agriculture in Hawai'i or on Maui since an abundance of currently fallow former sugar and pineapple land is currently available elsewhere. The project will, however, help to address the current shortage of agricultural park lots on Maui by establishing a new private and/or public agricultural park within Central Maui.

E. UNRESOLVED ISSUES

The following issues remain unresolved at the time this document is being prepared:

~~**Wastewater Treatment**~~

~~As documented in Section V.D.5 of the DEIS FEIS, the WCT proposes to temporarily connect to the County's sewer system and complete the required upgrades to connect approximately 650 units, or an equivalent amount of generated wastewater, in the Phase I development. The Applicant is working with the DEM to establish an agreement for wastewater capacity in the County system. To service the remaining 750 residential units, commercial and public facility uses the Applicant will need to construct a stand-alone private wastewater treatment facility, or partner with other projects in the Waikapū area, such as A&B's Wai`ale project to construct a combined wastewater treatment plant. However, the treatment plant will be needed in about 2020 and the Applicant will continue to work with the County and other projects within the Waikapū area on a collaborative wastewater treatment facility.~~

~~Development of a package wastewater treatment facility will be subject to an Environmental Assessment, pursuant to HRS, Chapter 343.~~

Wai`ale By-pass Road Improvements

The County Department of Public Works (DPW) commented in their May 23, 2016 letter (**See**: Appendix S) that the timing of the Wai'ale Bypass is uncertain and that the Applicant should assume that the roadway may not be constructed. In response to the DPW's letter, the Applicant contracted with Fehr & Peers to conduct an analysis of the Project's traffic impacts at full buildout without the Wai'ale Bypass Road. Fehr & Peers completed the analysis in October 2016. The "No Wai'ale Bypass Scenario" analysis demonstrates that even under a worst-case scenario where the subject roadway isn't in place, the Project can achieve an acceptable level-of-service through off-site intersection improvements.

The Applicant dedicated the required road-widening lot to accommodate the Wai`ale Bypass in 2014. The Wai`ale Bypass Road would extend from its existing terminus at Waiko Road to intersect Honoapi'ilani Highway approximately one mile south of Honoapi'ilani Highway/ Waiko Road. It is assumed that the bypass would be constructed as a two-way, two-lane roadway and left-turn pockets will be provided at key intersections, including the bypass roadway's intersection with the Project's "Main Street". However, the precise schedule for funding and development of this roadway is uncertain at this time.

~~The Wai`ale Bypass Road is identified in the County's Fiscal Year 2016 Capital Improvement Program for funding between 2017 and 2021. The Wai`ale Bypass Road would extend from its existing terminus at Waiko Road to intersect Honoapi'ilani Highway approximately one mile south of Honoapi'ilani Highway/ Waiko Road. It is assumed that the bypass would be constructed as a two-way, two-lane roadway and left-turn pockets will be provided at key intersections, including the bypass roadway's intersection with the project's "Main Street". The precise schedule for funding and development of this roadway is uncertain at this time.~~

Final Water Quality Testing

Pump tests and water quality testing for compliance with State DOH water quality has been conducted ~~standards is being conducted~~ on the Project's three potable wells. The water quality tests must be reviewed and approved by the CWRM. Pump and water quality testing must still be conducted on Wells 4 and 5. Until the pump and water quality testing has been completed

on Wells 4 and 5 it will not be known whether these wells will generate potable or non-potable water and whether these wells will draw upon the sustainable yield of the Waikapū Aquifer.

Renewable Energy Development

An important objective of the project is to off-set its energy consumption by developing on-site renewable energy systems. These systems may include photovoltaic panels that would be installed on the roofs of residential and commercial buildings, within parking areas and on "solar farms" within the WCTs agricultural lands. Development of these systems may be dependent upon many factors including financial viability and having access to MECO's electrical grid.

Amendments to Maui County Code (MCC) Chapter 19.33

Implementation of the WCT Master Plan will require the adoption of a Project District Ordinance, pursuant to MCC Chapter 19.58. The ordinance will relate to the types of uses permitted within the project, density of development, building massing, parking requirements, etc. It is not yet known whether the ordinance will be adopted through the legislative process. Should the ordinance not be adopted, or be revised significantly, then the ultimate mix of land uses and character of development may be affected.

CHAPTER VII

Relationship to Governmental Plans, Policies, and Controls

VII. RELATIONSHIP TO GOVERNMENTAL PLANS, POLICIES, AND CONTROLS

A. STATE LAND USE

Chapter 205, Hawai'i Revised Statutes (HRS), relating to the Land Use Commission (LUC), establishes four (4) major land use districts in which all lands in the state are placed. These districts are designated as *Urban*, *Rural*, *Agricultural*, and *Conservation*. The lands of the MRTP lie within the State *Urban* and *Agricultural* districts. Refer to Figure 5, "State Land Use Map".

The WCT will require a State Land Use District Boundary Amendment (DBA) from *Agricultural to Urban* for approximately 335.07 acres and a DBA from *Agricultural to Rural* for approximately 149.84 acres. The total land area expected to be reclassified is approximately 485 acres. Table 57 ~~51~~ identifies the subject parcels and land area subject to the DBA request. See Appendix M, District Boundary Amendment Petition Maps.

Table 57 ~~51~~: WCT Land Area Subject to State Land Use District Boundary Amendment

Acres Subject to State Land Use District Boundary Amendment					
Ownership	Parcel	Acres	Existing State Land Use	Acres Subject to DBA	Proposed State Land Use
Waikapū Properties LLC	(2) 3-6-004:003 (2) 3-6-004:006	657.195 52.97 [29]	Agriculture Agriculture	149.848 53.775[30]	Rural Urban
MTP Land Partners LLC and the Filios, William	(2) 3-6-005:007	59.054	Agriculture	45.054	Urban

[29] Acreage identified on TMK Map.

[30] Acreage identified by survey.

Acres Subject to State Land Use District Boundary Amendment					
Ownership	Parcel	Acres	Existing State Land Use	Acres Subject to DBA	Proposed State Land Use
Separate Property Trust					
Wai`ale 905 Partners LLC	(2) 3-6-002:003	521.40	Agriculture	236.236	Urban

Additionally, the WCT will require amendments to the conditions placed upon currently urbanized lands, comprising approximately 15-acres within the existing MTP.

Decision making criteria to be used in the LUC review of petitions for reclassification of district boundaries is found in Section 205-17, HRS and Section 15-15-77, HAR. In addition, standards for determining the Urban District are contained in Section 15-15-18 HAR and the standards for determining the Rural District are contained in Section 15-15-21 HAR.

The following is an analysis of how the WCT conforms to these criteria and standards.

205-17 Land Use Commission Decision Making Criteria. In its review of any petition for reclassification of district boundaries pursuant to this chapter, the commission shall specifically consider the following:

1. ***The extent to which the proposed reclassification conforms to the applicable goals, objectives, and policies of the Hawai‘i State Plan and relates to the applicable priority guidelines of the Hawai‘i State Plan and the adopted functional plans;***

Analysis:

The WCT conforms to the goals, objectives, and policies of the Hawai‘i State Plan and Functional Plans as more fully described in Section VII.A-D of the ~~DEIS~~ FEIS.

2. ***The extent to which the proposed reclassification conforms to the applicable district standards; and***

Analysis:

Conformance of the WCT to the Urban and Rural District Standards are discussed in this section's analysis of HAR Section 15-15-18.

3. The impact of the proposed reclassification on the following areas of State concern:

A. Preservation or maintenance of important natural systems of habitats;

Analysis:

A Biological Resources Survey was prepared as part of the ~~DEIS~~ FEIS (**See:** Section IV.A.4 and Appendix B of the ~~DEIS~~ FEIS). The objectives of the Biological Resources Survey were to:

1. Document the types of plant and animal species that exist on the property;
2. Identify the presence or likely presence of native flora and fauna;
3. Identify the presence or likely presence of federally listed Threatened or Endangered species and what on-site habitats might be essential for these species;
4. Determine if the project area contains any special habitats, which if lost or altered, might result in a significant negative impact on the flora and fauna found on the property.

The Botanical Resources Survey determined that there is little of botanical concern on the subject property. The study states that the project is not expected to have a significant negative impact on the botanical resources on the site or in the immediate area and no recommendations are recommended in the study.

With respect to fauna, the study notes that the 'ua'u and 'a'o are known to overfly the property. The report recommends measures to mitigate potential impacts to these species, specifically recommending that outdoor lighting should be shielded to direct the light downward so that the light is not visible from above. The fauna survey also found two tree tobacco plants on the property. One of these plants was host to two mature Blackburn's sphinx moth eggs. The study recommends that the U.S. Fish and Wildlife Service (USFWS) be consulted so that required protections and management actions can be taken.

The USFWS provided comments on the Botanical Resources Survey and EISPN in a letter dated June 11, 2015 (**See**: Appendix Q ~~L~~). The USFWS notes that there are three listed animals including the Hawaiian hoary bat (*Lasiurus cinerueus semotus*), Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*), and the threatened Newell's shearwater (*Puffinus auricularis newelli*), and one endangered insect, the Blackburn's sphinx moth (*Manduca blackburni*) within or near the project area. The USFWS notes that there is no proposed or designated final critical habitat within the described project footprint. The USFWS recommends the following avoidance and minimization measures to ensure the protection of the Hawaiian hoary bat and the Hawaiian petrels and Newell's Shearwaters:

- ***Hawaiian hoary bat***. Avoid removing woody plants greater than 15 feet tall between June 1 and September 15, which is the bat's breeding season. Avoid using barbed wire fencing within the project since bats can become entangled in the wire.
- ***Seabirds (Hawaiian petrels and Newell's shearwaters)***. Telecommunication towers that might be placed on the property should be unguyed and without lighting. During the seabird fledgling season (approximately September 15 through December 15) night work requiring artificial illumination should be avoided. Moreover, project lighting should be minimized and shielded so the bulb is not visible at or above bulb-height.

With respect to the Blackburn's sphinx moth, the USFWS provided specific guidance in a December 15, 2015 e-mail to Planning Consultants Hawai'i LLC the measures that must be taken to mitigate the Project's impact to the moth. These measures are documented in Section IV.A.4 of the ~~DEIS~~ FEIS and in Appendix Q, ~~L~~ "EISPN Agency Comment and Response Letters"). Implementing the USFWS mitigation measures will not constrain development of the property.

B. Maintenance of valued cultural, historical, or natural resources;

Analysis:

The ~~DEIS~~ FEIS includes an Archaeological Inventory Survey (Appendix E), a Cultural Impact Assessment (Appendix F), and a detailed History Report (Appendix N ~~J~~). A Flora & Fauna

Assessment (Appendix B) and a Drainage Report (Appendix H) are also included in the ~~DEIS~~ FEIS.

Archaeological Resources:

The AIS was conducted to determine the presence/absence, extent, and significance of historic properties within the project area and to formulate future mitigation measures for these remains. The following historic properties were identified (See Appendix E):

- Sites 50-50-04-7881-7884 (formerly TS1, 3-5) comprised of 19 subcomponent features were newly recorded with the majority related to sugarcane cultivation.
- Site 5197 Waihe`e Ditch is extant within the central portion of the project area and was also recorded. A section of Site 5197 Waihe`e Ditch bisects the central portion of the project area in a north/south direction. This historic property was also recorded during the current undertaking and may be covered (though continue to be operational) during construction.
- Site 7881 Features 1-18 consists of concrete lined ditches, sluice gates, dirt culverts with concrete lined headwalls. This feature may be considered significant under Criterion D.
- Site 7882 (TS3) is a disturbed, historic L-shaped retaining wall. This feature may be considered significant under Criterion D.
- Site 7883 (TS3) comprises a World War II bunker. This feature may be considered significant under Criterion D and C. This site has been documented at the inventory level and may or may not be affected by proposed development.
- Site 7884 Features 1-3 (TS 2 and 5) are secondarily deposited historic materials recorded at three localities within the project area. This feature may be considered significant under Criterion D.

During the investigation, no evidence of traditional Hawaiian activities, with the possible exception of Site 7882 (remnant retaining wall or terrace) was recorded. These negative results are primarily due to the compounded disturbances from sugarcane cultivation,

historic habitation and modern land use; and possibly the inherent bias of random sampling during the inventory survey testing.

The AIS makes the following conclusions and recommendations:

- Site 7881 Features 1-18 are located along the northern boundary of Parcel 3 and will not be adversely affected by the development.
- Site 7884 Features 2-3 (historic trash scatter and refuse pit); a section of Site 5197 (Waihe`e Ditch) and possibly Site 7883 (WWII bunker) may be impacted by the development. The aforementioned historic properties have been properly recorded and may be removed and or altered during construction. However, it is recommended that an interpretive plaque commemorating Site 7883 (WWII bunker) be erected if the bunker is to be removed.
- Sites 7881 (agricultural waterways, sluice gates, reservoirs) and 7882 (L-shaped retaining wall) may be removed and or altered during construction; although no ground-altering activities are planned at this time.
- Archaeological monitoring of Parcel 3 “Mauka” and “Waena” is recommended for those areas that contain former LCA’s and Grants, as well as extant historic properties. However, spot monitoring inspections of other localities not expressed above may also be instituted. Parcels 6 and 7 contain numerous LCA’s and Grants; thus monitoring may initially be full-time until the nature of the subsurface conditions in relationship to the proposed ground-altering activities is determined. Similarly for Parcel 3 “Makai”, monitoring may initially be full-time; yet it is envisioned that the primary focus will be along the eastern and western perimeters, which are close to Wai`ale and Waiko Roads, known areas to contain traditional and historic burials.
- Prior to the commencement of construction, an Archaeological Monitoring Plan (AMP) detailing the localities to undergo monitoring procedures should be prepared and submitted to SHPD for review and approval.

Cultural Resources:

A Cultural Impact Assessment (CIA) was prepared by Hana Pono, LLC to describe existing Native Hawaiian cultural activities, practices and resources that occur on the property, potential impacts from the project, and mitigation, if necessary, to address these impacts. Specifically, the CIA addresses potential effects on the Hawaiian culture, cultural landscapes, and traditional and customary rights of Native Hawaiians. The following are areas of cultural concern and proposed mitigation measures (See Appendix F):

- ***Mahi Kuleana Parcels.*** There are two kuleana lots privately owned by the Mahi family (LCAw: 2499, R.P. 4070 AP 1 &2 to Ehunui) and (Grant 1153 to Ehunui) that are situated within TMK: (2) 3-6-004:003 on lands that are proposed to remain in agricultural use. These Kuleana lots are identified as TMK: Nos. (2) 3-6-005:009 (0.06 acres) and TMK: (2) 3-6-005:010 (0.5 acres). The proposed WCT Master Plan was adjusted so that these two parcels will remain within the project's agricultural lands. The Mahi family would like to keep these lands in their family and work with the developer to seek a solution that will benefit both parties.

- ***Waikapū Stream***. There is a strong desire among Waikapū kuleana farmers and other community residents to protect and restore the Waikapū Stream. Waikapū Stream is considered Waikapū's most valuable cultural resource. Waikapū Properties, LLC uses a percentage of Waikapū Stream surface water via Wailuku Water Company's delivery system. The use of this water is for the MTP; irrigation of lands leased to HC&S for cultivating sugarcane, and irrigation to support diversified agriculture. Waikapū Properties since 2012 has drilled a total of 5 groundwater wells to be used for the Project and current and future agricultural endeavors. In May of 2014, The State Commission on Water Resource Management returned 2.9 mgd of surface water to the Waikapū Stream via the IIFS (Interim Instream Flow Process) (CWRM) and established a groundwater aquifer sustainable yield of 4 mgd (CWRM). The Waikapū community and many kuleana farmers are having discussions with the Applicant to establish a long term water use plan for both surface and groundwater. One significant concern of expressed by Kuleana farmers that are using water from Waikapū Stream for kalo cultivation is sedimentation into the stream. It was noted that sedimentation has occurred during large rainfall events as well as from

maintenance and management issues associated with the existing plantation infrastructure. The Project's Ka Pa'akai Cultural Analysis offers specific mitigation measures to ensure that there are minimal to no adverse effects on any of the cultural practices identified within the CIA (**See**: Section V.A.5 of the FEIS and Appendix F, A). The Applicant is committed to working with neighboring kuleana farmers to help resolve these issues.

- ***Ground Water.*** The sustainable yield of the Waikapū aquifer is 3 million gallons per day (mgd). The Applicant has drilled 6 ~~5~~ ground water wells, five (5) of which ~~that~~ will be used for servicing the Project's potable and agricultural water demand. Concerns have been expressed about overall impact of the drilling of wells upon the health of the aquifer and surface water stream flows. The Applicant will strictly adhere to the water use allocations set forth by the State Commission on Water Resources Management (CWRM) to ensure that the pumpage from the on-site wells remains well within the sustainable yield for the aquifer.

- ***Kuleana Agricultural Lands Adjacent to Waikapū Stream.*** The cultivation of kalo is an important traditional and customary right that is being practiced by kuleana farmers along the Waikapū Stream. These farmers rely upon stream water for their crops. Kalo farmers have shared their concerns about the accessibility of stream flow via the WCT's 'auwai and the quality of the water within the Waikapū Stream. The Project's Ka Pa'akai Cultural Analysis offers specific mitigation measures to ensure that there are minimal to no adverse effects on any of the cultural practices identified within the CIA (**See**: Section V.A.5 of the FEIS and Appendix F, A).

- **Native Dryland Forest and Watershed.** Degradation of native plant species and habitats within the Waikapū Ahupua'a are a significant concern for kuleana farmers that rely upon the Waikapū Stream and for Hui Mālama o Waikapū and other kama'āina of Waikapū that are actively engaged in the restoration of native dryland forests and invasive species eradication within the Ahupua'a. There is a concern that indirect impacts by increased accessibility into the Ahupua'a by future residents could result in further damage to the forest by introducing additional invasive

species and disease. The Applicant is committed to working with the kama'āina of Waikapū and other concerned residents to develop proper access management programs to protect the Ahupua'a for future generations. The Project's Ka Pa'akai Cultural Analysis addresses specific mitigation measures to ensure that there are minimal to no adverse effects on any of the cultural practices identified within the CIA (**See**: Section V.A.5 of the FEIS and Appendix F, A).

- ***Inadvertent Finds (Artifacts & Burials).*** Because the development will occur on former kuleana lands, there may be the potential of inadvertent finds such as artifacts and burials during the Project's construction phase. It is recommended that if any cultural features (i.e. artifacts, burials, etc.) are uncovered during construction that the developer immediately contact the State Historic Preservation Division and comply with all applicable state laws. It is further recommended that close communication be maintained with the Waikapū Community since many of the kuleana lands once belonged to Hawaiian families, many of whom have descendants that continue to live in Waikapū. As discussed in Section V.A.4 of the FEIS, Archaeological Monitoring will be conducted during the construction phase of the project in accordance with a SHPD approved Archaeological Monitoring Plan.

- ***On-going Community Input***. The Waikapū community desires to continue to provide input on how to incorporate traditional cultural practices and knowledge within the development plan in order to maintain the unique traditions and practices of Waikapū and to preserve the community's identity.

Natural Resources:

With the incorporation of the mitigation measures described in this report, natural resources will not be impacted by the project.

Flora & Fauna Resources:

See analysis provided in Section VII.A.3.

Coastal Water Quality:

In accordance with the County's *"Rules for the Design of Storm Water Treatment Best Management Practices",* the design of the stormwater system will include water quality treatment to reduce the discharge of pollutants to the maximum extent practicable. Some examples of stormwater BMPs are:

- **Grassed swales** will be implemented within the landscaped areas where practical. Grass and groundcover provides natural filtration and allows for percolation into the underlying soils.
- **Open space and parks** will be maintained with grass or other landscape materials, thereby reducing the amount of impervious surfaces and promoting infiltration.
- **Stormwater detention** collects stormwater allowing some of the suspended solids to settle out. The stored runoff infiltrates into the underlying soils and recharges groundwater. In accordance with the County's *"Rules for the Design of Storm Drainage Facilities",* the design of the drainage systems with retention basins shall be based on the following design conditions:

  "In areas where the existing drainage systems are inadequate, the existing system shall be upgraded to handle runoff from the new project area or a new system shall be provided to connect to an adequate outlet. When there is no existing drainage system or adequate outlet to connect to, the additional runoff generated by the development may be retained on-site in a temporary retention basin with the following design conditions:

  A. Storage volume of an infiltration basin, infiltration trench piping, or retention basin shall equal at least the total additional runoff volume for the appropriate storm intensity.

  B. Soil percolation shall not be used in satisfying required storage volumes.

  C. Fifty percent (50%) of voids within the rock envelope for subsurface drains may be used in satisfying required storage volume provided that filter fabric is installed

around the pipe and at the interface of the rock envelope and soil.

D. Sumps, detention and retention facilities will remain private.

E. Detention or retention ponds with embankment heights equal to or in excess of 50 acre-feet shall conform to all state and federal requirements relative to dams".

- ***Runoff from Agricultural Lands into the Waikapū Stream.*** The Applicant is working with Waikapū community stakeholders to address concerns regarding stormwater runoff from the agricultural lands that may be contributing to sedimentation of the Waikapū Stream. The implementation of on-site low impact development techniques (LID's) may help to mitigate these concerns. LID's that may be feasible along the upper reaches of the Waikapū Stream include: 1) a landscaped buffer and or riparian zone adjacent to the stream that is planted with vegetation to promote filtration and infiltration; 2) grass swales; and 3) bio-retention systems. All of these techniques are proven to promote infiltration and filtration of groundwater.

- ***Post-Construction Water Quality Goals and Standards.*** The Project's drainage system will be designed to meet the County's drainage and water quality standards. The project will also be required to comply with Ordinance 3902, which requires subdivisions to comply with Section 18.20.130 Post Construction Storm Water Quality Best Management Practices of the Maui County Code. The criteria for sizing of storm water quality facilities are:

  "(a) The criteria can be met by:

  (1) Either detaining storm water for a length of time that allows storm water pollutants to settle (detention treatment from such methods as extended detention wet and dry ponds, created wetlands, vaults/tanks, etc.);

(2) By use of filtration or infiltration methods (flow-through based treatment from such methods as sand filters, grass swales, other media filters, and infiltration);

(3) Short-term detention can be utilized with a flow-through based treatment system (e.g., a detention pond designed to meter flows through a swale of filter) to meet the criteria; or

(4) Upstream flow-through treatment and detention treatment can be utilized.

(b) Other proposals to satisfy the water quality criteria may be approved by the director if the proposal is accompanied by a certification and appropriate supporting material from a civil engineer, licensed in the State of Hawai'i, that verifies compliance with one of the following (by performance or design):

(1) After construction has been completed and the site is permanently stabilized, reduce the average annual total suspended solid ("TSS") loadings by eighty percent. For the purposes of this measure, an eighty percent TSS is to be determined on an average annual basis for the two-year/twenty-four hour storm.

(2) Reduce the post development loadings of TSS so that the average annual TSS loadings are no greater than predevelopment loadings."

BMPs will consist of grassed swales and retention basins sized adequately to promote infiltration and filter pollutants to meet water quality standards. Other Low Impact Development Techniques (LID's) will also be explored to help reduce runoff volumes, promote infiltration and filtration of groundwater. Some of these measures may include promoting rain gardens, the use of rain barrels, developing green roofs, and use of permeable paving surfaces, where appropriate, within residential, commercial, and institutional developments. The Applicant will also explore the opportunity of utilizing bio-retention swales with native plantings at appropriate locations within the street network to reduce and filter stormwater runoff and to take advantage of natural drainage for irrigation.

A maintenance plan will be developed for the stormwater BMPs. The plan will include the requirements for removal of the accumulated debris and sediment, maintaining vegetation, and performing inspections to insure that the BMPs are functioning properly. Moreover, stormwater runoff during site preparation will be controlled in compliance with the County Code Chapter 20.08 "Soil Erosion and Sediment Control Minimum BMPs". During the construction period, temporary erosion control measures will be incorporated to minimize dust and soil erosion. ~~Additional controls will be implemented to protect Waikapū Stream.~~ Temporary BMPs include the construction of diversion berms and swales, dust fences, silt fences, stabilized construction entrances, truck wash down areas, inlet protection, temporary grassing of graded areas, and slope protection.

Water trucks and temporary sprinkler systems will be used to minimize dust generated from the graded areas. A National Pollution Discharge Elimination System (NPDES) permit will be required by the Department of Health prior to approval of the grading permit. The drainage design criteria will be to minimize any alterations to the drainage pattern of the existing onsite surface runoff. No additional runoff will be allowed to sheet flow toward Keālia Pond.

C. Maintenance of other natural resources relevant to Hawai'i's economy, including, but not limited to, agricultural resources.

Analysis:

The WCT will result in the urbanization of approximately 485 acres of prime agricultural land. However, the urbanization of these lands represents a relatively small percentage of agricultural lands statewide and on Maui. As noted in Section V.A.7 and in Appendix G, there are approximately 2 million acres in the State Agricultural District. The subject development represents just .024% of this area. On Maui, there are approximately 82,582 acres of agricultural lands rated by the LSB as A, B, or C. The subject development represents just 0.59% of these lands. Within Maui County, approximately 64,150 acres has been released from crop production since 1987. The subject development represents just 0.76% of these

lands.[31] Moreover, in January 2016 HC&S announced that its sugar plantation on Maui would be closed after a final harvest. This event will release approximately 33,000 acres from sugarcane production, which will dramatically increase the supply of land available for diversified agriculture. Thus, the urbanization of the subject 485 acres should have minimal long-term impact on the availability of agricultural land within the County and/or State since an abundance of other land, of a similar or higher quality, is currently fallow and available for production elsewhere.

It has been noted that an impediment to agricultural development on Maui, and throughout the State, is the scarcity of agricultural land, with irrigation water, that is both readily available and affordable for long-term lease to diversified farmers. The WCTs agricultural component includes nearly 1,077 acres of land that will remain in agricultural use. Of this land, approximately 800 acres will be permanently dedicated to agricultural use with no residential structures to be permitted. The remaining 277 acres may be subdivided into as many as five agricultural lots where a farm dwelling may be permitted. It is currently planned that a public and/or private agricultural park will be established within the agricultural preserve to help facilitate Maui's agricultural development. The establishment of a centrally located agricultural park within the reserve, with access to affordable irrigation water, should help Maui farmers develop economically viable farms that can compete in local, mainland and international markets.

The development of the WCT should also produce minimal impact to the County's potable ground waters. The use of any surface water or ground water will be in compliance with permits issued by the State Commission on Water Resources Mangement (CWRM). The pumpage from the wells will be well within the State ~~Commission on Water Resources Management's (~~CWRM's~~)~~ definition of the sustainable supply for the Waikapū Aquifer. In order to conserve potable water resources, non-potable wells have also been drilled and will be used for irrigation of WCTs parks, open space, residential and commercial lots, and agricultural operations. Moreover, the Project's wastewater will be reclaimed and used for

[31] Does not account for the release of an additional 33,000 acres from sugarcane resulting from the closure of HC&S. If these lands are added to the 64,150 acres released since 1987, then the subject development accounts for just 0.50 percent since 1987.

irrigation of the Agricultural Preserve and/or the Project's urban open spaces. Any source of water for the project will be developed and managed in a manner that complies with all State and County laws. In developing the property, BMPs will be incorporated to mitigate potential impacts to the State's freshwater and estuarine environment.

D. Commitment of State funds and resources;

Analysis:

Use of State or County funds could include some increase in funding for infrastructure and public facilities needed to service population growth. However, the Applicant anticipates funding the project's on-site infrastructure and contributing a pro-rata share towards off-site infrastructure and public facility costs directly attributable to the project as required by current state and county regulations. The project will also contribute to State and County revenues through payment of property taxes, impact fees, and general excise taxes from businesses within the WCT. A summary of revenues to the State and County are summarized below:

- The County of Maui will realize Real Property Taxes ($27.7 million) (~~$28.3 million~~), other secondary receipts, and impact fees of ~~$48.8~~ $47.9 million during the 15-year projection period (2016-2030), and ~~$5.0~~ $4.9 million annually on a stabilized basis thereafter. After new per capita costs for services are considered the County will earn a net "profit" $42.2 million during build-out and $4.2 million annually after stabilization. The WCT will also be providing approximately 32.5 acres of public park land within the project, of which at least 16.5 acres will be dedicated to the County.

- The State of Hawai'i will receive Gross Excise and Income taxes, secondary revenues, and impact fees of ~~$228.0~~ $95.94 million during the 2016-2030 period, and ~~$20~~ $4.4 million per year thereafter. Overall, after new per capita governmental costs are deducted, the State will generate net benefits of $82.6 million during build-out and $2.9 million annually on a stabilized basis. The State of Hawai'i will also receive a 12-acre elementary school site.

~~As is typical of a residential-focused master-planned community, with limited commercial components, and having a significant percentage of affordably-priced housing units for local families, the expense to the State and County from a "per capita basis" of all governmental operating costs perspective may exceed the specific on-site tax/fee revenue benefits. However, given~~ Given the existing emergency services and social services infrastructure available in nearby Wailuku and Kahului, the provision of a school site within WCT, payment of impact fees, and young age of the project components, it is ~~unlikely~~ likely the "actual" public cost burden associated with the Project would be less that the per capita assessment or independently require the need for major new public facilities. ~~exceed the revenues generated.~~ Further, the substantial benefits provided by expanding the island's housing and workforce housing inventory are primary social considerations beyond basic fiscal accounting.

E. Provision of employment opportunities and economic development; and

Analysis:

The WCT is expected to indirectly support Maui's existing economic base activities by providing much needed housing to serve the island's workforce. The WCT is intended to provide housing along with supporting commercial, employment and institutional uses that will allow for Maui's economic base industries to grow, diversify and become more sustainable - including the island's agricultural industry.

Moreover, the project will directly support Hawai'i's diversified agricultural sector by establishing an approximate 800-acre agricultural park on prime agricultural land that has access to readily available irrigation water. This centrally located agricultural park should help Maui's farmers better compete with mainland agricultural producers in Hawai'i's market while also creating opportunities to expand export crops.

As discussed in Section V.B.3-4 (Economy), the WCT will bring in ~~$609.1~~ $ 644.1 million of new capital investment into the Maui economy. The construction of the WCT components will directly create an estimated ~~2,320~~ 2,476 "worker-years" of employment (the equivalent of 52 work weeks at 40 hours per week) in the trades and associated businesses during

build-out, averaging about 165 Full Time Equivalent (FTE) per year for the 15 years of building. Most of these positions will not be new jobs for new businesses, but work flowing to existing contractors and suppliers. ~~positions 193 worker years annually, with an estimated $188.3 million in wages (averaging about $15.7 million per year).~~

The 169,000 square feet of new commercial operation will generate some 4,251 FTE worker years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions. These jobs will be new positions in the Maui economy. This total does not include the employment, wages or business activity contributions of the existing 29,250 square feet of commercial space in the Maui Tropical Plantation which will be retained.

The Project will require an estimated 66 worker years of maintenance and common area element employment on a continual basis, and will generate some 1,750 1,789 worker years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions. In aggregate, during the development of the WCT 8,750 8,946 worker years of employment will be created during construction and operations, on-site/direct and off-site/indirect, with stabilized employment after completion of 746 jobs. During the 15 years projection period, WCT will have a base economic impact on Maui of some $817.1 million in new monies with a stabilized annual benefit of $32.1 million thereafter.

~~The on-going operations and maintenance of the business commercial and residential components will directly provide an estimated 4,251 FTE worker years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions. The Project will require an estimated 66 worker years of maintenance and common area element employment on a continual basis, and will generate some 1,750 worker years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions.~~

~~In aggregate, during the development of the WCT 8,750 worker years of employment will be created during construction and operations, on-site/direct and off-site/indirect, with stabilized employment after completion of 746 jobs. During the 15 years projection period, WCT will have a base economic impact of $1.3 billion with a stabilized annual benefit of $137.3 million thereafter.~~

By providing much needed housing in a format that will create a high quality of life for Maui's working families, and generating both short- and long-term employment in the construction, trade and agricultural industries, the project is directly supportive of the County's economic development.

F. Provision for housing opportunities for all income groups, particularly the low, low-moderate, and gap groups; and

Analysis:

According to the Project's Market Study, (See Appendix A) it is estimated that in 2021 there will be a shortfall in housing supply of between 2,351 to 9,518 new residential units; with a mid- point under-supply of 5,935 units. The subject project will be a significant contributor to the Central Maui market, helping to address demand for housing. The Market Study also estimates that approximately 75 percent of the demand for resident housing in the Wailuku-Kahului Study Area will be for units with a current price of $660,000 or less; the upper-price threshold for meeting County affordability standards at 160 percent of median household income, with 30 percent of demand for units having a current price of less than $330,000 (the 80 percent of median household income threshold).

The WCT's country-town and mixed-use development concept will provide additional housing opportunities for Central Maui residents. The Project's homes will all be located within a 5-minute bicycle ride or walk to jobs and services within the project area and also conveniently located by transit to the region's employment centers in Wailuku-Kahului and South Maui. The WCT will offer a mix of single and multi-family housing types to address the diverse housing needs of Maui residents. The Project will comply with the County's workforce housing ordinance, which will require that between twenty and twenty-five percent of the Project's housing be sold to low, low-moderate and gap groups in accordance with sales price and resale restrictions enumerated in Chapter 2.96, MCC. The Applicant expects that in consideration of the project's Central Maui location, master plan layout and the types of housing to be built, that the Project's market priced housing would be in demand at prices deemed affordable to Maui County residents earning between 100 and

140 percent of the County's median income as determined by the United States Department of Housing and Urban Development. Housing types are expected to include multi-family condominiums, small cottage homes on small lots with common open spaces, 'Ohana dwellings, traditional single-family lots within a variety of home and lot size configurations, rental apartments, townhomes and larger estate rural lots. The goal is to serve the demands of all Maui residents.

4. ***In establishing the boundaries of the districts in each county, the commission shall give consideration to the general plan, and community, development, or community development plans of the county in which the land is located;***

Analysis:

The WCT is consistent with the goals, objectives and policies of the MIP and the Wailuku-Kahului Community Plan (**See**: Section VII.H.1-3). A Community Plan Amendment will be requested to bring the WCT project area into a Community Plan designation that better aligns with the WCTs goals and objectives.

5. ***The representations and commitments made by the petitioner in securing a boundary amendment, including a finding that the petitioner has the necessary economic ability to carry out the representations and commitments relating to the proposed use or development; and***

Analysis:

The representations and commitments made by the petitioner are in the Applicant's Petition for District Boundary Amendment (Docket No. A15-798). Copies of the Applicant's petition were served upon the parties required by law in April 2015.

6. **Lands in intensive agricultural use for two years prior to date of filing of a petition or lands with a high capacity for intensive agricultural use shall not be taken out of the agricultural district unless the commission finds either that the action:**

(A) Will not substantially impair actual or potential agricultural production in the vicinity of the subject property or in the County or State; or

Analysis:

The ~~DEIS~~ FEIS includes an Agricultural Impact Assessment (See: Section V.A.7 and Appendix G). The Project will result in the urbanization of approximately 485 acres of ALISH designated prime agricultural land. However, in the context of the availability of agricultural lands statewide and on Maui, the land proposed for urbanization represents a very small percentage of the lands available. There are approximately 2 million acres in the State Agricultural District. The subject development represents just .024% of this area. On Maui, there are approximately 82,582 acres of agricultural lands rated by the LSB as A, B, or C. The subject development represents just 0.59% of these lands. Within Maui County, approximately 64,150 acres has been released from crop production since 1987. The subject development represents just 0.76% of these lands.[32] Moreover, in January 2016 HC&S announced that its sugar plantation on Maui would be closed after a final harvest. This event will release approximately 33,000 acres from sugarcane production, which will dramatically increase the supply of land available for diversified agriculture.

Thus, the urbanization of the subject 485 acres should have minimal long-term impact on the availability of agricultural land within the County and/or State since an abundance of other land, of a similar or higher quality, is currently fallow and available for production elsewhere. In addition, the WCT's agricultural component includes nearly 1,077 acres of land that will remain in agricultural use. Of these lands, approximately 800 acres will be permanently dedicated to agricultural use with no residential structures to be permitted. The remaining 277 acres may be subdivided into as many as five agricultural lots where a farm dwelling may be permitted. Within the agricultural lands, several hundred acres may be developed as a public and/or private agricultural park to help facilitate Maui's agricultural development.

There are currently four ~~three~~ commercial farms farming MTP lands. These include Kumu Farms, Hoaloa Farms, Makani Olu Ranch, and Beef and Bloom. ~~Hawai'i Taro LLC, and HC&S.~~ The

[32] Does not account for the release of an additional 33,000 acres from sugarcane resulting from the closure of HC&S. If these lands are added to the 64,150 acres released since 1987, then the subject development accounts for just 0.50 percent since 1987.

proposed urbanization will require both Kumu Farms and Hoaloa Farms ~~Hawai'i Taro~~ to relocate their agricultural operations to the proposed agricultural park and other suitable agricultural lands within the project. ~~The project will also impact a portion of the current lands being leased by HC&S. It is anticipated that these lands will gradually begin to be impacted in about three to five years. Over the long-term, HC&S may lose approximately 330 acres to urbanization and up to additional acres to the private agricultural park. According to HC&S General Manager, Mr. Rick Volner, HC&S would desire to continue farming its MTP lands to maximize its current economy of scale in production. However, Mr. Volner acknowledged that HC&S has additional lands available that are currently fallow and that urbanization of a portion of its MTP leased lands will not significantly impact the Plantation's long-term economic viability.~~

The Agricultural Impact Assessment (Appendix G) notes that a significant impediment to agricultural development on Maui, and throughout the state, is the scarcity of agricultural land, with irrigation water, that is both readily available and affordable for long-term lease to diversified farmers. The establishment of a centrally located 800-acre agricultural reserve, comprising productive lands, affordable irrigation water and close proximity to inter-island and mainland shipping opportunities, should help Maui farmers compete in local, mainland and international markets.

The subject land was placed into an Urban Growth Boundary during the General Plan 2030 update, when other overriding factors were present. These factors included the forecasted demand for additional urban lands to accommodate projected population growth and housing demand, the development suitability of the subject land, as well as its proximity to existing employment, infrastructure, public facility systems and existing urban development. Moreover, as documented in the Agricultural Impact Assessment (Appendix G), the urbanization of the subject lands will not significantly impact the future viability of the sugar or pineapple industries or the growth of diversified agriculture on Maui or throughout the State.

The proposed action has been carefully analyzed for its short- and long-term impacts upon the agricultural industry. While the proposed action will result in the loss of prime agricultural lands, it will not significantly impact the short- or long-term viability of agriculture in Hawai'i since an abundance of currently fallow former sugar and pineapple land is currently available

elsewhere. The project will, however, help to address the current shortage of agricultural park lots by establishing a new private and/or public agricultural park within Central Maui.

B) Is reasonably necessary for urban growth; and

Analysis:

In December, 2012, the County of Maui adopted the MIP. The MIP establishes goals, objectives, policies and actions to direct growth and development on Maui through the year 2030. The MIP was based upon a comprehensive analysis of population growth, economic conditions, development capacity of existing entitled lands, and extensive community outreach.

The MIP's Directed Growth Plan places 502 acres of the Project's 1,576 acres into the MIP's Small Town and Rural Growth Boundaries. The MIP keeps the remaining 1,074 acres within the State's Agricultural District. The MIP allocates 1,433 residential units, plus or minus 10 percent, to the WCT Planned Growth Area together with supporting commercial, employment and civic uses. Additional units may be permitted if they are "Ohana" units or are constructed as affordable housing in excess of what is required for the project.

A market study was conducted for the project by The Hallstrom | CRBE and is included in Appendix A. The market study forecasts demand for residential development within Wailuku-Kahului through the 2035 planning horizon.

According to the Market Study, it is estimated the demand for new residential units in the Wailuku-Kahului study area will be from 9,647 to 16,814 units over the next 21 years (through 2035); including allowances for non-resident purchasers and vacancies, with a mid-point demand of 13,230 units. The number of existing unsold and planned resident housing units within the regional "Directed Growth Boundary of the MIP", excluding the proposed WCT product, totals some 7,296 units. This indicates there will be a shortfall in the sector of from 2,351 to 9,518 new residential units; with a mid- point under-supply of 5,935 units. Thus, sufficient unmet demand should exist to readily absorb the 1,433 units of subject inventory during the projection period.

The median price for a single family home in Central Maui (which includes many smaller, older homes/units) during the first half of 2015 was $507,300 and at $308,750 for a multifamily unit. Both indicators show meaningful appreciation since prices reached a post-recessionary nadir in 2011. Median prices are anticipated to increase into the long-term as thousands of higher priced new units manifesting the higher costs of land, construction, impact fees and entitlement, are added to the inventory, and appreciation (though cyclical) continues.

Based on the limited availability of alternative Central Maui supply relative to demand and the favorable competitive characteristics of the subject location/community, it is estimated that the 1,433 proposed residential units of WCT will require about 10 years to be fully absorbed following anticipated commencement of sales in 2017, or at an average rate approaching 150 units annually. This represents only some 20 percent of total regional mid-point demand during the sales period; a moderate perspective which could readily be swifter if some proposed projects fail to reach fruition and the market standing of WCT achieves expectations.

It is estimated the demand for neighborhood commercial space by WCT residents and day workers at build-out will be some 85,100 square feet, with patronage by guests in the community, other Waikapū households, and passerby contributing an additional 34,000 square feet of demand on a stabilized basis. The remaining 50,500 square feet (of the total 169,600 square feet proposed) will be modestly absorbed over-time with specialized/niche businesses, many with cross-over appeal to residents and visitors, and keeping with the small town context. It is estimated that it will require about 12 years for the WCT commercial space to be fully absorbed.

The WCT proposes the development of up to 1,433 residential dwelling units <u>plus as many as 146 Ohana units</u> targeted at the full spectrum of workers in the development. Homes will be priced for a range of consumer groups, including workforce affordable homes in compliance with Chapter 2.96 MCC (Residential Workforce Hosing Policy). All workforce affordable homes will be priced and subject to restrictions in accordance with the requirements of Chapter 2.96, MCC. A key Project objective is to also develop a significant percentage of the market priced housing in a manner that will make it affordable to residents earning between 80 and 140 percent of the median income. Therefore, the market priced units will include for sale and rental housing in a variety of configurations including ‘Ohana units, granny flats, cottage

dwellings, multi-family dwellings, small lot single-family dwellings, townhomes and larger single-family and rural lots.

c) Amendments of a land use district boundary in conservation districts involving land areas fifteen acres or less shall be determined by the commission pursuant to this subsection and section 205-3.1, HRS.

Analysis:

Not Applicable

d) Amendments of land use district boundary in other than conservation districts involving land areas fifteen acres or less shall be determined by the appropriate county land use decision-making authority for the district.

Analysis:

Not Applicable

e) Amendments of a land use district boundary involving land areas greater than fifteen acres shall be determined by the commission, pursuant to this subsection and section 205-3.1, HRS.

Analysis:

In accordance with Section 205-3.1, HRS and Subsection 15-15-77, HRS, the Applicant has filed a Petition for District Boundary Amendment (Docket No. A-15-798).

Section 15-15-18, Hawai'i Administrative Rules

The proposed boundary reclassification is consistent with the following standards of the Urban District, Sec 15-15-18, Hawai'i Administrative Rules:

1. It shall include lands characterized by "city-like" concentrations of people, structures, streets, urban and other related land uses.

Analysis:

The Project Area is bound to the north by the town of Waikapū, which has an existing development pattern of single-family residential and rural lots, with a population of approximately 2,695 residents (Maui County Data Book, 2012). Waikapū is serviced by urban levels of State, County and Privately-owned infrastructure systems, including water, wastewater, electric utilities and roadways. Waikapū's public facilities (police, fire, education and medical) are provided from Wailuku-Kahului. Wailuku is located approximately three miles to the north of Waikapū. Kahului's commercial core is located approximately four miles to the north-east. Each town is readily accessible by existing County and State roadways and the County's public transit system.

Abutting the eastern boundary of the project are lands recently acquired by the County of Maui. Approximately 100 acres is planned for County facilities including offices, baseyards and a regional fire station. Just to the east of the County parcel, and about 0.5 miles from the northeast corner of the WCT, are lands that comprise the Wai`ale community. Wai`ale is a proposed A&B project that encompasses approximately 545 acres and will include 2,550 homes and nearly 39-acres of commercial and light industrial uses, parks and schools. The County also owns approximately 309-acres abutting the 100-acre government campus that it intends to develop as a region serving park facility.

To the west of the WCT are the West Maui Mountains, which will remain undeveloped. To the south of the project site is the existing King Kamehameha Golf Club. Lands encircling and mauka and makai of the golf course are located with the MIPs Rural Growth Boundary and are within the State Land Use Agricultural District. To the south of the WCTs proposed urban and rural lands is the 800-acre agricultural preserve. The agricultural preserve is intended to be used for agricultural development, but will also serve as a permanent open space separation between Waikapū and the small coastal community of Mā'alaea.

The Waikapū area is an evolving community. The immediate area has seen several new housing developments built-our over the prior decade. These subdivisions have predominantly served the local market rather than off-shore buyers. With the planned development of Wai`ale and the WCT, Waikapū will evolve to become a more complete community, supportive of "city-like" concentrations of people, structures, public facilities, infrastructure and services. However, the

development of the WCT will be done in a manner that is characteristic of the country town and village concept, but one in higher densities promote efficiency of land use, housing affordability and increased non-motorized connectivity between land uses.

2. It shall take into consideration the following specific factors:

(A) Proximity to centers of trading and employment except where the development would generate new centers of trading and employment;

Analysis:

The project area is located in close proximity to Wailuku-Kahului, which is the island's largest population and employment center. In 2010 the region's population was approximately 53,456, which represented about 37% of the island's 2010 population of 144,444. In 2010, Wailuku-Kahului was also the island's largest employment center with 32,898 jobs, or approximately 53.6% of all jobs on the island.

Wailuku serves as Maui's civic center. Most State and County offices are located in Wailuku, along Main and High Streets. The Wailuku Police Station, which services Central and Upcountry Maui, is located in Wailuku as is the Maui Memorial Hospital. The island's only State Correctional Facility, Maui Community Correctional Center (MCCC), is also located in Wailuku, along Wai`ale Road. A small "main street" commercial district that dates to the 1880s is located in Wailuku along Main, Market, Vineyard and Church Streets. The district supports a mixture of office, retail and restaurant space, which housing in close proximity.

Kahului is home to the island's only major airport and commercial harbor and the 78-acre University of Hawai'i Maui College, which offers Associate, Bachelor and Master Degree programs to more than 4,400 full- and part-time students. Several "Big Box" retail stores are located in Kahului, including Costco, Walmart, Lowes, Target, K-Mart and Home Depot. Both Wailuku and Kahului have extensive commercial, industrial districts and governmental facilities that generate the majority of the island's employment.

The WCT is not envisioned to become a major regional center of trading and employment. However, the project will incorporate sufficient commercial and employment uses to create

diverse on-site employment opportunities and to offer residents commercial and retail services, which will make the community a more convenient place to live, while also reducing automobile dependency.

(B) Availability of basic services such as schools, parks, wastewater systems, solid waste disposal, drainage, water, transportation systems, public utilities, and police and fire protection; and

Analysis:

Basic public services and facilities, such as transportation systems, water, drainage and public utility hook-ups are available in close proximity to the WCT.

As documented in Section V.D.4 (Water), the WCT has developed three on-site potable wells and two on-site non-potable wells. Both of the non-potable wells have preliminarily shown low salinity levels, and testing is being conducted to determine the viability of those wells for domestic use. If not viable for domestic use, they will be used for non-potable agricultural use. Water pumped from the non-potable wells will be discharged into the Waihee Ditch or lined onsite reservoirs and used for irrigation purposes for the residential lots, agricultural farming, parks and open areas. A sixth well also exists to be used for monitoring. ~~to meet the Project's water demand~~. Development of these wells is being done with input from the County's Department of Water Supply and the State Commission on Water Resources Management (CWRM). The Applicant proposes to supply the Project's potable water demand through its on-site wells, which will draw from the Waikapū Aquifer. It is expected that the WCT water system will have sufficient capacity to accommodate the project and other potable water needs within the area. The Applicant proposed to meet its non-potable water demand for agriculture and irrigation of parks and open space through a combination of surface water provided from the Waihee Ditch system (subject to the issuance of surface water use permits from the CWRM), non-potable agricultural wells, and reclaimed wastewater.

As described in Section V.D.5 of the ~~DEIS~~ FEIS, the Applicant proposes ~~proposed~~ to develop an on-site wastewater reclamation facility to treat the Project's wastewater. Reclaimed wastewater will be treated to R-1 standards and the recycled water will be used for irrigation of

the Project agricultural lands and urban landscapes. ~~the WCT has several wastewater treatment options that are currently being evaluated. These include connecting to the County's Kahului Wastewater Reclamation Facility (KWWRF) for the initial 650 residential units, subject to the developer making off-site improvements to increase capacity of the transmission system. The remaining units would be serviced by a new wastewater treatment facility developed in association with the County of Maui and other nearby developers or by a package treatment plant designed to just serve the WCT community.~~

The County of Maui currently provides solid waste disposal service to single-family residences in the area. The WCT is also adjacent to Honoapi'ilani Highway, a major roadway connecting Central Maui with South and West Maui. Honoapi'ilani Highway and the County's proposed Wai`ale Bypass Road provide convenient access from the WCT to Wailuku and Kahului.

There are schools and several parks located in close proximity to the WCT, including the Waikapū Community Center, which is within walking and bicycling distance of the Project. The Wailuku Heights Park, Wailuku Elementary School Park, Wailuku Gymnasium and Wells Park complex are all within a short drive of the project area. The proposed 209-acre County of Maui regional park and the State's proposed Central Maui Regional Sports Complex will be within walking and bicycling distance and a short vehicular commute of the project area. It should be noted that the WCT will also include a number of open space and park areas, which will help to mitigate vehicular traffic to and from the subject property and will also provide amenities to existing Waikapū residents.

The State Department of Education's public school system in the vicinity of Waikapū includes the Wailuku Elementary School, ʻĪao Intermediate School and Baldwin High School. In addition, a future intermediate school is planned at Wai`ale and an elementary school is planned at the WCT. These two future schools will be within walking and bicycling distance of WCT and Wai`ale residents.

Police protection for the Waikapū area is provided by the Police Department's Central Maui Station, which is located approximately 3 miles from the WCT. Fire protection is currently provided by the Wailuku Station, which is also located approximately 3 miles from the project

area. However, a future regional fire station is proposed in Waikapū, on lands recently acquired by the County for government facilities. As such, the proposed development will not result in any extension of the existing service area limits for these emergency services.

(C). Sufficient reserve areas for foreseeable urban growth.

Analysis:

The WCTs developed project area is proposed to be about 499 acres. Significantly, all of the Project Area is within the MIPs "Small Town" growth boundary. The MIP directs 1,433 residential units, plus or minus 10 percent, to the subject property. Moreover, the Plan recommends that the project area be built at a net residential density of about 9 to 12 dwelling units per acre. The MIPs directed growth strategy is intended to allocate sufficient land area to accommodate the island's projected population growth through 2030. The MIPs Directed Growth Plan prescribes a regional framework for accommodating future urban and rural development. Theme Four of this framework describes how growth will take place within urban boundaries. It states:

> *Maui's future growth will be accommodated largely within UGBs. These boundaries will encompass higher density mixed-use infill development, planned urban expansion, and the creation of new, self-sufficient towns. A primary objective of the Directed Growth Plan is to ensure that our urban communities offer a high quality of life.*
>
> *Designing pedestrian-oriented communities with a mix of uses to sustain daily needs and close to places of employment makes for a more vibrant and livable environment. Providing parks and open space, tree lined roadways, and easy connections to the natural and built environment are necessary to promote health and well-being.*
>
> *Beyond our urban boundaries, working agricultural landscapes, natural wildland areas, and undeveloped shorelines and beaches are vitally necessary to provide a sense of refuge and escape from the stresses of urban life.*

With the requested District Boundary Amendment the WCT will have sufficient urban lands to accommodate the land uses proposed in the WCT Master Plan. Importantly, WCTs Master Plan was developed with the goal of addressing the key goals, objectives and policies of the MIP and Wailuku-Kahului Community Plan.

3. It shall include lands with satisfactory topography, drainage, and reasonably free from the danger of any flood, tsunami, unstable soil condition, and other adverse environmental effects.

Analysis:

The elevation on the mauka development site ranges from approximately 350 feet above mean sea level at its southeasterly corner to approximately 710 feet above mean sea level at its northwesterly corner, with a slope averaging approximately 8%. The elevation on the makai development site ranges from approximately 256 feet above mean sea level at a low point along the southerly border to approximately 408 feet above mean sea level at the northwesterly corner, with a slope averaging approximately 4%. The land within the agricultural preserve will remain undeveloped.

There are three soil series and seven soil types within the area proposed for development. The topography is gentle to moderately sloping, and the soil series are highly suited for urban development.

A portion of TMK Parcel Nos. 3-6-002:003 and 3-6-004:003, paralleling the Waikapū Stream, are located in Zones AEF and AE and XS. Zones AEF and AE are Special Flood Hazard Areas subject to inundation by the 1% annual chance flood. Zone AEF is defined as the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE. Zone AE is an area where the base flood elevation has been determined. The project area located adjacent to the Waikapū Stream, within the Special Flood Hazard Area, is proposed to be set aside for parks, open space and agriculture. No structures will be will be located within Zone AEF.

4. Land contiguous with existing urban areas shall be given more consideration than non-contiguous land, and particularly when indicated for future urban use on state or county general plans.

Analysis:

The WCT Project Area is bound on the north by the town of Waikapū, which is an existing community of single-family residential subdivisions. To the east are State Agricultural Lands. These lands were acquired by the County of Maui for the purpose of developing government facilities and a regional park, which are urban uses. Abutting these lands is the proposed Wai`ale development, which will encompass up to 2,550 homes and supporting commercial, institutional and recreational uses when fully developed. To the west are State Agricultural and Conservation District lands that form the valleys and slopes of the West Maui Mountains. To the South is the King Kamehameha Golf Course. The lands abutting the King Kamehameha Golf course are within the MIPs Rural Growth Boundary. These lands will likely be developed as 2-acre lots fronting the golf course. The WCTs 800-acre agricultural preserve also abuts the southern boundary of the project site, creating long-term opportunities for agricultural development and establishing a permanent green open space separation between the towns of Waikapū and Mā‘alaea.

Thus, the project area is contiguous to existing urban development on its northern boundary. It will be contiguous to future urban development on its eastern boundary. An existing golf course, rural and agricultural lands are contiguous to the Project's southern boundary. Agricultural and conservation lands are contiguous to the western boundary.

5. It shall include lands in appropriate locations for new urban concentrations and shall give consideration to areas of urban growth as shown on the state and county general plans or community plans or development plans.

Analysis:

The Project Area is located within the MIPs Small Town Growth Boundary, with an allocation of 1,433 residential units, plus or minus ten percent, and an average density guideline of 9 to 12 units per acre. The Project Area is proximate to Wailuku-Kahului, which is the island's primary

civic and employment center and supports an urban level of infrastructure and public facilities including schools, parks, police and fire support services. Moreover, the Project Area is characterized by topography and soils that are highly suited for development and the project site is not significantly constrained by the presence of sensitive environmental or cultural resources.

6. May include lands which do not conform to the standards in paragraphs (1) to (5):

(A) When surrounded by or adjacent to existing urban development; and

(B) Only when those lands represent a minor portion of this district;

Analysis:

While the Applicant believes the Agricultural land conforms to the standards in paragraphs (1) to (5) of HAR § 15-15-18, it is significant to note that the Agricultural land is immediately adjacent to existing urban development such as Waikapū Town. In addition, the Project Area is abutting County land that will be developed for public facilities, such as a region serving fire station, a regional park and government offices and baseyard facilities. These are urban uses that will require urban infrastructure and services to support them. In addition, the Wai`ale community is proposed on lands about one-half mile to the east of the Project Area. It is expected that the Wai`ale and WCT communities will be designed in a manner that will allow for safe and convenient pedestrian and bicycle connectivity to shared facilities like parks and schools as well as commercial areas that may be used by residents of each community.

Because of the WCTs proposal to create an 800-acre agricultural preserve, together with an additional 277 acres that will be kept in agriculture with very limited subdivision potential, it is expected that agriculture will be a significant economic and cultural driver of the WCT community into the foreseeable future.

It can be reasonably concluded that any potential impact to agriculture resulting from the Project is significantly outweighed by the benefits of the proposed development, including:

- The Applicant's proposal to dedicate 800-acres of agricultural land in perpetuity for agricultural development and limit subdivision potential on another 277 acres;
- The designation of the project site as a Planned Growth Area in the MIP;

- The project site's proximity to existing and planned urban development;
- The project site's high suitability for urban development because of its favorable topography and soils; and
- The need for additional urban land to accommodate the projected housing demand through 2030.

7. It shall not include lands, the urbanization of which will contribute toward scattered spot urban development, necessitating unreasonable investment in public infrastructure or support services.

Analysis:

Urbanization of the subject property will not contribute to scattered spot urban development. The subject property is located adjacent to, and will become part of, the existing and future urban uses proposed in the area.

Moreover, the WCT will not necessitate unreasonable public investment in infrastructure facilities or public services. The Applicant will be engaging in infrastructure improvements to mitigate any potential impacts of the proposed development.

8. It may include lands with a general slope of twenty per cent or more if the commission finds that those lands are desirable and suitable for urban purposes and that the design and construction controls, as adopted by any federal, state, or county agency, are adequate to protect the public health, welfare and safety, and the public's interests in the aesthetic quality of the landscape.

Analysis:

Not Applicable.

The proposed boundary reclassification is consistent with the following standards of the Rural District, Sec 15-15-21, Hawai'i Administrative Rules:

1. Areas consisting of small farms; provided that the areas need not be included in this district if their inclusion will alter the general characteristics of the areas;

Analysis:

The approximate 149.85-acres proposed for the Rural District is intended to serve as a buffer between the WCTs residential uses on the mauka side of Honoapi'ilani Highway and the WCTs agricultural lands to the west and south. The Rural site plan was designed using Conservation Subdivision Design (CSD) techniques to cluster the rural residences and preserve open land for community gardening, grazing of livestock or horses and open land recreation. There are two different sites proposed for rural development. Each site is mauka (west) of Honoapi'ilani Highway. There are 57.46 acres located mauka of the northwestern most residential lots. These lands are surrounded by agricultural lands to the west, north, and south. WCT urban lands will be abutting the eastern boundary of these rural lots.

The second rural area comprises approximately 92.39 acres and is located on the mauka development site, adjacent to single-family residences on the south side of the property. Of the 92.398 acres comprising this rural area, approximately 25-acres will remain in open space, or about 27 percent of the area. It is envisioned that this area will be used for community gardening, grazing of horses or cattle, open land recreation and open space. These rural lots will be adjacent to WCT urban lands to the north, Honoapi'ilani Highway and urban lands to the east, rural lands and the King Kamehameha Golf Course to the west, and the proposed agricultural preserve to the south. Each owner of a rural lot will be permitted to engage in agricultural activities and/or recreational gardening on their property, but commercial agriculture will not be a requirement of rural home owners.

The area proposed for rural development is currently in diversified agricultural use. Once developed, these existing agricultural uses will be relocated to the 1,077 acres of agricultural lands that will be abutting the WCT. The MIPs Directed Growth Strategy allocates 80-rural lots to the WCT in order to help address the demand for rural lots on Maui. Once the urban and rural lots are developed, the WCT will resemble an urban country-town village,

encircled by the West Maui Mountains and community gardens, small farms and diversified agricultural operations farming the abutting agricultural lands.

Rural home buyers will be informed of all applicable Right-to-Farm Laws and will be apprised of the potential for agricultural related impacts to their properties, including dust, noise, and odors from agricultural operations.

2. ***Activities or uses as characterized by low-density residential lots of not less than one-half acre and a density of not more than one single-family dwelling per one-half acre in areas where "city-like" concentration of people, structures, streets, and urban level of services are absent, and where small farms are intermixed with the low density residential lots; and***

   Analysis:

   The average rural lot is expected to be about .65 acres, or 27,878 square feet, which is greater than the one-half acre minimum lot size within the Rural District. As noted, the rural lots are intended to serve as a transition between the urban and agricultural lands and to compliment the diversity of housing types that will be offered by the project. Rural lots will comprise just 5.6 percent of the 1,433 residential units, but will create a more diverse settlement pattern to help serve the demand for large rural lots on Maui. While the rural lots will be proximate to urban levels of infrastructure and public services, the lots will be developed utilizing rural subdivision standards so as to maintain a more rural and agricultural sense of place in these areas. As noted, the MIPs Directed Growth Plan allocates 80-rural lots to the project area in order to help address the demand for these types of lots on Maui.

3. ***It may also include parcels of land which are surrounded by, or contiguous to this district, and are not suited to low-density residential uses for small farm or agricultural uses.***

   Analysis:

   The WCT will create a "complete community" integrating urban, rural and agricultural land uses into a unified whole. The lands to the north of the project site comprise the existing Waikapū town, which has already been developed with urban uses. To the east of the

project area are lands recently acquired by the County of Maui for governmental facilities and a regional park. The rural lands will be contiguous to the WCTs urban and agricultural lands.

B. HAWAIʻI STATE PLAN

Chapter 226, HRS, also known as the *Hawaiʻi State Plan*, is a long-range comprehensive plan that serves as a guide for the future long-range development of the State by identifying goals, objectives, policies, and priorities, as well as implementation mechanisms. As stated in Section 226-1,

> *The purpose of this chapter is to set forth the Hawaiʻi state plan that shall serve as a guide for the future long-range development of the State; identify the goals, objectives, policies, and priorities for the State; provide a basis for determining priorities and allocating limited resources, such as public funds, services, human resources, land, energy, water, and other resources; improve coordination of federal, state, and county plans, policies, programs, projects, and regulatory activities; and to establish a system for plan formulation and program coordination to provide for an integration of all major state, and county activities.*

Table 58 ~~52~~: Hawaiʻi State Plan, Chapter 226 – Part I. Overall Theme, Goals, Objectives and Policies

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
HRS 226-1: Findings and Purpose		
HRS 226-2: Definitions		
HRS 226-3: Overall Theme		
HRS 226-4: State Goals. In order to guarantee, for the present and future generations, those elements of choice and mobility that insure that individuals and groups may approach their desired levels of self-reliance and self-determination, it shall be the goal of the State to achieve:		
1. A strong, viable economy, characterized by stability, diversity, and growth, that enables the fulfillment of the needs and expectations of Hawaiʻi's present and future generations.		**S**
2. A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural		**S**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
	systems, and uniqueness, that enhances the mental and physical well-being of the people.	
	3. Physical, social, and economic well-being, for individuals and families in Hawai‘i, that nourishes a sense of community responsibility, of caring, and of participation in community life.	**S**
ANALYSIS: The WCT serves the above-referenced goals by creating both housing and employment for Maui residents, which will result in greater opportunity for self-reliance and self-determination. The project will demonstrate the benefits of a “complete community”, which among several benefits, includes the provision of a diverse range of housing types, commercial and civic uses inter-connected by vehicular, pedestrian and bicycle networks. The WCT is envisioned to be a more cohesive, livable and environmentally sustainable community than the more homogenous and automobile dependent communities that were built elsewhere in Hawai‘i and on the Mainland over the prior several decades.		
Chapter 226-5, HRS, Objective and Policies for Population		
Objective: It shall be the objective in planning for the state’s population to guide population growth to be consistent with the achievement of physical, economic and social objectives contained in this chapter.		
Policies:		**RATING**
(1) Manage population growth statewide in a manner that provides increased opportunities for Hawai‘i's people to pursue their physical, social, and economic aspirations while recognizing the unique needs of each county.		**S**
(2) Encourage an increase in economic activities and employment opportunities on the neighbor islands consistent with community needs and desires.		**S**
(3) Promote increased opportunities for Hawai‘i's people to pursue their socio-economic aspirations throughout the islands.		**S**
(4) Encourage research activities and public awareness programs to foster an understanding of Hawai‘i's limited capacity to accommodate population needs and to address concerns resulting from an increase in Hawai‘i's population.		**NA**
(5) Encourage federal actions and coordination among major governmental agencies to promote a more balanced distribution of immigrants among the states, provided that such actions do not prevent the reunion of immediate family members.		**NA**
(6) Pursue an increase in federal assistance for states with a greater proportion of foreign immigrants relative to their state's population.		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
	(7) Plan the development and availability of land and water resources in a coordinated manner so as to provide for the desired levels of growth in each geographic area. [L 1978, c 100, pt of §2; am L 1986, c 276, §4; am L 1988, c 70, §3; am L 1993, c 213, §3]	**S**
	ANALYSIS: In 2007 the County of Maui initiated the update of the 1990 General Plan to address County goals, objectives, policies and priority actions in the areas of population growth, housing, economic development, public infrastructure and facilities, the environment and cultural resources through 2030. The General Plan update resulted in the adoption of the *County-wide Policy Plan* in 2010 and the MIP (December 2012). Maui's first "Managed and Directed Growth Strategy" (MDGS) was a key element brought forth through the MIP effort. The MDGS attempts to balance the demand for more housing and economic development with the desire to protect and maintain the island's sense of place, environmental and cultural resources. The MIP designated the WCT property as a "Planned Growth Area". Planned Growth Areas receive an allocation of housing and supporting land uses in order to accommodate the island's future needs. In this sense, the project is directly supportive of policies 1, 2, 3 and 7.	
	Chapter 226-6, HRS, Objectives and Policies for the Economy – in General	
	Objectives: Planning for the State's economy in general shall be directed toward achievement of the following objectives:	
	Objectives:	**RATING**
	(1) Increased and diversified employment opportunities to achieve full employment, increased income and job choice, and improved living standards for Hawai'i's people, while at the same time stimulating the development and expansion of economic activities capitalizing on defense, dual-use, and science and technology assets, particularly on the neighbor islands where employment opportunities may be limited.	**S**
	(2) A steadily growing and diversified economic base that is not overly dependent on a few industries, and includes the development and expansion of industries on the neighbor islands.	**S**
	Policies:	
	(1) Expand Hawai'i's national and international marketing, communication, and organizational ties, to increase the State's capacity to adjust to and capitalize upon economic changes and opportunities occurring outside the State.	**NA**
	(2) Promote Hawai'i as an attractive market for environmentally and socially sound investment	**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
activities that benefit Hawai'i's people.		
(3) Seek broader outlets for new or expanded Hawai'i business investments.		**NA**
(4) Expand existing markets and penetrate new markets for Hawai'i's products and services.		**NA**
(5) Assure that the basic economic needs of Hawai'i's people are maintained in the event of disruptions in overseas transportation.		**NA**
(6) Strive to achieve a level of construction activity responsive to, and consistent with, state growth objectives.		**S**
(7) Encourage the formation of cooperatives and other favorable marketing arrangements at the local or regional level to assist Hawai'i's small scale producers, manufacturers, and distributors.		**NA**
(8) Encourage labor-intensive activities that are economically satisfying and which offer opportunities for upward mobility.		**NA**
(9) Foster greater cooperation and coordination between the government and private sectors in developing Hawai'i's employment and economic growth opportunities.		**NA**
(10) Stimulate the development and expansion of economic activities which will benefit areas with substantial or expected employment problems.		**NA**
(11) Maintain acceptable working conditions and standards for Hawai'i's workers.		**NA**
(12) Provide equal employment opportunities for all segments of Hawai'i's population through affirmative action and nondiscrimination measures.		**NA**
(13) Stimulate the development and expansion of economic activities capitalizing on defense, dual-use, and science and technology assets, particularly on the neighbor islands where employment opportunities may be limited.		**NA**
(14) Encourage businesses that have favorable financial multiplier effects within Hawai'i's economy, particularly with respect to emerging industries in science and technology.		**NA**
(15) Promote and protect intangible resources in Hawai'i, such as scenic beauty and the Aloha Spirit, which are vital to a healthy economy.		**S**
(16) Increase effective communication between the educational community and the private sector to develop relevant curricula and training programs to meet future employment needs in general, and requirements of new, potential growth industries in particular.		**NA**
(17) Foster a business climate in Hawai'i-including attitudes, tax and regulatory policies, and financial and technical assistance programs--that is conducive to the expansion of existing		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
	enterprises and the creation and attraction of new business and industry. [L 1978, c 100, pt of §2; am L 1986, c 276, §5; am L 1988, c 70, §4; am L 1993, c 213, §4; am L 2009, c 167, §2]	

ANALYSIS: The WCT is intended to provide housing along with supporting commercial, employment and institutional uses that will allow for Maui's economic base industries to grow, diversify and become more sustainable - including the island's agricultural industry.

As discussed in Section V.B.3-4 (Economy and Project Induced Economic Impacts) the WCT development will bring in ~~$609.1~~ $644.1 million of new capital investment into the Maui economy. The construction of the WCT components will directly create an estimated ~~2,320~~ 2,476 "worker-years" of employment (the equivalent of 52 work weeks at 40 hours per week) in the trades and associated businesses during build-out, an average of 1`65 FTE positions per year for the 15 years of building. ~~averaging about 193 worker years annually, with an estimated $188.3 million in wages (averaging about $15.7 million per year).~~

The 169,000 square feet of new commercial operation will generate some 4,251 FTE worker years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions. These jobs will be new positions in the Maui economy. This total does not include the employment, wages or business activity contributions of the existing 29,250 square feet of commercial space in the Maui Tropical Plantation which will be retained.

The Project will require an estimated 66 worker years of maintenance and common area element employment on a continual basis, and will generate some 1,750 1,789 worker years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions. In aggregate, during the development of the WCT 8,750 8,946 worker years of employment will be created during construction and operations, on-site/direct and off-site/indirect, with stabilized employment after completion of 746 jobs. During the 15 years projection period, WCT will have a base economic impact on Maui of some $817.1 million in new monies with a stabilized annual benefit of $32.1 million thereafter.

By providing much needed housing in a format that will create a high quality of life for Maui's working families, and generating short- and long-term employment in the construction, trade and agricultural industries, the project is directly supportive of policies 1, 2, 6, and 15.

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
	~~The on-going operations and maintenance of the business commercial and residential components will directly provide an estimated 4,251 FTE worker-years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions. The Project will require an estimated 66 worker years of maintenance and common area element employment on a continual basis, and will generate some 1,750 worker years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions.~~ ~~In aggregate, during the development of the WCT 8,750 worker years of employment will be created during construction and operations, on site/direct and off site/indirect, with stabilized employment after completion of 746 jobs. During the 15 years projection period, WCT will have a base economic impact of $1.3 billion with a stabilized annual benefit of $137.3 million thereafter.~~	
Chapter 226-7 Objectives and policies for the economy-agriculture.		
Objectives; Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:		
Objectives:		
(1) Viability of Hawai‘i's sugar and pineapple industries.		**NS**
(2) Growth and development of diversified agriculture throughout the State.		**S**
(3) An agriculture industry that continues to constitute a dynamic and essential component of Hawai‘i's strategic, economic, and social well-being.		**S**
Policies:		
(1) Establish a clear direction for Hawai‘i's agriculture through stakeholder commitment and advocacy.		**S**
(2) Encourage agriculture by making best use of natural resources.		**S**
(3) Provide the governor and the legislature with information and options needed for prudent decision making for the development of agriculture.		**NA**
(4) Establish strong relationships between the agricultural and visitor industries for mutual marketing benefits.		**NA**
(5) Foster increased public awareness and understanding of the contributions and benefits of agriculture as a major sector of Hawai‘i's economy.		**S**
(6) Seek the enactment and retention of federal and state legislation that benefits Hawai‘i's		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
agricultural industries.		
(7) Strengthen diversified agriculture by developing an effective promotion, marketing, and distribution system between Hawai'i's producers and consumer markets locally, on the continental United States, and internationally.		**S**
(8) Support research and development activities that strengthen economic productivity in agriculture, stimulate greater efficiency, and enhance the development of new products and agricultural by-products.		**NA**
(9) Enhance agricultural growth by providing public incentives and encouraging private initiatives.		**S**
(10) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.		**S**
(11) Increase the attractiveness and opportunities for an agricultural education and livelihood.		**S**
(12) Expand Hawai'i's agricultural base by promoting growth and development of flowers, tropical fruits and plants, livestock, feed grains, forestry, food crops, aquaculture, and other potential enterprises.		**S**
(13) Promote economically competitive activities that increase Hawai'i's agricultural self-sufficiency.		**S**
(14) Promote and assist in the establishment of sound financial programs for diversified agriculture.		**NA**
(15) Institute and support programs and activities to assist the entry of displaced agricultural workers into alternative agricultural or other employment.		**S**
(16) Facilitate the transition of agricultural lands in economically non-feasible agricultural production to economically viable agricultural uses. [L 1978, c 100, pt of §2; am L 1986, c 276, §6; am L 1993, c 25, §2; am L 2009, c 167, §3]		**S**

ANALYSIS: The ~~DEIS~~ FEIS includes an Agricultural Impact Assessment (**See**: Section IV.A.7 and Appendix G). The Project will result in the urbanization of approximately 485 acres of ALISH designated prime agricultural land. However, in the context of the availability of agricultural lands statewide and on Maui, the land proposed for urbanization represents a very small percentage of the lands available. There are approximately 2 million acres in the State Agricultural District. The subject development represents just .024% of this area. On Maui, there are approximately 82,582 acres of agricultural lands rated by the LSB as A, B, or C. The subject development represents just 0.59% of these lands. Within Maui County, approximately 64,150 acres has been released from

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING

crop production since 1987. The subject development represents just 0.76% of these lands.[33] Moreover, in January 2016 HC&S announced that its sugar plantation on Maui would be closed after a final harvest. This event will release approximately 33,000 acres from production, which will dramatically increase the supply of land available for diversified agriculture.

Thus, the urbanization of the subject 485 acres should have minimal long-term impact on the availability of agricultural land within the County and/or State since an abundance of other land, of a similar or higher quality, is currently fallow and available for production elsewhere. In addition, the WCT's agricultural component includes nearly 1,077 acres of land that will remain in agricultural use. Of these lands, approximately 800 acres will be permanently dedicated to agricultural use with no residential structures to be permitted. The remaining 277 acres may be subdivided into as many as five agricultural lots where a farm dwelling may be permitted. Within the agricultural lands, several hundred acres may be developed as a public and/or private agricultural park to help facilitate Maui's agricultural development.

There are ~~four~~ ~~three~~ commercial farms farming MTP lands. These include Kumu Farms, Hoaloa Farms, Makani Olu Ranch, and Beef and Bloom. ~~Hawai'i Taro LLC and HC&S~~. The proposed urbanization will require both Kumu Farms and Hoaloa Farms ~~Hawai'i Taro~~ to relocate their agricultural operations to the proposed agricultural park and other suitable agricultural lands within the project. ~~The Project will also impact a portion of the current lands being leased by HC&S. It is anticipated that these lands will gradually begin to be impacted in about three to five years. Over the long-term, HC&S may lose approximately 330 acres to urbanization and additional lands to the agricultural park. According to HC&S General Manager, Mr. Rick Volner, HC&S would desire to continue farming its MTP lands to maximize its current economy of scale in production. However, Mr. Volner acknowledged that HC&S has additional lands available that are currently fallow and that urbanization of a portion of its MTP leased lands will not significantly impact the Plantation's long-term economic viability.~~

The Agricultural Impact Assessment (Appendix G) notes that a significant impediment to agricultural development on Maui, and throughout the state, is the scarcity of agricultural land, with irrigation water, that is

[33] Does not account for the release of an additional 33,000 acres from sugarcane resulting from the closure of HC&S. If these lands are added to the 64,150 acres released since 1987, then the subject development accounts for just 0.50 percent since 1987.

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
readily available and affordable for long-term lease to diversified farmers. The establishment of a centrally located 800-acre agricultural reserve that consists of highly productive lands with access to affordable irrigation water and close proximity to inter-island and mainland shipping opportunities, should help Maui farmers compete in local, mainland and international markets. The subject land was placed into the Small Town Growth Boundary during the General Plan 2030 update, when other overriding factors were present. These factors included the forecasted demand for additional urban lands to accommodate projected population growth and housing demand, the development suitability of the subject land, as well as its proximity to existing employment, infrastructure, public facility systems and existing urban development. Moreover, as documented in the Agricultural Impact Assessment, the urbanization of the subject lands will not significantly impact the future viability of the sugar or pineapple industries or the growth of diversified agriculture on Maui or throughout the State. The proposed action has been carefully analyzed for its short- and long-term impacts upon the agricultural industry. While the proposed action will result in the loss of prime agricultural lands, it will not significantly impact the short- or long-term viability of agriculture in Hawai‘i since an abundance of currently fallow former sugar and pineapple land is currently available elsewhere. The project will, however, help to address the current shortage of agricultural park lots by establishing a new private and/or public agricultural park within Central Maui.	
Chapter 226-8 Objective and policies for the economy-visitor industry.		
Objectives: Planning for the State's economy with regard to the visitor industry shall be directed towards the achievement of the objective of a visitor industry that constitutes a major component of steady growth for Hawai‘i's economy.		
Policies:		
(1) Support and assist in the promotion of Hawai‘i's visitor attractions and facilities.		**NA**
(2) Ensure that visitor industry activities are in keeping with the social, economic, and physical needs and aspirations of Hawai‘i's people.		**NA**
(3) Improve the quality of existing visitor destination areas by utilizing Hawai‘i's strengths in science and technology.		**NA**
(4) Encourage cooperation and coordination between the government and private sectors in		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
developing and maintaining well-designed, adequately serviced visitor industry and related developments which are sensitive to neighboring communities and activities.		
(5) Develop the industry in a manner that will continue to provide new job opportunities and steady employment for Hawai‘i's people.		**S**
(6) Provide opportunities for Hawai‘i's people to obtain job training and education that will allow for upward mobility within the visitor industry.		**NA**
(7) Foster a recognition of the contribution of the visitor industry to Hawai‘i's economy and the need to perpetuate the aloha spirit.		**NA**
(8) Foster an understanding by visitors of the aloha spirit and of the unique and sensitive character of Hawai‘i's cultures and values. [L 1978, c 100, pt of §2; am L 1986, c 276, §7; am L 1988, c 70, §5; am L 2009, c 167, §4]		**NA**
ANALYSIS: The WCT is not targeting the visitor industry; however a small business hotel may be established as a permitted use within the project's mixed-use commercial district. Such a facility would only be proposed if it were considered economically viable and demand warranted its establishment. A business hotel would support Maui's economy and create additional employment in the visitor industry. Transient vacation rentals and timeshare units will be prohibited within the WCT; therefore these objectives and policies are not applicable. A limited number of B&B's may be permitted within certain areas of the WCT, if it is deemed that such uses would add economic vitality to the commercial core while not negatively impacting residential neighborhoods.		
Chapter 226-9 Objective and policies for the economy-federal expenditures.		
Objective: Planning for the State's economy with regard to federal expenditures shall be directed towards achievement of the objective of a stable federal investment base as an integral component of Hawai‘i's economy.		
Policies:		**RATING**
(1) Encourage the sustained flow of federal expenditures in Hawai‘i that generates long-term government civilian employment;		**NA**
(2) Promote Hawai‘i's supportive role in national defense, in a manner consistent with Hawai‘i's social, environmental, and cultural goals by building upon dual-use and defense applications to develop thriving ocean engineering, aerospace research and development, and related dual-use technology sectors in Hawai‘i's economy;		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
(3) Promote the development of federally supported activities in Hawai‘i that respect statewide economic concerns, are sensitive to community needs, and minimize adverse impacts on Hawai‘i's environment;		**NA**
(4) Increase opportunities for entry and advancement of Hawai‘i's people into federal government service;		**NA**
(5) Promote federal use of local commodities, services, and facilities available in Hawai‘i;		**NA**
(6) Strengthen federal-state-county communication and coordination in all federal activities that affect Hawai‘i; and		**NA**
(7) Pursue the return of federally controlled lands in Hawai‘i that are not required for either the defense of the nation or for other purposes of national importance, and promote the mutually beneficial exchanges of land between federal agencies, the State, and the counties. [L 1978, c 100, pt of §2; am L 1986, c 276, §8; am L 2006, c 65, §3; am L 2009, c 167, §5]		**NA**
ANALYSIS: The WCT is not expected to have a measurable impact on Federal expenditures to Hawai‘i.		
Chapter 226-10 Objective and policies for the economy-potential growth activities.		
Objective: Planning for the State's economy with regard to potential growth activities shall be directed towards achievement of the objective of development and expansion of potential growth activities that serve to increase and diversify Hawai‘i's economic base.		
Policies:		**RATING**
(1) Facilitate investment and employment growth in economic activities that have the potential to expand and diversify Hawai‘i's economy, including but not limited to diversified agriculture, aquaculture, renewable energy development, creative media, and science and technology-based sectors;		**S**
(2) Expand Hawai‘i's capacity to attract and service international programs and activities that generate employment for Hawai‘i's people;		**NA**
(3) Enhance and promote Hawai‘i's role as a center for international relations, trade, finance, services, technology, education, culture, and the arts;		**NA**
(4) Accelerate research and development of new energy-related industries based on wind, solar, ocean, and underground resources and solid waste;		**NA**
(5) Promote Hawai‘i's geographic, environmental, social, and technological advantages to attract new economic activities into the State;		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
(6) Provide public incentives and encourage private initiative to attract new industries that best support Hawai'i's social, economic, physical, and environmental objectives;		**NA**
(7) Increase research and the development of ocean-related economic activities such as mining, food production, and scientific research;		**NA**
(8) Develop, promote, and support research and educational and training programs that will enhance Hawai'i's ability to attract and develop economic activities of benefit to Hawai'i;		**NA**
(9) Foster a broader public recognition and understanding of the potential benefits of new, growth-oriented industry in Hawai'i;		**NA**
(10) Encourage the development and implementation of joint federal and state initiatives to attract federal programs and projects that will support Hawai'i's social, economic, physical, and environmental objectives;		**NA**
(11) Increase research and development of businesses and services in the telecommunications and information industries; and		**NA**
(12) Foster the research and development of non-fossil fuel and energy efficient modes of transportation. [L 1978, c 100, pt of §2; am L 1986, c 276, §9; am L 1988, c 70, §6; am L Sp 1988, c 1, §5; am L 2009, c 156, §2 and c 167, §6]		**NA**
ANALYSIS: The WCT is expected to indirectly support Maui's existing economic base activities by providing much needed housing to serve the island's workforce. Moreover, the project will directly support Hawai'i's diversified agricultural sector by establishing an approximate 800-acre agricultural preserve on prime agricultural lands with access to a reliable source of irrigation water. A centrally located agricultural park within the WCT will help Maui's farmers better compete with mainland agricultural producers in Hawai'i's market while also creating opportunities to expand exports to mainland and international markets.		
Chapter 226-10.5 Objectives and policies for the economy-information industry.		
Objective: Planning for the State's economy with regard to telecommunications and information technology shall be directed toward positioning Hawai'i as a leader in broadband communications and applications in the Pacific Region.		
Policies:		
(1) Encourage the continued development and expansion of the telecommunications infrastructure serving Hawai'i to accommodate future growth in the information industry;		**NA**
(2) Facilitate the development of new business and service ventures in the information industry		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
which will provide employment opportunities for the people of Hawai‘i;		
(3) Encourage greater cooperation between the public and private sectors in developing and maintaining a well- designed information industry;		**NA**
(4) Ensure that the development of new businesses and services in the industry are in keeping with the social, economic, and physical needs and aspirations of Hawai‘i's people;		**NA**
(5) Provide opportunities for Hawai‘i's people to obtain job training and education that will allow for upward mobility within the information industry;		**NA**
(6) Foster a recognition of the contribution of the information industry to Hawai‘i's economy; and		**NA**
(7) Assist in the promotion of Hawai‘i as a broker, creator, and processor of information in the Pacific. [L Sp 1988, c 1, §3; am L 2009, c 167, §7]		**NA**
ANALYSIS: The WCT will have minimal direct impact on Maui's telecommunications and information technology industries.		
Chapter 226-11, HRS, Objectives and Policies for the Physical Environment – Land Based, Shoreline, and Marine Resources		
Objectives:		RATING
(1) Prudent use of Hawai‘i's land-based, shoreline, and marine resources.		**S**
(2) Effective protection of Hawai‘i's unique and fragile environmental resources.		**S**
Policies:		
(1) Exercise an overall conservation ethic in the use of Hawai‘i's natural resources.		**S**
(2) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.		**S**
(3) Take into account the physical attributes of areas when planning and designing activities and facilities.		**S**
(4) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.		**S**
(5) Consider multiple uses in watershed areas, provided such uses do not detrimentally affect water quality and recharge functions.		**NA**
(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawai‘i.		**S**
(7) Provide public incentives that encourage private actions to protect significant natural resources		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
from degradation or unnecessary depletion.		
(8) Pursue compatible relationships among activities, facilities, and natural resources.		**S**
(9) Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes. [L 1978, c 100, pt of §2; am L 1986, c 276, §10]		**S**
ANALYSIS: The WCT is not located within the State's Special Management Area and no listed or endangered species of flora and fauna were identified on the property that will impact the development feasibility of the project site. During build-out and during the operations phase BMPs will be implemented to mitigate non-point source pollution to Maui's coastal resources as well as to mitigate fugitive dust impacts. In addition, through the EIS and entitlement application processes mitigation measures will be identified to help address any environmental impacts that may arise from the project. From a site planning perspective, the WCT Master Plan carefully considers the natural topography of the site and incorporates unique natural areas into parks and open spaces throughout the WCT. Proposed buildings will be incorporated into the natural topography of the property and building layout will be oriented to preserve view planes towards the Pacific Ocean, Haleakalā, and the West Maui Mountains.		
Chapter 226-12, HRS, Objective and Policies for the Physical Environment – Scenic, Natural Beauty, and Historic Resources		
Objective: Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawai'i's scenic assets, natural beauty, and multi-cultural/historical resources.		
Policies:		
(1) Promote the preservation and restoration of significant natural and historic resources.		**S**
(2) Provide incentives to maintain and enhance historic, cultural, and scenic amenities.		**NA**
(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.		**S & NS**
(4) Protect those special areas, structures, and elements that are an integral and functional part of Hawai'i's ethnic and cultural heritage.		**S & NS**
(5) Encourage the design of developments and activities that complement the natural beauty of the islands. [L 1978, c 100, pt of §2; am L 1986, c 276, §11]		**S**
ANALYSIS: As discussed in Section V.A.4 (Historical and Archaeological Resources) the Project's AIS documented no evidence of traditional Hawaiian activities, with the possible exception of a remnant retaining		

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING

wall or terrace (Site 7882) on the property. It was noted that the negative results are primarily due to the compounded disturbances from sugarcane cultivation, historic habitation and modern land use. Other historic features documented in the AIS primarily relate to plantation-era agricultural irrigation features, including a section of the Waihe`e Ditch that traverses north to south across the subject property mauka of Honapi'ilani Highway. The Waihe`e Ditch may by covered as part of the development for the purpose of reducing water loss through seepage, preventing potential liability once the project area is developed, making it easier and less costly to develop the project site, and to create a north-south pedestrian and bicycle corridor within the ditch right-of-way. The AIS concludes that the Waihe`e Ditch has been adequately recorded and that covering it will not significantly impact the State's archaeological resources. The AIS also recorded a World War II era bunker on the site. Policy 4 is checked as both a "Support" and "Not Support" because the project will have an adverse impact upon the Waihe`e Ditch and may also impact a WWII bunker, but proactive measures have also been taken to record these features in advance of their being impacted.

The AIS also recommends Archaeological Monitoring for those areas that contain former LCA's and Grants, as well as extant historic properties; however spot monitoring inspections of other localities not expressed above may also be instituted. In addition, archaeological monitoring is recommended in the areas that are in close proximity to Wai`ale and Waiko Roads. These areas are known to contain traditional and historic burials. Prior to the commencement of construction, an Archaeological Monitoring Plan (AMP) detailing the localities to undergo monitoring procedures will be prepared and submitted to SHPD for review and approval.

As discussed in Section V.A.5 (Cultural Resources) and in Appendix F (Cultural Impact Assessment) Waikapū has a long and rich cultural history and a strong representation of traditional cultural practices. The cultural practices and beliefs that are documented in the CIA include Hawaiian subsistence and residential agriculture on kuleana lands. These lands utilize the Waikapū Stream, which is a valuable cultural resource. Intricate irrigation systems built prior to western contact continue to be maintained and utilized. There are also on-going projects in the mauka portion of the Applicant's land that are being utilized for cultural site and native habitat restoration, while providing a traditional access point into the Waikapū Valley for gathering of lā'au lapa'au (medicinal plants) and native seed gathering. The traditional agricultural practices and cultural/natural site restoration projects have an important value to the native Hawaiian people, the Waikapū community, and other ethnic groups found in Hawai'i by enhancing cultural identity and well-being.

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING

There are also two kuleana lots privately owned by the Mahi family (LCAw: 2499, R.P. 4070 AP 1 &2 to Ehunui) and (Grant 1153 to Ehunui) that are situated within TMK: (2) 3-6-004:003. These kuleana parcels will remain in agricultural use and will not be subject to entitlement changes. The subject lots are identified as TMK: Nos. (2) 3-6-005:009 (0.06 acres) and TMK: (2) 3-6-005:010 (0.5 acres). The Mahi family would like to preserve their lands. In the oral interviews conducted during the CIA, the Mahi Family expressed a desire to keep these lands in their family while working with the developer to seek a solution that will benefit both parties.

The CIA also notes that there is a community desire to protect and restore the Waikapū Stream. Waikapū Stream is considered Waikapū's most valuable cultural resource. There is an established 100-foot riparian buffer along the stream as it traverses mauka to makai along the eastern edge of the project boundary. The WCT proposes agricultural, park and open space land uses along the stream corridor. The closest abutting urban land use is located approximately 100-feet away from the stream on the makai development site. The kuleana farmers that use the stream for crop cultivation continue to have discussions with the Applicant in order to establish a long term water use plan for both surface and groundwater.

As discussed in Section V.A.6 *(Visual Resources)* the WCT will have approximately 4,700 linear feet of urban and rural frontage along Honoapi'ilani Highway and 7,550 linear feet of agricultural frontage. The WCT will change the character of the existing open space, Haleakalā and West Maui Mountain views along the frontage of the Highway where urban and rural development is being proposed. The views in this area, where not currently obstructed by vegetation within the right-of-way, are of agricultural lands and the West Maui Mountain in the background looking in a mauka direction. Looking in a makai direction, where not obstructed by existing vegetation, views of sugarcane are prominent with Haleakalā and the Pacific Ocean in the background on clear days.

While the existing character of the open space, Haleakalā and West Maui Mountain views will be impacted by the development, setbacks of at least 60-feet, and in some areas up to 100-feet or more, will be utilized along each side of the Honoapi'ilani Highway to separate the development from the public right-of-way. In order to mitigate the obstruction of views from the highway to the West Maui Mountains, buildings will be setback from the highway and building heights will be limited to a maximum of 30-feet along the highway frontage.

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING

Buildings will also be separated, placed and oriented in a manner that will establish view corridors from the highway to the West Maui Mountains. Building setbacks and placement will help to mitigate the project's overall impact upon the existing views of Haleakalā and the West Maui Mountains.

While the development will produce an impact upon the character of views along Honoapi'ilani Highway, fronting the urban lands, the Applicant is also proposing to create a permanent 800-acre agricultural preserve that will exist on both the mauka and makai sides of Honoapi'ilani Highway. The preserve's frontage is approximately 7,550-feet along the highway. The approximate 800-acres of agricultural land will create a permanent open space buffer and permanent separation between Waikapū Town and Mā'alaea. Along this section of the highway, largely unobstructed views of Haleakalā, the West Maui Mountains and partial views of the Pacific Ocean will exist in perpetuity.

Within the setbacks along Honoapi'ilani Highway pedestrian and bicycle facilities are planned and landscape planting of canopy shade trees will be established. As is common throughout Hawai'i, and especially on Maui, the planting of large canopy Monkey Pod trees, tropical shrubs and ground covers will be maintained within the setbacks to create a sense of separation and definition between the urban development and the highway. Separated from the highway, an approximate 10-foot wide shared pedestrian and bicycle track will meander along the roadways frontage. The overall effect will be to create a greenway, with a variety of plant massing and color, and the presence of intermittent views of Haleakalā and the West Maui Mountains along the highway frontage of the development.

Within the project, roadways will also be aligned, where practical, to create mauka and makai view corridors. This opportunity exists at each entrance into the project site and along the internal roadways that travel from east to west. Within the project site, the WCT Master Plan will transform the current character of the MTP from a visitor oriented attraction to a park-like village center, with the existing lagoon, gardens, open spaces, shops, and restaurants coming together to create a unique sense of place. While the existing agricultural and open space ambiance of the lands abutting the MTP will be transformed into an urban settlement pattern, the WCT will maintain a rural and agricultural ambiance at its boundaries because of the preservation of the agricultural lands comprising the agricultural preserve.

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
The WCT Master Plan Design Guidelines will limit building heights, where necessary, in order to maintain views towards the summits of Haleakalā and the West Maui Mountains. Moreover, open space will be integrated throughout the Project and, together with the proposed street layout, will create and frame view corridors throughout the WCT to the Pacific Ocean, Haleakalā, and the West Maui Mountains. From an urban design perspective, the proposed project will complement the unique country-town architectural character that exists in Waikapū, Wailuku, Pāʻia, and Makawao. The WCT design guidelines will control the density, architectural design, and variation of all buildings in the WCT without sacrificing views or the aesthetic character of the development. The goals of the design guidelines will be to preserve views and maintain the aesthetic character of the community. A defining quality of the urban design character of the development will be to create architecturally pleasing streets, with landscape planting that will frame the travel ways and provide scale around architectural elements.		
Chapter 226-13, Hawaiʻi Revised Statutes, Objectives and Policies for the Physical Environment – Land, Air, and Water Quality		
Objectives:		
(1) Maintenance and pursuit of improved quality in Hawaiʻi's land, air, and water resources.		**S**
(2) Greater public awareness and appreciation of Hawaiʻi's environmental resources.		**S**
Policies:		
(1) Foster educational activities that promote a better understanding of Hawaiʻi's limited environmental resources.		**NA**
(2) Promote the proper management of Hawaiʻi's land and water resources.		**S**
(3) Promote effective measures to achieve desired quality in Hawaiʻi's surface, ground, and coastal waters.		**S**
(4) Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawaiʻi's people.		**S**
(5) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.		**S**
(6) Encourage design and construction practices that enhance the physical qualities of Hawaiʻi's communities.		**S**
(7) Encourage urban developments in close proximity to existing services and facilities.		**S**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
(8) Foster recognition of the importance and value of the land, air, and water resources to Hawai'i's people, their cultures and visitors. [L 1978, c 100, pt of §2; am L 1986, c 276, §12]		**S**

ANALYSIS: The WCT is not located within the State's Special Management Area and no listed or endangered species of flora and fauna were identified on the property that will constrain development of the site. During build-out and during the operation phase BMPs will be implemented to mitigate non-point source pollution to Maui's coastal resources as well as to mitigate fugitive dust impacts. In addition, through the EIS and entitlement application processes, mitigation measures will be identified to help address any environmental impacts that may arise from the project.

From a site planning perspective, the master plan design layout carefully considers the natural topography of the site and incorporates unique natural areas into parks and open spaces throughout the WCT. Proposed buildings are incorporated into the natural topography of the property and building layout is oriented to preserve view planes towards the Pacific Ocean, Haleakalā and the West Maui Mountains. Buildings will also be situated to take advantage of trade-winds for natural cooling and sunlight for natural lighting and photovoltaic power generation. Landscape planting of canopy shade trees along streets, within parking lots, and within the open space lands will provide shade and cooling. Non-potable water will be used for irrigation of the parks, common open space and of individual and commercial lots reducing the demand for potable water by at least one-third.

As discussed in Section V.A.2 (Air Quality), the WCT may create short term impacts on air quality directly and indirectly during construction; however mitigation measures will be implemented to control these impacts. It is anticipated that the WCT will not violate Federal or State air quality standards.

As discussed in Section IV.A.3 (Natural Hazards), the development of the WCT will not increase the possibility of natural hazards such as flooding, tsunami inundation, hurricanes and earthquakes. The WCT will be constructed in compliance with all County, State and Federal standards.

The WCT master plan incorporates Smart Growth, New Urbanism and Conservation Subdivision Design best practice to create a community that will be environmentally and socially sustainable. The Project incorporates

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
over eight miles of pedestrian and bicycle trails to link together the Project's residential neighborhoods, commercial districts, parks, schools and surrounding open lands. The Project is within close proximity of Wailuku-Kahului, which is Maui's primary civic and employment center. Reducing vehicular trips in favor of active transportation promotes better health and wellbeing, while also protecting the environment by reducing carbon based emissions.		
Chapter 226-14 Objective and policies for facility systems-in general.		
Objective: Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.		
Policies:		
(1) Accommodate the needs of Hawai'i's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.		**S**
(2) Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.		**NA**
(3) Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.		**S**
(4) Pursue alternative methods of financing programs and projects and cost-saving techniques in the planning, construction, and maintenance of facility systems. [L 1978, c 100, pt of §2; am L 1986, c 276, §13]		**NA**
ANALYSIS: The WCT will coordinate with State and County agencies to ensure the delivery of adequate public infrastructure and facility systems to the project's residents. The subject improvements will conform to State and County plans and be compliant with applicable State and County requirements.		
Chapter 226-15, Hawai'i Revised Statutes, Objectives and Policies for Facility Systems - Solid and Liquid Waste.		
Objectives:		
(1) Maintenance of basic public health and sanitation standards relating to treatment and disposal of solid and liquid wastes.		**S**
(2) Provision of adequate sewerage facilities for physical and economic activities that alleviate problems in housing, employment, mobility, and other areas.		**S**
Policies:		

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
(1) Encourage the adequate development of sewerage facilities that complement planned growth.		**S**
(2) Promote re-use and recycling to reduce solid and liquid wastes and employ a conservation ethic.		**S**
(3) Promote research to develop more efficient and economical treatment and disposal of solid and liquid wastes. [L 1978, c 100, pt of §2; am L 1986, c 276, §14]		**S**

ANALYSIS: As discussed in Section V.D.5 (Wastewater), of the ~~DEIS~~ FEIS, the Applicant proposed to develop an on-site wastewater reclamation facility to treat the Project's wastewater. Reclaimed wastewater will be treated to R-1 recycled standards and used for irrigation of the Project agricultural lands and urban landscapes.

~~the WCT will coordinate with the County of Maui, Department of Environmental Management, to request treatment of up to 650 units within Phase I at the Kahului Wastewater Treatment Facility. If capacity is available, WCT may be required to make necessary upgrades to the off-site transmission system. The WCT will also be developing its own private wastewater treatment facility, or developing a facility in association with the County and other neighboring landowners~~, to treat wastewater generated by the Project. ~~If a joint facility is constructed, it would accommodate wastewater generated by several other large projects in Central Maui including Wai`ale and the County's regional park and governmental complex. Wastewater treated at the plant would be treated to R-1 quality and the treated water would be used for landscape irrigation at the County's 310-acre regional park and on other open space lands within the WCT and neighboring developments.~~

As discussed in Section V.C.6 (Solid Waste) the WCT will develop strategies for reducing solid waste delivered to the land fill by providing options for recycling and promoting recycling practices among residents and businesses.

Chapter 226-16, Hawai'i Revised Statutes, Objectives and Policies for Facility Systems - Water.

Objective: Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.

Policies:	
(1) Coordinate development of land use activities with existing and potential water supply.	**S**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
(2) Support research and development of alternative methods to meet future water requirements well in advance of anticipated needs.		**NA**
(3) Reclaim and encourage the productive use of runoff water and wastewater discharges.		**S**
(4) Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use.		**S**
(5) Support water supply services to areas experiencing critical water problems.		**S**
(6) Promote water conservation programs and practices in government, private industry, and the general public to help ensure adequate water to meet long-term needs. [L 1978, c 100, pt of §2; am L 1986, c 276, §15]		**S**

ANALYSIS: As documented in Section V.D.4 (Water), the WCT has developed three on-site potable wells and two on-site non-potable wells. Both of the non-potable wells have preliminarily shown low salinity levels, and testing is being conducted to determine the viability of those wells for domestic use. If not viable for domestic use, they will be used for non-potable agricultural use. Water pumped from the non-potable wells will be discharged into the Waihee Ditch or lined onsite reservoirs and used for irrigation purposes for the residential lots, agricultural farming, parks and open areas. A sixth well also exists to be used for monitoring. to meet the Project's water demand. Development of these wells is being done with input from the County's Department of Water Supply and the State Commission on Water Resources Management (CWRM). The Applicant proposes to supply the Project's potable water demand through its on-site wells, which will draw from the Waikapū Aquifer. It is expected that the WCT water system will have sufficient capacity to accommodate the project and other potable water needs within the area. The Applicant proposed to meet its non-potable water demand for agriculture and irrigation of parks and open space through a combination of surface water provided from the Waihee Ditch system (subject to the issuance of surface water use permits from the CWRM), non-potable agricultural wells, and reclaimed wastewater.

~~As discussed in Section V.D.4 (Water) the WCT has developed three on-site potable wells and two on-site non-potable wells to meet the Project's potable and non-potable water demand. Development of these wells is being done with input from the County's Department of Water Supply and the State Commission on Water Resources Management. It is expected that the WCT water system will have sufficient capacity to accommodate the Project and other potable water needs within the area.~~

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
The Applicant is proposing to develop a dual water system for potable and irrigation water demand. The non-potable system will service the WCTs park lands, open space and landscape planting of individual residential and commercial lots. It is expected that the dual system will reduce potable water demand by at least one-third. Moreover, the WCT will incorporate other water conservation measures into the project, such as low flow toilets and shower heads. Water conserving irrigation practices including using draught tolerant plants and drip irrigation will also be utilized to conserve non-potable water resources. In the future, when reclaimed water becomes available, this resource will also be used within the project in appropriate areas.		
Chapter 226-17 Objectives and policies for facility systems-transportation.		
Objectives: Planning for the State's facility systems with regard to transportation shall be directed towards the achievement of the following objectives:		
Objectives:		
(1) An integrated multi-modal transportation system that services statewide needs and promotes the efficient, economical, safe, and convenient movement of people and goods.		**S**
(2) A statewide transportation system that is consistent with and will accommodate planned growth objectives throughout the State.		**NA**
Policies:		
(1) Design, program, and develop a multi-modal system in conformance with desired growth and physical development as stated in this chapter;		**S**
(2) Coordinate state, county, federal, and private transportation activities and programs toward the achievement of statewide objectives;		**NA**
(3) Encourage a reasonable distribution of financial responsibilities for transportation among participating governmental and private parties;		**NA**
(4) Provide for improved accessibility to shipping, docking, and storage facilities;		**NA**
(5) Promote a reasonable level and variety of mass transportation services that adequately meet statewide and community needs;		**NA**
(6) Encourage transportation systems that serve to accommodate present and future development needs of communities;		**S**
(7) Encourage a variety of carriers to offer increased opportunities and advantages to interisland movement of people and goods;		**NA**
(8) Increase the capacities of airport and harbor systems and support facilities to effectively		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
accommodate transshipment and storage needs;		
(9) Encourage the development of transportation systems and programs which would assist statewide economic growth and diversification;		**NA**
(10) Encourage the design and development of transportation systems sensitive to the needs of affected communities and the quality of Hawai'i's natural environment;		**NA**
(11) Encourage safe and convenient use of low-cost, energy-efficient, non-polluting means of transportation;		**S**
(12) Coordinate intergovernmental land use and transportation planning activities to ensure the timely delivery of supporting transportation infrastructure in order to accommodate planned growth objectives; and		**S**
(13) Encourage diversification of transportation modes and infrastructure to promote alternate fuels and energy efficiency. [L 1978, c 100, pt of §2; am L 1986, c 276, §16; am L 1993, c 149, §1; am L 1994, c 96, §3]		**S**
ANALYSIS: As discussed in Section III.B.1-3 of the ~~DEIS~~ FEIS, the WCT offers a more compact and mixed-use settlement pattern than more auto-centric suburban settlement patterns developed on Maui following World War II. The WCT Master Plan facilitates active transportation by reducing commuting distances and creating an interconnected network of pedestrian and bicycle infrastructure that will connect the residential, mixed-use and employment areas together into a unified whole. The pedestrian and bicycle facilities will be designed with the safety and comfort of commuters as the system's highest priority. In addition, transportation demand management strategies such as ridesharing, bicycle and pedestrian use, off-peak commuting and other measures will reduce vehicular trips, as discussed in the TIAR in Appendix I.		
Chapter 226-18, Hawai'i Revised Statutes, Objectives and Policies for Facility Systems - Energy.		
Objectives: Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives, giving due consideration to all:		
Objectives:		
(1) Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;		**NA**
(2) Increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased;		**S**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
(3) Greater energy security and diversification in the face of threats to Hawai‘i's energy supplies and systems; and		**S**
(4) Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use.		**S**
Policies:		
(1) Support research and development as well as promote the use of renewable energy sources;		**S**
(2) Ensure that the combination of energy supplies and energy-saving systems is sufficient to support the demands of growth;		**S**
(3) Base decisions of least-cost supply-side and demand-side energy resource options on a comparison of their total costs and benefits when a least-cost is determined by a reasonably comprehensive, quantitative, and qualitative accounting of their long-term, direct and indirect economic, environmental, social, cultural, and public health costs and benefits;		**NA**
(4) Promote all cost-effective conservation of power and fuel supplies through measures, including:		
(A) Development of cost-effective demand-side management programs;		**S**
(B) Education; and		**S**
(C) Adoption of energy-efficient practices and technologies;		**S**
(5) Ensure, to the extent that new supply-side resources are needed, that the development or expansion of energy systems uses the least-cost energy supply option and maximizes efficient technologies;		**NA**
(6) Support research, development, demonstration, and use of energy efficiency, load management, and other demand-side management programs, practices, and technologies;		**NA**
(7) Promote alternate fuels and transportation energy efficiency;		**NA**
(8) Support actions that reduce, avoid, or sequester greenhouse gases in utility, transportation, and industrial sector applications;		**S**
(9) Support actions that reduce, avoid, or sequester Hawai‘i's greenhouse gas emissions through agriculture and forestry initiatives; and		
(10) Provide priority handling and processing for all state and county permits required for renewable energy projects. [L 1978, c 100, pt of §2; am L 1986, c 276, §17; am L 1990, c 319, §2; am L 1994, c 96, §4; am L 2000, c 176, §1; am L 2007, c 205, §6; am L 2009, c 155, §17 and c 156,		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
§3]		

ANALYSIS: As discussed in Section V.D.2 "Electric, Telephone and Cable TV" the WCT will include energy-efficient design and conservation measures. Specifically, WCTs design guidelines will encourage the use of energy efficient technology throughout the project, specifically in lighting, air-conditioning, and building materials. Solar hot water heaters will be utilized throughout the residential portion of the development and installation of Photovoltaic Energy Systems will be encouraged, where appropriate, on residential and commercial buildings within the WCT. Additionally, the WCT proposes to develop, in appropriate locations within the agricultural district, solar farms to help off-set the Project's demand for carbon emitting electrical energy. If forty percent of residential and commercial buildings install photovoltaic systems (generating approximately 11.9 GWh per year), demand for carbon-based fuels could be reduced by roughly 50 percent. Moreover, the WCT desires to install a limited number of solar farms in appropriate locations within the agricultural lands. If two solar farms of approximately 5-acres (0.75 MW each) each are developed, the electricity generated would be about 2.6 GWh per year, which could service approximately 236 residential units. Thus, the WCT could potentially generate about 70 percent of its energy consumption through renewables. However, the installation of such systems will depend upon the technical and financial viability of such systems at the time the project is being constructed.

Moreover, the WCT is utilizing smart growth planning techniques that will help to reduce automobile trips. Smart Growth helps to minimize automobile trips by providing employment, goods, services and housing all within walking or biking distance of each other. The WCT will have a unified pedestrian and bicycle system throughout the project that links the project site to its existing and future surroundings. The pedestrian and bicycle system will provide future residents an alternative to driving for traveling within the WCT and to neighboring developments.

Chapter 226-18.5 Objectives and policies for facility systems-telecommunications.

Objectives: Planning for the State's telecommunications facility systems shall be directed towards the achievement of dependable, efficient, and economical statewide telecommunications systems capable of supporting the needs of the people.

(b) To achieve the telecommunications objective, it shall be the policy of this State to ensure the provision of adequate, reasonably priced, and dependable telecommunications services to accommodate demand.

Policies

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
(1) Facilitate research and development of telecommunication systems and resources;		**NA**
(2) Encourage public and private sector efforts to develop means for adequate, ongoing telecommunications planning;		**NA**
(3) Promote efficient management and use of existing telecommunications systems and services; and		**NA**
(4) Facilitate the development of education and training of telecommunications personnel. [L 1994, c 96, §2]		**NA**
ANALYSIS: the WCT does not involve planning for the State's telecommunication systems; therefore these objectives and policies are not applicable.		
Chapter 226-19 Objectives and policies for socio-cultural advancement-housing.		
Objectives: Planning for the State's socio-cultural advancement with regard to housing shall be directed toward the achievement of the following objectives:		
Objectives:		
(1) Greater opportunities for Hawai'i's people to secure reasonably priced, safe, sanitary, and livable homes, located in suitable environments that satisfactorily accommodate the needs and desires of families and individuals, through collaboration and cooperation between government and nonprofit and for-profit developers to ensure that more affordable housing is made available to very low-, low- and moderate-income segments of Hawai'i's population.		**S**
(2) The orderly development of residential areas sensitive to community needs and other land uses.		**S**
(3) The development and provision of affordable rental housing by the State to meet the housing needs of Hawai'i's people.		**S**
Policies:		
(1) Effectively accommodate the housing needs of Hawai'i's people.		**S**
(2) Stimulate and promote feasible approaches that increase housing choices for low-income, moderate-income, and gap-group households.		**S**
(3) Increase homeownership and rental opportunities and choices in terms of quality, location, cost, densities, style, and size of housing.		**S**
(4) Promote appropriate improvement, rehabilitation, and maintenance of existing housing units and residential areas.		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
(5) Promote design and location of housing developments taking into account the physical setting, accessibility to public facilities and services, and other concerns of existing communities and surrounding areas.		**S**
(6) Facilitate the use of available vacant, developable, and underutilized urban lands for housing.		**S**
(7) Foster a variety of lifestyles traditional to Hawai‘i through the design and maintenance of neighborhoods that reflect the culture and values of the community.		**S**
(8) Promote research and development of methods to reduce the cost of housing construction in Hawai‘i. [L 1978, c 100, pt of §2; am L 1986, c 276, §18; am L 1992, c 27, §2]		**S**
ANALYSIS: As discussed in Section V.B.2 (Housing) the WCT will offer a mix of single and multi-family housing types to address the diverse housing needs of Maui residents. Due to the Project's Central Maui location and the expected lot and unit size configurations, the Applicant expects that the majority of the Project's market priced housing will be sold at prices considered affordable to Maui County residents earning between 100 and 140 percent of the County's median income as determined by the United States Department of Housing and Urban Development. The WCT will also include workforce housing units pursuant to Chapter 2.96, MCC, "Residential Workforce Housing Policy". These homes will be subject to price controls and resale restrictions to ensure that affordable homes remain available for full-time Maui residents. Housing types within the WCT may include multi-family condominiums, small cottage homes on small lots with common open spaces, traditional single-family lots within a variety of home and lot size configurations, rental apartments, townhomes and larger estate rural lots. The goal is to serve the demands of all Maui residents.		
Chapter 226-20 Objectives and policies for socio-cultural advancement-health.		
Objectives: Planning for the State's socio-cultural advancement with regard to health shall be directed towards achievement of the following objectives:		
Objectives:		
(1) Fulfillment of basic individual health needs of the general public.		**NA**
(2) Maintenance of sanitary and environmentally healthful conditions in Hawai‘i's communities.		**NA**
Policies:		
(1) Provide adequate and accessible services and facilities for prevention and treatment of physical and mental health problems, including substance abuse.		**NA**
(2) Encourage improved cooperation among public and private sectors in the provision of health care to accommodate the total health needs of individuals throughout the State.		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
(3) Encourage public and private efforts to develop and promote statewide and local strategies to reduce health care and related insurance costs.		**NA**
(4) Foster an awareness of the need for personal health maintenance and preventive health care through education and other measures.		**NA**
(5) Provide programs, services, and activities that ensure environmentally healthful and sanitary conditions.		**NA**
(6) Improve the State's capabilities in preventing contamination by pesticides and other potentially hazardous substances through increased coordination, education, monitoring, and enforcement. [L 1978, c 100, pt of §2; am L 1986, c 276, §19]		**NA**
ANALYSIS: The WCT does not plan for the State's socio-cultural advancement with regard to health; therefore these objectives and policies are not applicable.		
Chapter 226-21, Hawai'i Revised Statutes, Objectives for Socio-Cultural Advancement - Education.		
Objective: Planning for the State's socio-cultural advancement with regard to education shall be directed towards achievement of the objective of the provision of a variety of educational opportunities to enable individuals to fulfill their needs, responsibilities, and aspirations.		
Policies:		
(1) Support educational programs and activities that enhance personal development, physical fitness, recreation, and cultural pursuits of all groups.		**S**
(2) Ensure the provision of adequate and accessible educational services and facilities that are designed to meet individual and community needs.		**S**
(3) Provide appropriate educational opportunities for groups with special needs.		**NA**
(4) Promote educational programs which enhance understanding of Hawai'i's cultural heritage.		**S**
(5) Provide higher educational opportunities that enable Hawai'i's people to adapt to changing employment demands.		**NA**
(6) Assist individuals, especially those experiencing critical employment problems or barriers, or undergoing employment transitions, by providing appropriate employment training programs and other related educational opportunities.		**NA**
(7) Promote programs and activities that facilitate the acquisition of basic skills, such as reading, writing, computing, listening, speaking, and reasoning.		**NA**
(8) Emphasize quality educational programs in Hawai'i's institutions to promote academic		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
excellence.		
(9) Support research programs and activities that enhance the education programs of the State. [L 1978, c 100, pt of §2; am L 1986, c 276, §20]		**NA**
ANALYSIS: As discussed in Section V.C.5 (Schools) the project site is being designed to accommodate a public elementary school campus on 12-acres adjacent to the proposed 18.5-acre community park. In addition, in 2007, the Hawai'i Legislature enacted Act 245 as Section 302A, HRS, "School Impact Fees". Based upon this legislation, the Department of Education has enacted impact fees for residential developments that occur within identified school impact districts. The Project is within the boundaries of the Central Maui Impact Fee District and is within the Wailuku Cost Area of that district. Projects within the district and cost area pay a construction fee and either a fee-in-lieu of land or a land donation, at the DOE's discretion. At the appropriate time, the applicant will contact the DOE to enter into an impact fee agreement. The Applicant has also expressed a willingness to provide land for a Hawaiian Immersion school at the elementary school site, should the DOE determine a need for such a facility at that location. It is expected that privately run programs related to community gardening, the promotion of Hawaiian agricultural practices and other cultural-based learning opportunities may be offered within the WCT and on its' agricultural lands by the DOE and/or non-profit community-based organizations.		
Chapter 226-22 Objective and policies for socio-cultural advancement-social services.		
Objective: Planning for the State's socio-cultural advancement with regard to social services shall be directed towards the achievement of the objective of improved public and private social services and activities that enable individuals, families, and groups to become more self-reliant and confident to improve their well-being.		
Policies:		
(1) Assist individuals, especially those in need of attaining a minimally adequate standard of living and those confronted by social and economic hardship conditions, through social services and activities within the State's fiscal capacities.		**NA**
(2) Promote coordination and integrative approaches among public and private agencies and programs to jointly address social problems that will enable individuals, families, and groups to deal effectively with social problems and to enhance their participation in society.		**NA**
(3) Facilitate the adjustment of new residents, especially recently arrived immigrants, into Hawai'i's communities.		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
(4) Promote alternatives to institutional care in the provision of long-term care for elder and disabled populations.		**NA**
(5) Support public and private efforts to prevent domestic abuse and child molestation, and assist victims of abuse and neglect.		**NA**
(6) Promote programs which assist people in need of family planning services to enable them to meet their needs. [L 1978, c 100, pt of §2; am L 1986, c 276, §21; am L 1990, c 67, §8]		**NA**
ANALYSIS: The WCT does not plan for the State's socio-cultural advancement with regard to social services; therefore this objective and these policies are not applicable.		
Chapter 226-23, Hawai'i Revised Statutes, Objectives for Socio-Cultural Advancement – Leisure.		
Objective: Planning for the State's socio-cultural advancement with regard to leisure shall be directed towards the achievement of the objective of the adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations.		
Policies:		
(1) Foster and preserve Hawai'i's multi-cultural heritage through supportive cultural, artistic, recreational, and humanities-oriented programs and activities.		**S**
(2) Provide a wide range of activities and facilities to fulfill the cultural, artistic, and recreational needs of all diverse and special groups effectively and efficiently.		**S**
(3) Enhance the enjoyment of recreational experiences through safety and security measures, educational opportunities, and improved facility design and maintenance.		**S**
(4) Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values while ensuring that their inherent values are preserved.		**S**
(5) Ensure opportunities for everyone to use and enjoy Hawai'i's recreational resources.		**S**
(6) Assure the availability of sufficient resources to provide for future cultural, artistic, and recreational needs.		**S**
(7) Provide adequate and accessible physical fitness programs to promote the physical and mental well-being of Hawai'i's people.		**S**
(8) Increase opportunities for appreciation and participation in the creative arts, including the literary, theatrical, visual, musical, folk, and traditional art forms.		**NA**
(9) Encourage the development of creative expression in the artistic disciplines to enable all		**NA**

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
segments of Hawai'i's population to participate in the creative arts.		
(10) Assure adequate access to significant natural and cultural resources in public ownership. [L 1978, c 100, pt of §2; am L 1986, c 276, §22]		**S**
ANALYSIS: As discussed in Section III.B.1, 2 and 4 of the ~~DEIS~~ FEIS, the WCT provides an extensive network of neighborhood and community parks, open spaces and separated pedestrian and bicycle facilities throughout the Project. The Project's park facilities will provide diverse opportunities for community and family gatherings, passive recreation and active recreation. The park system will include shaded areas for picnics and barbeques, developed tot lot facilities for families with young children, areas for community gardening, and areas for active recreation such as soccer, football, baseball and basketball. The WCTs approximate 8-mile network of trails, walkways and bikeways will provide additional open land recreational opportunities while connecting the Project's residential areas, neighborhood parks and employment areas together. The Project's agricultural lands may also offer opportunities for horseback riding, hiking, and mountain bike riding.		
Chapter 226-24 Objective and policies for socio-cultural advancement-individual rights and personal well-being.		
Objective: Planning for the State's socio-cultural advancement with regard to individual rights and personal well-being shall be directed towards achievement of the objective of increased opportunities and protection of individual rights to enable individuals to fulfill their socio-economic needs and aspirations.		
Policies:		
(1) Provide effective services and activities that protect individuals from criminal acts and unfair practices and that alleviate the consequences of criminal acts in order to foster a safe and secure environment.		**NA**
(2) Uphold and protect the national and state constitutional rights of every individual.		**NA**
(3) Assure access to, and availability of, legal assistance, consumer protection, and other public services which strive to attain social justice.		**NA**
(4) Ensure equal opportunities for individual participation in society. [L 1978, c 100, pt of §2; am L 1986, c 276, §23]		**NA**
Analysis: The WCT does not plan for the State's socio-cultural advancement with regard to individual rights and personal well-being; therefore this objective and these policies are not applicable.		
Chapter 226-25, Hawai'i Revised Statutes, Objectives for Socio-Cultural Advancement – Culture.		
Objective: Planning for the State's socio-cultural advancement with regard to culture shall be directed toward		

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
the achievement of the objective of enhancement of cultural identities, traditions, values, customs, and arts of Hawai‘i's people.		
Policies		
(1) Foster increased knowledge and understanding of Hawai‘i's ethnic and cultural heritages and the history of Hawai‘i.		**S**
(2) Support activities and conditions that promote cultural values, customs, and arts that enrich the lifestyles of Hawai‘i's people and which are sensitive and responsive to family and community needs.		**S**
(3) Encourage increased awareness of the effects of proposed public and private actions on the integrity and quality of cultural and community lifestyles in Hawai‘i.		**S**
(4) Encourage the essence of the Aloha Spirit in people's daily activities to promote harmonious relationships among Hawai‘i's people and visitors. [L 1978, c 100, pt of §2; am L 1986, c 276, §24]		**S**

Analysis: The WCT intends to create a sense of place within the community that reflects the cultural values, traditions and history of Hawai‘i, and more specifically Waikapū. In preparing the ~~DEIS~~ FEIS, a Cultural Impact Assessment (CIA) was prepared to thoroughly document any potential impacts that the project could have upon traditional and customary rights. The CIA recommends that the Applicant work with the Waikapū community to ensure that the Waikapū stream isn't impacted by the Development, that traditional access rights are maintained into the Waikapū Valley, and that existing kuleana land owner rights are protected. The Applicant is committed to protecting the Waikapū Stream by establishing a wide riparian buffer and greenway along the stream where development will not be permitted. The WCT will also have negligible impact upon existing stream flows as no requests for additional stream water will be made for the development. As noted in the ~~DEIS~~ FEIS, the WCT will be served by new wells that will be managed in strict compliance with County and State requirements.

The Applicant also intends to work with the Waikapū community to develop a cultural resources plan to ensure that local cultural values are incorporated into the fabric of the project. The Cultural Resources Plan may include recommendations such as the naming of streets and places within the WCT, identifying a site for a small museum depicting the history and culture of Waikapū, incorporating various features and artifacts reflecting Waikapū's past – such as remnants from the sugar industry – into the design of key buildings and sites, and maintaining and protecting access into the Waikapū Valley for the purpose of hunting, gathering,

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
the replanting of native trees and vegetation. The Applicant also intends to facilitate the expansion of diversified agricultural activities, including the growing of traditional Hawaiian food staples such as wet and dryland kalo, banana, sweet potato, etc. within the Project's agricultural lands. Moreover, small community gardens may be dispersed throughout the project site so that residents can connect with the land and grow their own foods, including traditional Hawaiian staples, for their daily needs.		
Chapter 226-26 Objectives and policies for socio-cultural advancement-public safety.		
Objectives:		RATING
(1) Assurance of public safety and adequate protection of life and property for all people.		**NA**
(2) Optimum organizational readiness and capability in all phases of emergency management to maintain the strength, resources, and social and economic well-being of the community in the event of civil disruptions, wars, natural disasters, and other major disturbances.		**NA**
(3) Promotion of a sense of community responsibility for the welfare and safety of Hawai'i's people.		**NA**
Policies related to public safety:		
(1) Ensure that public safety programs are effective and responsive to community needs.		**NA**
(2) Encourage increased community awareness and participation in public safety programs.		**NA**
Policies related to criminal justice:		
(1) Support criminal justice programs aimed at preventing and curtailing criminal activities.		**NA**
(2) Develop a coordinated, systematic approach to criminal justice administration among all criminal justice agencies.		**NA**
(3) Provide a range of correctional resources which may include facilities and alternatives to traditional incarceration in order to address the varied security needs of the community and successfully reintegrate offenders into the community.		**NA**
Policies related to emergency management:		
(1) Ensure that responsible organizations are in a proper state of readiness to respond to major war-related, natural, or technological disasters and civil disturbances at all times.		**NA**
(2) Enhance the coordination between emergency management programs throughout the State. [L 1978, c 100, pt of §2; am L 1986, c 276, §25]		**NA**
ANALYSIS: The WCT does include State public safety programs; therefore these objectives and policies are not applicable.		

SECTION	Chapter 226 – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES	RATING
Chapter 226-27 Objectives and policies for socio-cultural advancement-government.		
Objectives: Planning the State's socio-cultural advancement with regard to government shall be directed towards the achievement of the following objectives:		
(1) Efficient, effective, and responsive government services at all levels in the State.		**NA**
(2) Fiscal integrity, responsibility, and efficiency in the state government and county governments.		**NA**
Policies:		
(1) Provide for necessary public goods and services not assumed by the private sector.		**NA**
(2) Pursue an openness and responsiveness in government that permits the flow of public information, interaction, and response.		**NA**
(3) Minimize the size of government to that necessary to be effective.		**NA**
(4) Stimulate the responsibility in citizens to productively participate in government for a better Hawai'i.		**NA**
(5) Assure that government attitudes, actions, and services are sensitive to community needs and concerns.		**NA**
(6) Provide for a balanced fiscal budget.		**NA**
(7) Improve the fiscal budgeting and management system of the State.		**NA**
(8) Promote the consolidation of state and county governmental functions to increase the effective and efficient delivery of government programs and services and to eliminate duplicative services wherever feasible. [L 1978, c 100, pt of §2; am L 1986, c 276, §26]		**NA**
ANALYSIS: The WCT does not involve planning the State's socio-cultural advancement with regard to government; therefore these objective and policies are not applicable.		

C. HAWAI'I STATE PLAN PART III. PRIORITY GUIDELINES

The purpose of the priority guidelines of the Hawai'i State Plan is to establish overall priority guidelines to address areas of statewide concern. The Hawai'i State Plan notes that the State shall strive to improve the quality of life for Hawai'i's present and future population through the pursuit of desirable courses of action in five major areas of statewide concern which merit priority attention: 1) economic development; 2) population growth 3) affordable housing; 4) crime and criminal justice; and 5) quality

education (226-102). The WCT is consistent with the following priority guidelines of the Hawai‘i State Plan.

Table 59 ~~53~~: Hawai‘i State Plan, Chapter 226 – Part III. Priority Guidelines

SECTION	Chapter 226 – HRS PART III. PRIORITY GUIDELINES	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
HRS 226-101: Purpose. The purpose of this part is to establish overall priority guidelines to address areas of statewide concern.		
HRS 226-102: Overall Direction. The State shall strive to improve the quality of life for Hawai‘i's present and future population through the pursuit of desirable courses of action in five major areas of statewide concern which merit priority attention: economic development, population growth and land resource management, affordable housing, crime and criminal justice, and quality education. [L 1978, c 100, pt of §2; am L 1986, c 276, §29]		
HRS 226-103: Economic Priority Guidelines.		
(a) Priority Guidelines to stimulate economic growth and encourage business expansion and development to provide needed jobs for Hawai‘i’s people and achieve a stable and diversified economy;		
Priority Guidelines:		
(1) Seek a variety of means to increase the availability of investment capital for new and expanding enterprises.		**NA**
(A) Encourage investments which:		
(i) Reflect long term commitments to the State;		**NA**
(ii) Rely on economic linkages within the local economy;		**NA**
(iii) Diversify the economy;		**S**
(iv) Reinvest in the local economy;		**S**
(v) Are sensitive to community needs and priorities; and		**S**
(vi) Demonstrate a commitment to provide management opportunities to Hawai‘i residents.		**NA**
(2) Encourage the expansion of technological research to assist industry development and support the development and commercialization of technological advancements.		**NA**
(3) Improve the quality, accessibility, and range of services provided by government to business, including data and reference services and assistance in complying with governmental regulations.		**NA**
(4) Seek to ensure that state business tax and labor laws and administrative policies are equitable,		**NA**

SECTION	Chapter 226 – HRS PART III. PRIORITY GUIDELINES	RATING
rational, and predictable.		
(5) Streamline the building and development permit and review process, and eliminate or consolidate other burdensome or duplicative governmental requirements imposed on business, where public health, safety and welfare would not be adversely affected.		**NA**
(6) Encourage the formation of cooperatives and other favorable marketing or distribution arrangements at the regional or local level to assist Hawai‘i's small-scale producers, manufacturers, and distributors.		**NA**
(7) Continue to seek legislation to protect Hawai‘i from transportation interruptions between Hawai‘i and the continental United States.		**NA**
(8) Provide public incentives and encourage private initiative to develop and attract industries which promise long-term growth potentials and which have the following characteristics:		**S**
(A) An industry that can take advantage of Hawai‘i's unique location and available physical and human resources.		**NA**
(B) A clean industry that would have minimal adverse effects on Hawai‘i's environment.		**NA**
(C) An industry that is willing to hire and train Hawai‘i's people to meet the industry's labor needs at all levels of employment.		**NA**
(D) An industry that would provide reasonable income and steady employment.		**NA**
(9) Support and encourage, through educational and technical assistance programs and other means, expanded opportunities for employee ownership and participation in Hawai‘i business.		**NA**
(10) Enhance the quality of Hawai‘i's labor force and develop and maintain career opportunities for Hawai‘i's people through the following actions:		**NA**
(A) Expand vocational training in diversified agriculture, aquaculture, information industry, and other areas where growth is desired and feasible.		**NA**
(B) Encourage more effective career counseling and guidance in high schools and post-secondary institutions to inform students of present and future career opportunities.		**NA**
(C) Allocate educational resources to career areas where high employment is expected and where growth of new industries is desired.		**NA**
(D) Promote career opportunities in all industries for Hawai‘i's people by encouraging firms doing business in the State to hire residents.		**NA**
(E) Promote greater public and private sector cooperation in determining industrial training needs		**NA**

SECTION	Chapter 226 – HRS PART III. PRIORITY GUIDELINES	RATING
and in developing relevant curricula and on- the-job training opportunities.		
(F) Provide retraining programs and other support services to assist entry of displaced workers into alternative employment.		**NA**
(b) Priority guidelines to promote the economic health and quality of the visitor industry:		
Priority Guidelines:		
(1) Promote visitor satisfaction by fostering an environment which enhances the Aloha Spirit and minimizes inconveniences to Hawai‘i's residents and visitors.		**NA**
(2) Encourage the development and maintenance of well-designed, adequately serviced hotels and resort destination areas which are sensitive to neighboring communities and activities and which provide for adequate shoreline setbacks and beach access.		**NA**
(3) Support appropriate capital improvements to enhance the quality of existing resort destination areas and provide incentives to encourage investment in upgrading, repair, and maintenance of visitor facilities.		**NA**
(4) Encourage visitor industry practices and activities which respect, preserve, and enhance Hawai‘i's significant natural, scenic, historic, and cultural resources.		**NA**
(5) Develop and maintain career opportunities in the visitor industry for Hawai‘i's people, with emphasis on managerial positions.		**NA**
(6) Support and coordinate tourism promotion abroad to enhance Hawai‘i's share of existing and potential visitor markets.		**NA**
(7) Maintain and encourage a more favorable resort investment climate consistent with the objectives of this chapter.		**NA**
(8) Support law enforcement activities that provide a safer environment for both visitors and residents alike.		**NA**
(9) Coordinate visitor industry activities and promotions to business visitors through the state network of advanced data communication techniques.		**NA**
(c) Priority guidelines to promote the continued viability of the sugar and pineapple industries:		
Priority Guidelines:		
(1) Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.		**S & NS**
(2) Continue efforts to maintain federal support to provide stable sugar prices high enough to allow		**NA**

SECTION	Chapter 226 – HRS PART III. PRIORITY GUIDELINES	RATING
profitable operations in Hawai‘i.		
(3) Support research and development, as appropriate, to improve the quality and production of sugar and pineapple crops.		**NA**
(d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:		
(1) Identify, conserve, and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands.		**S & NS**
(2) Assist in providing adequate, reasonably priced water for agricultural activities.		**S**
(3) Encourage public and private investment to increase water supply and to improve transmission, storage, and irrigation facilities in support of diversified agriculture and aquaculture.		**S**
(4) Assist in the formation and operation of production and marketing associations and cooperatives to reduce production and marketing costs.		**NA**
(5) Encourage and assist with the development of a waterborne and airborne freight and cargo system capable of meeting the needs of Hawai‘i's agricultural community.		**NA**
(6) Seek favorable freight rates for Hawai‘i's agricultural products from interisland and overseas transportation operators.		**NA**
(7) Encourage the development and expansion of agricultural and aquacultural activities which offer long-term economic growth potential and employment opportunities.		**S**
(8) Continue the development of agricultural parks and other programs to assist small independent farmers in securing agricultural lands and loans.		**S**
(9) Require agricultural uses in agricultural subdivisions and closely monitor the uses in these subdivisions.		**S**
(10) Support the continuation of land currently in use for diversified agriculture.		**S**
(e) Priority guidelines for water use and development:		
Priority Guidelines:		
(1) Maintain and improve water conservation programs to reduce the overall water consumption rate.		**S**
(2) Encourage the improvement of irrigation technology and promote the use of non-potable water for agricultural and landscaping purposes.		**S**
(3) Increase the support for research and development of economically feasible alternative water		**NA**

SECTION	Chapter 226 – HRS PART III. PRIORITY GUIDELINES	RATING
sources.		
(4) Explore alternative funding sources and approaches to support future water development programs and water system improvements.		**NA**
(f) Priority guidelines for energy use and development:		
Priority Guidelines:		
(1) Encourage the development, demonstration, and commercialization of renewable energy sources.		**S**
(2) Initiate, maintain, and improve energy conservation programs aimed at reducing energy waste and increasing public awareness of the need to conserve energy.		**S**
(3) Provide incentives to encourage the use of energy conserving technology in residential, industrial, and other buildings.		**NA**
(4) Encourage the development and use of energy conserving and cost-efficient transportation systems.		**S**
(g) Priority guidelines to promote the development of the information industry:		
Priority Guidelines:		
(1) Establish an information network that will serve as the catalyst for establishing a viable information industry in Hawai‘i.		**NA**
(2) Encourage the development of services such as financial data processing, a products and services exchange, foreign language translations, telemarketing, teleconferencing, a twenty-four-hour international stock exchange, international banking, and a Pacific Rim management center.		**NA**
(3) Encourage the development of small businesses in the information field such as software development, the development of new information systems and peripherals, data conversion and data entry services, and home or cottage services such as computer programming, secretarial, and accounting services.		**NA**
(4) Encourage the development or expansion of educational and training opportunities for residents in the information and telecommunications fields.		**NA**
(5) Encourage research activities, including legal research in the information and telecommunications fields.		**NA**
(6) Support promotional activities to market Hawai‘i's information industry services. [L 1978, c 100, pt of §2; am L 1984, c 236, §15; am L 1986, c 276, §30; am L Sp 1988, c 1, §6; am L 1989, c 250, §2]		**NA**

SECTION	Chapter 226 – HRS PART III. PRIORITY GUIDELINES	RATING

ANALYSIS: The WCT is expected to indirectly support Maui's existing economic base activities by providing much needed housing to serve the island's workforce. The WCT is intended to provide housing along with supporting commercial, employment and institutional uses that will allow for Maui's economic base industries to grow, diversify and become more sustainable - including the island's agricultural industry.

The project will result in the urbanization of approximately 485-acres of agricultural land that is used for sugar cultivation. However, about 231.56 of these 485-acres will be impacted by the future Wai`ale Bypass Road, which will make this area more difficult for land extensive agriculture, such as the growing of sugar and pineapple. ~~During interviews conducted for the preparation of the Agricultural Impact Assessment (Appendix G), HC&S's General Manager stated that other fallow A&B lands are currently available and that the loss of the subject lands will not significantly impact the Plantation's economic viability.~~

As for diversified agriculture, the project will directly support this sector by establishing an approximate 800-acre agricultural preserve on prime agricultural lands. These lands will be supplied with a readily available and affordable source of irrigation water. This centrally located agricultural park will help Maui's farmers better compete with mainland agricultural producers in Hawai'i's market, while also creating opportunities to expand export crops to the mainland and overseas. There are currently ~~two~~ four successful commercial farms farming the Project areas agricultural lands. These include Kumu Farms, Hoaloa Farms, Makani Olu Ranch, and Beef and Bloom. ~~and Hawai'i Taro LLC.~~ These farms have many years of experience farming in Hawai'i and have had success competing in local, mainland and export markets.

The project will also create direct, indirect and induced short- and long-term positive economic impacts. As discussed in Section V.B.3-4 (Economy), the WCT will bring in ~~$609.1~~ $ 644.1 million of new capital investment into the Maui economy. The construction of the WCT components will directly create an estimated ~~2,320~~ 2,476 "worker-years" of employment (the equivalent of 52 work weeks at 40 hours per week) in the trades and associated businesses during build-out, averaging about 165 Full Time Equivalent (FTE) per year for the 15 years of building. Most of these positions will not be new jobs for new businesses, but work flowing to existing contractors and suppliers. ~~positions 193 worker years annually, with an estimated $188.3 million in wages (averaging about $15.7 million per year).~~

SECTION	Chapter 226 – HRS PART III. PRIORITY GUIDELINES	RATING

The 169,000 square feet of new commercial operation will generate some 4,251 FTE worker years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions. These jobs will be new positions in the Maui economy. This total does not include the employment, wages or business activity contributions of the existing 29,250 square feet of commercial space in the Maui Tropical Plantation which will be retained.

The Project will require an estimated 66 worker years of maintenance and common area element employment on a continual basis, and will generate some 1,750 1,789 worker years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions. In aggregate, during the development of the WCT 8,750 8,946 worker years of employment will be created during construction and operations, on-site/direct and off-site/indirect, with stabilized employment after completion of 746 jobs. During the 15 years projection period, WCT will have a base economic impact on Maui of some $817.1 million in new monies with a stabilized annual benefit of $32.1 million thereafter.

By providing much needed housing in a format that will create a high quality of life for Maui's working families, and by generating both short- and long-term employment in the construction, trade and agricultural industries, the project is directly supportive of the State and County's economic development.

~~The on-going operations and maintenance of the business commercial and residential components will directly provide an estimated 4,251 FTE worker years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions. The Project will require an estimated 66 worker years of maintenance and common area element employment on a continual basis, and will generate some 1,750 worker years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions.~~

~~In aggregate, during the development of the WCT 8,750 worker years of employment will be created during construction and operations, on-site/direct and off-site/indirect, with stabilized employment after completion of 746 jobs. During the 15 years projection period, WCT will have a base economic impact of $1.3 billion with a stabilized annual benefit of $137.3 million thereafter.~~

Chapter 226-104, HRS, Population Growth and Land Resources Priority Guidelines

(a) Priority guidelines to effect desired statewide growth and distribution:

SECTION	Chapter 226 – HRS PART III. PRIORITY GUIDELINES	RATING
Priority Guidelines:		
(1) Encourage planning and resource management to insure that population growth rates throughout the State are consistent with available and planned resource capacities and reflect the needs and desires of Hawai'i's people.		**S**
(2) Manage a growth rate for Hawai'i's economy that will parallel future employment needs for Hawai'i's people.		**S**
(3) Ensure that adequate support services and facilities are provided to accommodate the desired distribution of future growth throughout the State.		**S**
(4) Encourage major state and federal investments and services to promote economic development and private investment to the neighbor islands, as appropriate.		**NA**
(5) Explore the possibility of making available urban land, low-interest loans, and housing subsidies to encourage the provision of housing to support selective economic and population growth on the neighbor islands.		**NA**
(6) Seek federal funds and other funding sources outside the State for research, program development, and training to provide future employment opportunities on the neighbor islands.		**NA**
(7) Support the development of high technology parks on the neighbor islands.		**NA**
(b) Priority guidelines for regional growth distribution and land resource utilization:		
Priority Guidelines:		
(1) Encourage urban growth primarily to existing urban areas where adequate public facilities are already available or can be provided with reasonable public expenditures, and away from areas where other important benefits are present, such as protection of important agricultural land or preservation of lifestyles.		**S**
(2) Make available marginal or nonessential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.		**S & NS**
(3) Restrict development when drafting of water would result in exceeding the sustainable yield or in significantly diminishing the recharge capacity of any groundwater area.		**NA**
(4) Encourage restriction of new urban development in areas where water is insufficient from any source for both agricultural and domestic use.		**NA**
(5) In order to preserve green belts, give priority to state capital-improvement funds which encourage location of urban development within existing urban areas except where compelling		**NA**

SECTION	Chapter 226 – HRS PART III. PRIORITY GUIDELINES	RATING
public interest dictates development of a noncontiguous new urban core.		
(6) Seek participation from the private sector for the cost of building infrastructure and utilities, and maintaining open spaces.		**S**
(7) Pursue rehabilitation of appropriate urban areas.		**NA**
(8) Support the redevelopment of Kākā'āko into a viable residential, industrial, and commercial community.		**NA**
(9) Direct future urban development away from critical environmental areas or impose mitigating measures so that negative impacts on the environment would be minimized.		**S**
(10) Identify critical environmental areas in Hawai'i to include but not be limited to the following: watershed and recharge areas; wildlife habitats (on land and in the ocean); areas with endangered species of plants and wildlife; natural streams and water bodies; scenic and recreational shoreline resources; open space and natural areas; historic and cultural sites; areas particularly sensitive to reduction in water and air quality; and scenic resources.		**S**
(11) Identify all areas where priority should be given to preserving rural character and lifestyle.		**S**
(12) Utilize Hawai'i's limited land resources wisely, providing adequate land to accommodate projected population and economic growth needs while ensuring the protection of the environment and the availability of the shoreline, conservation lands, and other limited resources for future generations.		**S**
(13) Protect and enhance Hawai'i's shoreline, open spaces, and scenic resources. [L 1978, c 100, pt of §2; am L 1984, c 236, §16; am L 1986, c 276, §31]		**NA**

ANALYSIS: As discussed in Section V.B. of the ~~DEIS~~ FEIS the WCT will provide housing and employment opportunities for the growing population of Central Maui. The subject property is located within the Maui Island Plan's Small Town Growth Boundary. Significant urban development is adjacent to the site's northern boundary and supporting infrastructure and public facilities would exist on the site and are readily available within the urban area of Central Maui, which is in close proximity.

As discussed in Section V.D (Infrastructure) the WCT will be responsible for all required infrastructure improvements including water source and system improvements for potable and non-potable water use, on-site drainage improvements, a portion of regional traffic related improvements attributable to the project, required on- and off-site wastewater system improvements and utility upgrades as determined by the appropriate

SECTION	Chapter 226 – HRS PART III. PRIORITY GUIDELINES	RATING

governmental agencies and public utility companies.

From a site planning perspective, the WCT Master Plan carefully considers the natural topography of the site and incorporates unique natural areas into parks and open spaces throughout the WCT. Proposed buildings are incorporated into the natural topography of the property and building layout is oriented to preserve view planes towards the Pacific Ocean, Haleakalā and the West Maui Mountain. The orientation of buildings will also seek to take advantage of the tradewinds for natural cooling and sun exposure for natural lighting and the potential for clean and renewable energy development.

As discussed in Section V.C.5 (Schools) the project site is being designed to accommodate a public elementary school campus in the makai development area. In 2007, the Hawai'i Legislature enacted Act 245 as Section 302A, HRS, "School Impact Fees". Based upon this legislation, the Department of Education has enacted impact fees for residential developments that occur within identified school impact districts. The Project is within the boundaries of the Central Maui Impact Fee District and is within the Wailuku Cost Area of that district. Projects within the district and cost area pay a construction fee and either a fee-in-lieu of land or a land donation, at the DOE's discretion. The DOE has indicated that they prefer a land contribution at the location proposed in the WCT Master Plan. At the appropriate time, the Applicant will contact the DOE to enter into an impact fee agreement.

As discussed in Section V.C.3-4 (Police and Fire Protection) increased tax revenues generated by the project will provide additional funds to the County for police and fire capital facility improvements and service upgrades. Additionally, the applicant will comply with any impact fee ordinances for police and fire that may be established.

As discussed in Section V.A.7 (Agricultural Resources), while the project will result in the loss of prime agricultural lands to urbanization, the lands lost should have minimal long-term impact upon the viability of Maui's agricultural industry since other comparable lands are available on Maui for agricultural use. Importantly, the Applicant is proposing to dedicate 800-acres in perpetuity to agricultural use. This land will have access to a reliable source of irrigation water and it will be leased to farmers at affordable and long-term lease rents. Under such circumstances, the WCT should provide a favorable environment for diversified agricultural development on Maui.

SECTION	Chapter 226 – HRS PART III. PRIORITY GUIDELINES	RATING
Finally, the WCT is not located within the State's Special Management Area and no listed or endangered species of flora and fauna were identified that will constrain development of the property. The WCT Master Plan directs development away from the Waikapū Stream, which is a sensitive environmental and cultural resource, and also directs development away from the upper Waikapū watershed, which is sensitive for these same reasons. During build-out and during the operation phase, BMPs will be implemented to mitigate non-point source pollution to Maui's coastal resources as well as to mitigate fugitive dust impacts. In addition, through the EIS and entitlement application processes mitigation measures will be identified to help address any environmental impacts that may arise from the project.		
Chapter 226-105 Crime and criminal justice.		
Priority guidelines in the area of crime and criminal justice:		
(1) Support law enforcement activities and other criminal justice efforts that are directed to provide a safer environment.		**NA**
(2) Target state and local resources on efforts to reduce the incidence of violent crime and on programs relating to the apprehension and prosecution of repeat offenders.		**NA**
(3) Support community and neighborhood program initiatives that enable residents to assist law enforcement agencies in preventing criminal activities.		**NA**
(4) Reduce overcrowding or substandard conditions in correctional facilities through a comprehensive approach among all criminal justice agencies which may include sentencing law revisions and use of alternative sanctions other than incarceration for persons who pose no danger to their community.		**NA**
(5) Provide a range of appropriate sanctions for juvenile offenders, including community-based programs and other alternative sanctions.		**NA**
(6) Increase public and private efforts to assist witnesses and victims of crimes and to minimize the costs of victimization. [L 1978, c 100, pt of §2; am L 1984, c 236, §17; am L 1986, c 276, §32]		**NA**
ANALYSIS: The priority guidelines for crime and criminal justice are not applicable to the WCT.		
Chapter 226-106 Affordable housing. Priority guidelines for the provision of affordable housing:		
Priority guidelines for the provision of affordable housing:		
(1) Seek to use marginal or nonessential agricultural land and public land to meet housing needs of low- and moderate-income and gap-group households.		**S**

SECTION	Chapter 226 – HRS PART III. PRIORITY GUIDELINES	RATING
(2) Encourage the use of alternative construction and development methods as a means of reducing production costs.		**NA**
(3) Improve information and analysis relative to land availability and suitability for housing.		**NA**
(4) Create incentives for development which would increase home ownership and rental opportunities for Hawai'i's low- and moderate-income households, gap-group households, and residents with special needs.		**S**
(5) Encourage continued support for government or private housing programs that provide low interest mortgages to Hawai'i's people for the purchase of initial owner- occupied housing.		**NA**
(6) Encourage public and private sector cooperation in the development of rental housing alternatives.		**S**
(7) Encourage improved coordination between various agencies and levels of government to deal with housing policies and regulations.		**NA**
(8) Give higher priority to the provision of quality housing that is affordable for Hawai'i's residents and less priority to development of housing intended primarily for individuals outside of Hawai'i. [L 1986, c 276, §33; am L 1989, c 250, §3]		**S**
ANALYSIS: As discussed in Section V.B.2 (Housing) the WCT will offer a mix of single and multi-family housing types to address the diverse housing needs of Maui residents. Due to the Project's Central Maui location and the expected lot and unit size configurations, the Applicant expects that the majority of the Project's market priced housing will be sold at prices considered affordable to Maui County residents earning between 100 and 140 percent of the County's median income as determined by the United States Department of Housing and Urban Development. The WCT will also include workforce housing units pursuant to Chapter 2.96, MCC, "Residential Workforce Housing Policy". These homes will be subject to price controls and resale restrictions to ensure that affordable homes remain available for full-time Maui residents. Housing types within the WCT may include multi-family condominiums, small cottage homes on small lots with common open spaces, traditional single-family lots within a variety of home and lot size configurations, rental apartments, townhomes and larger estate rural lots. The goal is to serve the demands of all Maui residents.		
Chapter 226-107 Quality education.		
Priority guidelines to promote quality education:		
Priority Guidelines:		
(1) Pursue effective programs which reflect the varied district, school, and student needs to		**NA**

SECTION	Chapter 226 – HRS PART III. PRIORITY GUIDELINES	RATING
strengthen basic skills achievement;		
(2) Continue emphasis on general education "core" requirements to provide common background to students and essential support to other university programs;		**NA**
(3) Initiate efforts to improve the quality of education by improving the capabilities of the education work force;		**NA**
(4) Promote increased opportunities for greater autonomy and flexibility of educational institutions in their decision making responsibilities;		**NA**
(5) Increase and improve the use of information technology in education by the availability of telecommunications equipment for:		**NA**
(A) The electronic exchange of information;		**NA**
(B) Statewide electronic mail; and		**NA**
(C) Access to the Internet.		**NA**
Encourage programs that increase the public's awareness and understanding of the impact of information technologies on our lives;		
(1) Pursue the establishment of Hawai'i's public and private universities and colleges as research and training centers of the Pacific;		**NA**
(2) Develop resources and programs for early childhood education;		**NA**
(3) Explore alternatives for funding and delivery of educational services to improve the overall quality of education; and		**NA**
(4) Strengthen and expand educational programs and services for students with special needs. [L 1986, c 276, §34; am L 1999, c 178, §18]		**NA**
ANALYSIS: As discussed in Section V.C.5 (Schools) the project site is being designed to accommodate a public elementary school campus in the makai development area. In addition, in 2007, the Hawai'i Legislature enacted Act 245 as Section 302A, HRS, "School Impact Fees". Based upon this legislation, the Department of Education has enacted impact fees for residential developments that occur within identified school impact districts. The Project is within the boundaries of the Central Maui Impact Fee District and is within the Wailuku Cost Area of that district. Projects within the district and cost area pay a construction fee and either a fee-in-lieu of land or a land donation, at the DOE's discretion. The DOE has indicated that they prefer a land contribution at the location proposed in the WCT Master Plan. At the appropriate time, the Applicant will contact the DOE to enter into an impact fee agreement.		

D. HAWAIʻI STATE FUNCTIONAL PLANS

The Hawaiʻi State Plan directs State agencies to prepare functional plans for their respective program areas. There are fourteen (14) State Functional Plans that serve as the primary implementing vehicle for the goals, objectives, and policies of the Hawaiʻi State Plan.

Table 60 ~~54~~: Hawaiʻi State Functional Plans

SECTION	HAWAIʻI STATE FUNCTIONAL PLANS	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
Agriculture State Functional Plan		
Objectives:		
a. Achievement of increased agricultural production and growth through cultural and management practices.		**NA**
b. Achievement of an orderly agricultural marketing system through product promotion and industry organization.		**NA**
c. Achievement of optimal contribution by agriculture to the State's economy.		**S**
e. Achievement of adequate capital, and knowledge of its proper management, for agricultural development.		**S**
f. Achievement of increased agricultural production and growth through pest and disease controls.		**NA**
g. Achievement of effective protection and improved quality of Hawaiʻi's land, water, and air.		**S**
h. Achievement of productive agricultural use of lands most suitable and needed for agricultural use.		**S**
i. Achievement of efficient and equitable provision of adequate water for agricultural use.		**S**
j. Achievement of maximum degree of public understanding and support of agriculture in Hawaiʻi.		**S**
k. Achievement of adequate supply of properly trained labor for agricultural needs.		**NA**
l. Achievement of adequate transportation services and facilities to meet agricultural needs.		**NA**
m. Achievement of adequate support services and infrastructure to meet agricultural needs.		**S**
ANALYSIS: The WCTs agricultural component includes nearly 1,077 acres of land that will remain in agricultural		

SECTION	HAWAIʻI STATE FUNCTIONAL PLANS	RATING

use. Of these lands, approximately 800 acres will be permanently dedicated to agricultural use with no residential structures to be permitted. The remaining 277 acres may be subdivided into as many as five agricultural lots where a farm dwelling may be permitted. Within the agricultural lands, several hundred acres may be developed as a public and/or private agricultural park to help facilitate Maui's agricultural development.

There are currently four ~~three~~ commercial farms farming MTP lands. These include Kumu Farms, Hoaloa Farms, Makani Olu Ranch, and Beef and Bloom ~~Hawai'i Taro LLC, and HC&S~~. The proposed urbanization will require both Kumu Farms and Hawai'i Taro to relocate their agricultural operations to the proposed agricultural park and other suitable agricultural lands within the project. ~~The project will also impact a portion of the current lands being leased by HC&S. It is anticipated that these lands will gradually begin to be impacted in about three to five years. Over the long-term, HC&S may lose approximately 330 acres to urbanization and some additional acres to the agricultural park. According to HC&S General Manager, Mr. Rick Volner, HC&S would desire to continue farming its MTP lands to maximize its current economy of scale in production. However, Mr. Volner acknowledged that HC&S has additional lands available that are currently fallow and that urbanization of a portion of its MTP leased lands will not significantly impact the Plantation's long-term economic viability.~~

The Agricultural Impact Assessment (Appendix G) notes that a significant impediment to agricultural development on Maui, and throughout the state, is the scarcity of agricultural land, with irrigation water, that is both readily available and affordable for long-term lease to diversified farmers. The establishment of a centrally located 800-acre agricultural preserve, comprising productive lands, affordable irrigation water and close proximity to inter-island and mainland shipping opportunities, should help Maui farmers compete in local, mainland and international markets. WCT also plans to support direct marketing to Maui's consumers through the establishment of on-site farmers markets, fruit and produce stands, pick-your own opportunities and community supported agricultural programs.

Conservation Lands State Functional Plan	
Objectives:	
1a. Establishment of data bases for inventories of existing lands and resources.	**NA**
1b. Establishment of criteria for management of land and natural resources.	**NA**
2a. Establishment of plans for natural resources and land management.	**NA**
2b. Protection of fragile or rare natural resources.	**NA**

SECTION	HAWAIʻI STATE FUNCTIONAL PLANS	RATING
2c. Enhancement of natural resources.		**NA**
2d. Appropriate development of natural resources designated for commercial development.		**NA**
2e. Promotion and marketing of appropriate natural resources designated for commercial development.		**NA**
2f. Increase enforcement of land and natural resource use laws and regulations.		**NA**
3a. Develop and implement conservation education programs for the general public and visitors.		**NA**
3b. Increase access to land and natural resources data by the public and increase cooperation between agencies by making access to land and natural resource information more efficient.		**NA**
ANALYSIS: The WCT is not located within the State Conservation District; however the WCT is located adjacent to the Waikapū Stream. The WCT Master Plan incorporates a generous riparian buffer near the stream. In addition, as part of the ~~DEIS~~ FEIS a Flora and Fauna Assessment was prepared to identify any rare or endangered species on the property. None were identified that will significantly impact development of the site. However, in response to comments from the U.S. Fish & Wildlife Service, certain precautionary mitigation measures will be implemented as described in Section IV.A.4 (Flora and Fauna) and Appendix Q ~~L~~ (EISPN Agency Comment and Response Letters).		
Education State Functional Plan		
Objectives:		
A1. Academic Excellence. Emphasize quality educational programs in Hawaiʻi's institutions to promote academic excellence.		**NA**
A2. Basic Skills. Promote programs and activities that facilitate the acquisition of basic skills, such as reading, writing, computing, listening, speaking, and reasoning. Pursue effective programs which reflect the varied district, school, and student needs to strengthen basic skills achievement.		**NA**
A3. Education Workforce. Initiate efforts to improve the quality of education by improving the capabilities of the education workforce.		**NA**
A4. Services and Facilities. Ensure the provision of adequate and accessible educational services and facilities that are designed to meet individual and community needs.		**S**
B1. Alternatives for funding and delivery. Explore alternatives for funding and delivery of educational services to improve the overall quality of education.		**NA**
B2. Autonomy and flexibility. Promote increased opportunities for greater autonomy and flexibility of educational institutions in their decision making responsibilities.		**NA**

SECTION	HAWAIʻI STATE FUNCTIONAL PLANS	RATING
B3. Increase use of Technology. Increase and improve the use of information technology in education and encourage programs which increase the public's awareness and understanding of the impact of information technologies on our lives.		**NA**
B4. Personal Development. Support education programs and activities that enhance personal development, physical fitness, recreation, and cultural pursuits of all groups.		**S**
B5. Students with Special Needs. Provide appropriate educational opportunities for groups with special needs.		**NA**
C1. Early Childhood Education. Develop resources and programs for early childhood education.		**NA**
C2.Hawaiʻi's Cultural Heritage. Promote educational programs which enhance understanding of Hawaiʻi's cultural heritage.		**S**
C3. Research programs and (Communication) Activities. Support research programs and activities that enhance the education programs of the State.		**NA**
ANALYSIS: As discussed in Section V.C.5 (Schools) the project site is being designed to accommodate a public elementary school campus on 12-acres adjacent to the proposed 18.5-acre community park. In addition, in 2007, the Hawaiʻi Legislature enacted Act 245 as Section 302A, HRS, "School Impact Fees". Based upon this legislation, the Department of Education has enacted impact fees for residential developments that occur within identified school impact districts. The Project is within the boundaries of the Central Maui Impact Fee District and is within the Wailuku Cost Area of that district. Projects within the district and cost area pay a construction fee and either a fee-in-lieu of land or a land donation, at the DOE's discretion. At the appropriate time, the Applicant will contact the DOE to enter into an impact fee agreement. The Applicant has also expressed a willingness to provide land for a Hawaiian Immersion school at the elementary school site, should the DOE determine that the need for such a facility exists at that location. It is also expected that privately run programs related to community gardening, the promotion of Hawaiian agricultural practices and other cultural-based learning opportunities may be offered within the WCT and on WCT agricultural lands.		
Employment State Functional Plan		
Objectives:		
a. Improve the qualifications of entry-level-workers and their transition to employment.		**NA**
b. Develop and deliver education, training and related services to ensure and maintain a quality and competitive workforce.		**NA**
c. Improve labor exchange.		**NA**

SECTION	HAWAIʻI STATE FUNCTIONAL PLANS	RATING
d. Improve the quality of life for workers and families.		**S**
e. Improve planning of economic development, employment and training activities.		**NA**
ANALYSIS: The MRTP will improve the quality of life for workers and families by providing homes, services, schools and other daily needs near existing employment; thereby, decreasing automobile use and promoting healthier modes of transportation. The project will also generate considerable employment during both the construction and operations phases of the development.		
Energy State Functional Plan		
Objectives:		
a. Moderate the growth in energy demand through conservation and energy efficiency.		**S**
b. Displace oil and fossil fuels through alternate and renewable energy resources.		**S**
c. Promote energy education and legislation.		**NA**
d. Support and develop an integrated approach to energy development and management.		**NA**
e. Ensure State's ability to implement energy emergency actions immediately in event of fuel supply disruptions. Ensure essential public services are maintained and provisions are made to alleviate economic and personal hardships which may arise.		**NA**
ANALYSIS: The WCT will include energy-efficient design and conservation measures. Specifically, WCT's design guidelines will encourage the use of energy efficient technology throughout the project, specifically in lighting, air-conditioning, and building materials. Solar hot water heaters will be utilized throughout the residential portion of the development and installation of Photovoltaic Energy Systems will be encouraged, where appropriate, on residential and commercial buildings within the WCT. Additionally, the WCT proposes to develop, in appropriate locations within the agricultural district, solar farms to help off-set the Project's demand for carbon emitting electrical energy.		
Health State Functional Plan		
Objectives:		
1. Health promotion and disease prevention. Reduction in the incidence, morbidity and mortality associated with the preventable and controllable conditions.		**NA**
2. Prevention and control of communicable diseases. Reduction in the incidence, morbidity, and mortality associated with infectious and communicable diseases.		**NA**
3. Health needs of special populations with impaired access to health care. Increased availability and accessibility of health services for groups with impaired access to health care programs.		**NA**

SECTION	HAWAIʻI STATE FUNCTIONAL PLANS	RATING
4. Community hospitals system. Development of a community hospital system which is innovative, responsive and supplies high quality care to the constituencies it serves.		**NA**
5. Environmental programs to protect and enhance the environment. Continued development of new environmental protection and health services programs to protect, monitor, and enhance the quality of life in Hawaiʻi.		**NA**
6. DOH leadership. To improve the Department of Health's ability to meet the public health need of the State of Hawaiʻi in the most appropriate, beneficial and economical way possible.		**NA**
ANALYSIS: The WCT does not propose the creation of medical or health programs; therefore, the Health State Functional Plan is not applicable. However, the WCT Master Plan will allow for medical research facilities, medical clinics, and doctor's offices to locate within the WCT.		
Higher Education State Functional Plan		
Objectives:		
A. A number and variety of postsecondary education institutions sufficient to provide the diverse range of programs required to satisfy individual and societal needs and interests.		**NA**
B. The highest level of quality, commensurate with its mission and objectives, of each educational, research, and public service program offered in Hawaiʻi by an institution of higher education.		**NA**
C. Provide appropriate educational opportunities for all who are willing and able to benefit from postsecondary education.		**NA**
D. Provide financing for postsecondary education programs sufficient to ensure adequate diversity, high quality, and wide accessibility.		**NA**
E. Increase program effectiveness and efficiency through better coordination of education resources.		**NA**
ANALYSIS: The WCT does not propose the creation of higher education facilities or programs; therefore, the Higher Education State Functional Plan is not applicable.		
Historic Preservation State Functional Plan		
Objectives:		
A. Identification of historic properties.		**S**
B. Protection of historic properties.		**S**
C. Management and treatment of historic properties.		**S**
D. Provision of adequate facilities to preserve.		**NA**
E. The establishment of programs to collect and conserve historic records, artifacts, and oral histories		**NA**

SECTION	HAWAIʻI STATE FUNCTIONAL PLANS	RATING
and to document and perpetuate traditional arts, skills, and culture.		
F. Provision of better access to historic information.		**NA**
G. Enhancement of skills and knowledge needed to preserve historical resources.		**NA**
ANALYSIS: As discussed in Section V.A.4 (Historical and Archaeological Resources) the Project's AIS documented no evidence of traditional Hawaiian activities, with the possible exception of a remnant retaining wall or terrace (Site 7882) on the property. It was noted that the negative results are primarily due to the compounded disturbances from sugarcane cultivation, historic habitation and modern land use. Other historic features documented in the AIS primarily relate to plantation-era agricultural irrigation features, including a section of the Waihe`e Ditch that traverses north to south across the subject property mauka of Honoapi'ilani Highway. The AIS recommends Archaeological Monitoring during the construction phase. Prior to the commencement of construction, an Archaeological Monitoring Plan (AMP) detailing the localities to undergo monitoring procedures will be prepared and submitted to SHPD for review and approval. With the completion of an Archaeological Inventory Survey prior to ground altering activities, and conducting State approved archaeological monitoring during construction, the State's objectives for the identification and protection of historic properties should be satisfied.		
Housing State Functional Plan		
Objectives and Policies:		
A. Homeownership for at least sixty percent, or roughly 248,500 households by the year 2000.		**S**
B. Sufficient amount of affordable rental housing units by the year 2000 so as to increase the State's rental vacancy rate to at least 3% with priority given to increasing the supply of units affordable to very low and lower income households.		**S**
C. Increased development of rental housing units for the elderly and other special needs groups to afford them an equal access to housing.		**NA**
D. Preservation of existing public and private housing stock.		**NA**
E. Acquire and designate land suitable for housing development in sufficient amount to locate the deficit in housing units by the year 2000.		**S**
F. Maintain a statewide housing data system for use by public and private agencies engaged in the provision of housing.		**NA**
ANALYSIS: The WCT will help to satisfy the growing demand for housing in Central Maui by providing a variety of housing options including affordable workforce housing in compliance with Chapter 2.96, MCC.		

SECTION	HAWAIʻI STATE FUNCTIONAL PLANS	RATING
Human Services State Functional Plan		
Objectives and Policies:		
A. To sustain and improve current elder abuse and neglect services.		**NA**
B. To increase cost-effective, high quality home and community based services.		**NA**
C. To increase home-based services to keep children in their homes and to increase placement resources for those children who must be temporarily or permanently removed from their homes, due to abuse or neglect.		**NA**
D. To address factors that contribute to child abuse and other forms of family violence.		**NA**
E. To provide affordable, accessible, and quality child care.		**NA**
F. To maximize efforts of self-sufficiency through provision of transitional medical care services.		**NA**
G. To provide AFDC recipients with a viable opportunity to become independent of the welfare system.		**NA**
H. To facilitate client access to human services.		**NA**
I. To eliminate organizational barriers which limit client access to human services.		**NA**
ANALYSIS: The WCT does not include the creation of human service programs; therefore, the Human Services Functional Plan is not applicable.		
Recreation State Functional Plan		
Objectives and Policies:		
1a. Address the problem of saturation of the capacity of beach parks and nearshore waters.		**NA**
1b. Reduce the incidence of ocean recreation accidents.		**NA**
1c. Resolve conflicts between different activities at heavily used ocean recreation areas.		**NA**
1d. Provide adequate boating facilities. Balance the demand for boating facilities against the need to protect the marine environment from potential adverse impacts.		**NA**
2a. Plan, develop, and promote recreational activities and facilities in mauka and other areas to provide a wide range of alternatives.		**S**
2b. Meet special recreation needs of the elderly, the disabled, woman, single-parent families, immigrants, and other groups.		**NA**
2c. Improve and expand the provision of recreation facilities in urban areas and local communities.		**S**
3a. Prevent the loss of access to shoreline and upland recreation areas due to new developments.		**NA**
3b. Resolve the problem of landowner liability that seriously hampers public access over private		**NA**

SECTION	HAWAIʻI STATE FUNCTIONAL PLANS	RATING
lands.		
3c. Increase access to State Forest Reserve lands over federal property, leased State lands, and other government lands.		**NA**
3d. Acquire, develop, and manage additional public access ways.		**S**
4a. Promote a conservation ethic in the use of Hawaiʻi's recreational resources.		**S**
4b. Prevent degradation of the marine environment.		**S**
4c. Improve the State's enforcement capabilities.		**NA**
4d. Mitigate adverse impacts of tour helicopters on the quality of recreational experiences in wilderness areas.		**NA**
5a. Properly maintain existing park and recreation areas.		**NA**
5b. Promote interagency coordination and cooperation to facilitate sharing of resources, joint development efforts, clarification of responsibilities and jurisdictions, and improvements in enforcement capabilities.		**NA**
5c. Assure adequate support for priority outdoor recreation programs and facilities.		**NA**
6a. Increase recreational access and opportunities in Hawaiʻi's wetlands.		**NA**
6b. Develop and adequate information base to assist the County planning departments and other regulatory agencies in making decisions regarding the wetlands.		**NA**
6c. Assure the protection of the most valuable wetlands in the State.		**NA**

ANALYSIS: As discussed in Section III.B.1-4 of the ~~DEIS~~ FEIS, the WCT provides an extensive network of neighborhood and community parks, open spaces and separated pedestrian and bicycle facilities throughout the Project. The Project's park facilities will provide diverse opportunities for community and family gatherings, passive recreation and active recreation. The park system may include shaded areas for picnics and barbeques, developed tot lot facilities for families with young children, areas for community gardening, and areas for active recreation such as soccer, football, baseball and basketball. The WCTs approximate 8-mile network of trails, walkways and bikeways will provide additional open land recreational opportunities while connecting the Project's residential areas, neighborhood parks and employment areas together. The Project's agricultural lands may also offer opportunities for horseback riding, hiking, skeet shooting and mountain bike riding.

The WCT will comply with the requirements of MCC Title 18.16.320 "Parks and Playgrounds", which requires a dedication of land or money for each residential unit developed. There are no wetlands located in the WCT.

SECTION	HAWAIʻI STATE FUNCTIONAL PLANS	RATING
Tourism State Functional Plan		
Objectives:		
1a. Development, implementation and maintenance of policies and actions which support the steady and balanced growth of the visitor industry.		**NA**
2a. Development and maintenance of well-designed visitor facilities and related developments which are sensitive to the environment, sensitive to neighboring communities and activities, and adequately serviced by infrastructure and support services.		**NA**
3a. Enhancement of respect and regard for the fragile resources which comprise Hawaiʻi's natural and cultural environment. Increased preservation and maintenance efforts.		**NA**
4a. Support of Hawaiʻi's diverse range of lifestyles and natural environment.		**NA**
4b. Achievement of mutual appreciation among residents, visitors, and the visitor industry.		**NA**
5a. Development of a productive workforce to maintain a high quality visitor industry.		**NA**
5b. Enhancement of career and employment opportunities in the visitor destination in specific desired market segments.		**NA**
6a. Maintenance of a high customer awareness of Hawaiʻi as a visitor destination in specific desired market segments.		**NA**
ANALYSIS: The WCT is not targeting the visitor industry. However, it is possible that the establishment of a small business hotel could create jobs and stimulate economic vitality within the Project's commercial districts. Therefore, the Project's zoning ordinances may allow for a business hotel in order to accommodate such a facility should demand warrant.		
Transportation State Functional Plan		
Objectives:		
1a. Expansion of transportation system.		**S**
1b. Reduction of travel demand through zoning and decentralization initiatives.		**S**
1c. Management of existing transportation systems through a program of transportation systems management (TSM).		**NA**
1d. Identification and reservation of lands and right-of-way required for future transportation improvements.		**S**
1e. Planning and designing State highways to enhance inter-regional mobility.		**S**
1f. Improving and enhancing transportation safety.		**S**

SECTION	HAWAIʻI STATE FUNCTIONAL PLANS	RATING
1g. Improved transportation maintenance programs.		**NA**
1h. Ensure that transportation facilities are accessible to people with disabilities.		**NA**
2a. Development of a transportation infrastructure that supports economic development initiatives.		**S**
3a. Expansion of revenue bases for transportation improvements.		**NA**
4a. Providing educational programs.		**NA**

ANALYSIS: As discussed in Section V.D.1 (Roadways and Traffic) the WCT will provide a variety of traffic related improvements that will address the traffic impacts specifically related to the Project. In addition, the Applicant will coordinate with neighboring land owners and the State and County to address the need for regional improvements that will be warranted by development of the WCT, together with neighboring projects. Regional traffic improvements may include planning for the Wai`ale Bypass road and traffic signalization to enhance inter-regional mobility within Central Maui.

The WCT's non-vehicular transportation strategy includes: 1) compact and mixed-use development patterns, 2) pedestrian oriented streets integrating street trees, sidewalks, and traffic calming, 3) both striped and separated bike lanes in appropriate locations, 4) a network of greenways and parkways to facilitate mobility, and 5) providing connectivity to adjacent developments, such as the Wai`ale development and the State and County's proposed regional parks.

In addition, WCT transportation demand management measures may include: 1) encouraging alternate work schedules and off peak hours for employment generators and 2) supporting park and ride, ridesharing, carpooling, van pooling and regional and sub-regional shuttles.

Water Resources Development State Functional Plan	
Objectives:	
a. Enunciate State water policy and improve management framework.	**NA**
b. Maintain the long-term availability of freshwater supplies, giving consideration to the accommodation of important environmental values.	**S**
c. Improve management of floodplains.	**NA**
d. Assure adequate municipal water supplies for planned urban growth.	**S**
e. Assure the availability of adequate water for agriculture.	**S**
f. Encourage and coordinate with other water programs the development of self-supplied industrial	**NA**

SECTION	HAWAI'I STATE FUNCTIONAL PLANS	RATING
water and the production of water-based energy.		
g. Provide for the protection and enhancement of Hawai'i's freshwater and estuarine environment.		**S**
h. Improve State grant and loan procedures for water program and projects.		**NA**
i. Pursue water resources data collection and research to meet changing needs.		**NA**

ANALYSIS: As documented in Section V.D.4 (Water), the WCT has developed three on-site potable wells and two on-site non-potable wells. Both of the non-potable wells have preliminarily shown low salinity levels, and testing is being conducted to determine the viability of those wells for domestic use. If not viable for domestic use, they will be used for non-potable agricultural use. Water pumped from the non-potable wells will be discharged into the Waihee Ditch or lined onsite reservoirs and used for irrigation purposes for the residential lots, agricultural farming, parks and open areas. A sixth well also exists to be used for monitoring. ~~to meet the Project's water demand.~~ Development of these wells is being done with input from the County's Department of Water Supply and the State Commission on Water Resources Management (CWRM). The Applicant proposes to supply the Project's potable water demand through its on-site wells, which will draw from the Waikapū Aquifer.

~~As discussed in Section V.D.4 (Water) the WCT has developed three on-site potable wells and two on-site non-potable wells to meet the project's potable and non-potable water demand. Development of these wells is being done with input from the County's Department of Water Supply and the State Commission on Water Resources Management (CWRM). It is expected that the WCT water system will have sufficient capacity to accommodate the project and other potable water needs within the area.~~

The Applicant is also proposing to develop a dual water system for potable and irrigation water demand. The Project's non-potable water demand will be met through a combination of surface water provided from the Waihee Ditch system (subject to the issuance of surface water use permits from the CWRM), non-potable agricultural wells, and reclaimed wastewater. The non-potable system will service the WCTs park lands, open space and the landscape planting of residential and commercial lots. It is expected that the dual system will reduce potable water demand by at least one-third. Moreover, the WCT will incorporate other water conservation measures into the project, such as low flow toilets and shower heads. Water conserving irrigation practices including using draught tolerant plants and drip irrigation will also be utilized to conserve non-potable water resources. In the future, when reclaimed water becomes available, it will also be used within the Project in appropriate areas.

E. COASTAL ZONE MANAGEMENT

Coastal Zone Management objectives and policies (section 205A-2 HRS) and the Special Management Area Rules for the Maui Planning Commission (Chapter 202) have been developed to preserve, protect and, where possible, to restore the natural resources of the coastal zone of Hawai'i. While the subject property is not located within the Special Management Area, the ~~DEIS~~ FEIS will analyze the project's consistency with Coastal Zone Management Objectives and Policies.

1. Recreational Resources

Objective: Provide coastal recreational resources accessible to the public.

Policies:

(a) Improve coordination and funding of coastal recreational planning and management; and

(b) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

(i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

(ii) Requiring replacement of coastal resources having significant recreational value, including but not limited to surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or require reasonable monetary compensation to the state for recreation when replacement is not feasible or desirable;

(iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

(iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

(v) Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having standards and conservation of natural resources;

(vi) Adopting water quality standards and regulating point and non-point sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;

(vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing;

(viii) Encourage reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of Section 46-6, HRS.

Analysis: The WCT will not restrict public recreation opportunities along the coastline because the site is approximately three (3) miles from the Pacific Ocean. The proposed drainage system design will minimize the possibility of non-point source pollution from entering the marine environment. Adjacent gulches will not be impacted since storm runoff will be directed towards onsite retention basins strategically located throughout the site.

2. Historical/Cultural Resources

Objective: Protect, preserve and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies:

(a) Identify and analyze significant archeological resources;

(b) Maximize information retention through preservation of remains and artifacts or salvage operations; and

(c) Support state goals for protection, restoration, interpretation, and display of historic structures.

Analysis: As part of the ~~DEIS~~ FEIS an Archeological Inventory Survey (AIS) was conducted on the property. During the investigation, no evidence of traditional Hawaiian activities, with the possible exception of Site 7882 (remnant retaining wall or terrace) was recorded. These negative results are primarily due to the compounded disturbances from sugarcane cultivation, and historic habitation and modern land use.

Based on the proposed development plan, Site 7884 Features 2-3 (historic trash scatter and refuse pit); a section of Site 5197 (Waihe`e Ditch) and possibly Site 7883 (WWII bunker) may be adversely affected during the development activities. The AIS notes that these historic properties have been properly recorded and may be removed and or altered during construction. Archaeological monitoring is recommended for those areas that contain former LCA's and Grants. Prior to the commencement of construction, an Archaeological Monitoring Plan (AMP) detailing the localities to undergo monitoring procedures will be prepared and submitted to SHPD for review and approval. The Project is not expected to have an adverse impact upon archaeological or historical resources.

3. Scenic and Open Space Resources

Objective: Protect, preserve and, where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:

(a) Identify valued scenic resources in the coastal zone management area;

(b) Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

(c) Preserve, maintain, and where desirable, improve and restore shoreline open space and scenic resources; and

(d) Encourage those developments that are not coastal dependent to locate in inland areas.

Analysis:

As discussed in Section V.A.6 *(Visual Resources)* the WCT has approximately 12,243 feet, or 2.31 miles, of linear urban, rural and agricultural frontage along Honoapi'ilani Highway. The WCT will change the character of the existing open space, Haleakalā and West Maui Mountain views along the frontage of the Highway where urban and rural development is being proposed. The frontage that will be impacted stretches approximately 4,700 linear feet south of Waikapū, from the northern boundary of the MTP. The views from this area, where not currently obstructed by existing vegetation within the right-of-way, are of agricultural lands and the West Maui Mountain in the background looking in a mauka direction. Looking in a makai direction views of sugar cane are prominent with Haleakalā and the Pacific Ocean in the background on clear days.

While the existing character of the open space, Haleakalā and West Maui Mountain views will be impacted by the development, setbacks of at least 60-feet, and in some areas up to 100-feet or more, will be utilized along each side of the Honoapi'ilani Highway to separate the development from the public right-of-way. In order to mitigate the obstruction of views from the highway to the West Maui Mountains, buildings will be setback from the highway and building heights will be limited to a maximum of 30-feet along the highway frontage. Buildings will also be separated, placed and oriented in a manner that will establish view corridors from the highway to the West Maui Mountains. Building setbacks and placement will help to mitigate the project's overall impact upon the existing views of Haleakalā and the West Maui Mountains.

While the development will produce an impact upon the character of views along Honoapi'ilani Highway, fronting the urban lands, the Applicant is proposing to create a permanent 800-acre agricultural preserve that will exist on both the mauka and makai sides of Honoapi'ilani Highway. The preserve's frontage is approximately 7,550-feet along the highway. The approximate 800-acres of agricultural land will create a permanent open space buffer and separation between Waikapū Town and Māʻalaea. Along this section of the highway, largely unobstructed views of Haleakalā, the West Maui Mountains and partial views of the Pacific Ocean will exist in perpetuity.

4. Coastal Ecosystems

Objective: Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

(a) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

(b) Improve the technical basis for natural resource management;

(c) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;

(d) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

(e) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and non-point source water pollution control measures.

Analysis: The WCT is located approximately three (3) miles from the shoreline; therefore the proposed project is expected to have minimal impact on the coastal ecosystems. The proposed drainage design will minimize the possibility of non-point source pollution from entering the marine environment. Adjacent gulches will not be impacted since storm runoff will be directed towards onsite retention basins strategically located throughout the site.

Furthermore, the incorporation of mitigation BMPs during construction will minimize the potential for short term adverse impacts.

5. Economic Use

Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:

(a) Concentrate coastal dependent development in appropriate areas;

(b) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area;

(c) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such development and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

(i) Use of presently designated locations is not feasible;

(ii) Adverse environmental impacts are minimized; and

(iii) The development is important to the State's economy.

Analysis: The WCT is expected to indirectly support Maui's existing economic base activities by providing much needed housing to serve the island's workforce. The WCT is intended to provide housing along with supporting commercial, employment and institutional uses that will allow for Maui's economic base industries to grow, diversify and become more sustainable - including the island's agricultural industry.

The project will also directly support the agricultural industry by establishing an approximate 800-acre agricultural preserve on prime agricultural lands. These lands will be supplied with a readily available and affordable source of irrigation water. This centrally located agricultural park will help Maui's farmers better compete with mainland agricultural producers in Hawai'i's market, while also creating opportunities to expand export crops to the mainland and overseas. There are currently two successful commercial farms farming the WCTs agricultural lands. These include Kumu Farms and Hawai'i Taro LLC. These farms have many years of experience farming in Hawai'i and have had success competing in local, mainland and export markets.

The project will also create direct, indirect and induced short- and long-term positive economic impacts. As discussed in Section V.B.3-4 (Economy), the WCT will bring in ~~$609.1~~ $ 644.1 million of new capital investment into the Maui economy. The construction of the WCT components will directly create an estimated ~~2,320~~ 2,476 "worker-years" of employment (the equivalent of 52 work weeks at 40 hours per week) in the trades and associated businesses during build-out, averaging about 165 Full Time Equivalent (FTE) per year for the 15 years of building. Most of these positions will not be new jobs for new businesses, but work flowing to existing contractors and suppliers. ~~positions 193 worker years annually, with an estimated $188.3 million in wages (averaging about $15.7 million per year).~~

The 169,000 square feet of new commercial operation will generate some 4,251 FTE worker years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions. These jobs will be new positions in the Maui economy. This total does not include the employment, wages or business activity contributions of the existing 29,250 square feet of commercial space in the Maui Tropical Plantation which will be retained.

The Project will require an estimated 66 worker years of maintenance and common area element employment on a continual basis, and will generate some 1,750 1,789 worker years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions. In aggregate, during the development of the WCT 8,750 8,946 worker years of employment will be created during construction and operations, on-site/direct and off-site/indirect, with stabilized employment after completion of 746 jobs. During the 15 years projection period, WCT will have a base economic impact on Maui of some $817.1 million in new monies with a stabilized annual benefit of $32.1 million thereafter.

~~The on-going operations and maintenance of the business commercial and residential components will directly provide an estimated 4,251 FTE worker years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions. The Project will require an estimated 66 worker years of maintenance and common area element employment on a continual basis, and will generate some 1,750 worker years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions.~~

~~In aggregate, during the development of the WCT 8,750 worker years of employment will be created during construction and operations, on-site/direct and off-site/indirect, with stabilized employment after completion of 746 jobs. During the 15 years projection period, WCT will have a base economic impact of $1.3 billion with a stabilized annual benefit of $137.3 million thereafter.~~

By providing much needed housing in a format that will create a high quality of life for Maui's working families, and by generating both short- and long-term employment in the construction, trade and agricultural industries, the project is directly supportive of the State and County's economic development.

6. Coastal Hazards

Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence and pollution.

Policies:

(a) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and non-point source pollution hazards;

(b) Control development in areas subject to storm wave, tsunami, flood, erosion, subsidence, and point and non-point pollution hazards;

(c) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

(d) Prevent coastal flooding from inland projects.

Analysis: A portion of TMK Parcel Nos. 3-6-002:003 and 3-6-004:003, paralleling the Waikapū Stream, are located in Zones AEF and AE and XS. Zones AEF and AE are Special Flood Hazard Areas subject to inundation by the 1% annual chance flood. Zone AEF is defined as the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE. Zone AE is an area where the base flood elevation has been determined. The project area located adjacent to the Waikapū Stream, within the Special Flood Hazard Area, is proposed to be set aside for parks, open space and agriculture. No structures will be will be located within Zone AEF.

Therefore, the subject property should not have an adverse impact on neighboring properties with regards to flood hazard potential.

7. Managing Development

Objective: Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

Policies:

(a) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;

(b) Facilitate timely processing of applications for development permits and resolve overlapping of conflicting permit requirements; and

(c) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

Analysis: The WCT is not a coastal development and is located outside of the SMA, approximately three (3) miles from the Pacific Ocean. The Project is not anticipated to negatively impact the management of coastal resources in the SMA. The Project Team has conducted public informational meetings and will continue to do so in the future to facilitate public participation in the planning and review process.

8. Public Participation

Objective: Stimulate public awareness, education, and participation in coastal management.

Policies:

(a) Promote public involvement in coastal zone management processes;

(b) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and

(c) Organize workshops, policy dialogues, and site-specific medications to respond to coastal issues and conflicts.

Analysis: Master planning for the project was initiated in January 2009, nearly six years ago. Since 2009, the Applicant has consulted with State and County agencies and the Waikapū community regarding its development plans. Meetings have been conducted with the County of Maui's Department of Planning, Department of Public Works, Department of Environmental Management, Department of Parks and Recreation, and the Department of Water Supply. Meetings have also been conducted with the State Department of Education, State Department of Transportation, State Office of Planning, and State Land Use Commission. In addition, the

Applicant continues to have regular meetings with key Waikapū Stakeholders and regularly presents the project's status to the Waikapū Community Association. The meetings conducted by the Applicant provide an ongoing opportunity for the community to talk with the Project Team and to provide feedback about the proposed WCT Master Plan.

9. Beach Protection

Objective: Protect beaches for public use and recreation.

Policies:

(a) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;

(b) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and

(c) Minimize the construction of public erosion-protection structures seaward of the shoreline.

Analysis: The WCT is located approximately three (3) miles from the Pacific Ocean and therefore the subject project is not anticipated to negatively impact beaches for public use or recreation.

10. Marine Resources

Objective: Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

Policies:

(a) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

(b) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;

(c) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;

(d) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and

(e) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources. [L 1977, c 188, pt of §3; am L 1993, c 258, §1; am L 1994, c 3, §1; am L 1995, c 104, §5; am L 2001, c 169, §3]

ANALYSIS: As previously stated, the WCT is located approximately three (3) miles from the Pacific Ocean. The drainage system will retain stormwater runoff on-site in above ground basins and in subsurface chambers to capture any increase in run-off created by the Project. Best Management Practices (BMPs) will be implemented during the construction and operation phases of the development to protect coastal water quality. Construction BMPs are temporary measures installed before commencement of construction and removed after the site has been stabilized and the permanent measures are in place. Temporary construction measures include but are not limited to dust screens, silt fences, filter berms, fuel containment berms, and tire cleaning pads. Construction BMPs must also conform to the provisions of Chapter 20.08 – Soil Erosion and Sediment Control of the Maui County Code.

Permanent BMPs are measures that are part of the project and will remain in place after the construction is completed. Permanent measures are intended to reduce storm water pollution generated from the development of the project site. The use of detention basins, grassed swales, and permanent grassing and landscaping of exposed areas will be implemented to provide a level of stormwater filtration and pollution control. Section V.D.3, "Drainage" of the ~~DEIS~~ FEIS describes the Project's on-site drainage system, including construction phase BMPs. With the incorporation of the proposed drainage system, project related development impacts to marine resources should be avoided.

F. STATE ENVIRONMENTAL POLICY

HRS Chapter 344 establishes an environmental policy that (1) encourages productive and enjoyable harmony between people and their environment; (2) promotes efforts to prevent or eliminate damage to the environment and biosphere; (3) stimulates the health and welfare of humanity; and (4) enriches the understanding of the ecological systems and natural resources important to the people of Hawai‘i.

HRS §344-2 defines “environment” as the complex of physical and biological conditions that influence human well-being, including land, air, water, minerals, flora, fauna, energy, noise, and places of historic or aesthetic significance. Table 59 ~~53~~ summarizes the policies of the State Environmental Policy, HRS §344, and discusses the relationship and applicability, if any, of the policy to the WCT development.

Table 61 ~~55~~: State Environmental Policy

SECTION	STATE ENVIRONMENTAL POLICY	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
344-3	ENVIRONMENTAL POLICY. It shall be the policy of the State, through its programs, authorities, and resources to:	
(1)	Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State’s unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawai‘i.	**S**
(2)	Enhance the quality of life by:	
(A)	Setting population limits so that the interaction between the natural and artificial environments and the population is mutually beneficial;	**S**
(B)	Creating opportunities for the residents of Hawai‘i to improve their quality of life through diverse economic activities which are stable and in balance with the physical and social environments;	**S**

SECTION	STATE ENVIRONMENTAL POLICY	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
(C)	Establishing communities which provide a sense of identity, wise use of land, efficient transportation, and aesthetic and social satisfaction in harmony with the natural environment which is uniquely Hawaiian; and	**S**
(D)	Establishing a commitment on the part of each person to protect and enhance Hawai'i's environment and reduce the drain on nonrenewable resources.	**NA**
344-4	GUIDELINES. In pursuance of the state policy to conserve the natural resources and enhance the quality of life, all agencies, in the development of programs, shall, insofar as practicable, consider the following guidelines:	
(1)	POPULATION.	
(A)	Recognize population impact as a major factor in environmental degradation and adopt guidelines to alleviate this impact and minimize future degradation;	**S**
(B)	Recognize optimum population levels for counties and districts within the State, keeping in mind that these will change with technology and circumstance, and adopt guidelines to limit population to the levels determined.	**S**
(2)	LAND, WATER, MINERAL, VISUAL, AIR, AND OTHER NATURAL RESOURCES.	
(A)	Encourage management practices which conserve and fully utilize all natural resources;	**S**
(B)	Promote irrigation and waste water management practices which conserve and fully utilize vital water resources;	**S**
(C)	Promote the recycling of waste water;	**S**
(D)	Encourage management practices which conserve and protect watersheds and water sources, forest, and open space areas;	**S**
(E)	Establish and maintain natural area preserves, wildlife preserves, forest reserves, marine preserves, and unique ecological preserves;	**NA**
(F)	Maintain an integrated system of state land use planning which coordinates the state and county general plans.	**S**
(G)	Promote the optimal use of solid wastes through programs of waste prevention, energy resource recovery, and recycling so that all our wastes become utilized.	**S**
(3)	FLORA AND FAUNA.	

SECTION	STATE ENVIRONMENTAL POLICY	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
(A)	Protect endangered species of indigenous plants and animals and introduce new plants or animals only upon assurance of negligible ecological hazard;	**S**
(B)	Foster the planting of native as well as other trees, shrubs, and flowering plants compatible to the enhancement of our environment.	**S**
(4)	Parks, recreation, and open space.	
(A)	Establish, preserve and maintain scenic, historic, cultural, park and recreation areas, including the shorelines, for public recreational, educational, and scientific uses;	**S**
(B)	Protect the shorelines of the State from encroachment of artificial improvements, structures, and activities;	**NA**
(C)	Promote open space in view of its natural beauty not only as a natural resource but as an ennobling, living environment for its people.	**S**
(5)	ECONOMIC DEVELOPMENT.	
(A)	Encourage industries in Hawai‘i which would be in harmony with our environment;	**S**
(B)	Promote and foster the agricultural industry of the State; and preserve and conserve productive agricultural lands;	**S**
(C)	Encourage federal activities in Hawai‘i to protect the environment;	**NA**
(D)	Encourage all industries including the fishing, aquaculture, oceanography, recreation, and forest products industries to protect the environment;	**NA**
(E)	Establish visitor destination areas with planning controls which shall include but not be limited to the number of rooms;	**NA**
(F)	Promote and foster the aquaculture industry of the State; and preserve and conserve productive aquacultural lands.	**NA**
(6)	TRANSPORTATION.	
(A)	Encourage transportation systems in harmony with the lifestyle of the people and environment of the State;	**S**
(B)	Adopt guidelines to alleviate environmental degradation caused by motor vehicles;	**NA**
(C)	Encourage public and private vehicles and transportation systems to conserve energy, reduce pollution emission, including noise, and provide safe and convenient	**S**
(7)	ENERGY.	
(A)	Encourage the efficient use of energy resources.	**S**
(8)	COMMUNITY LIFE AND HOUSING.	

SECTION	STATE ENVIRONMENTAL POLICY	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
(A)	Foster lifestyles compatible with the environment; preserve the variety of lifestyles traditional to Hawai'i through the design and maintenance of neighborhoods which reflect the culture and mores of the community;	**S**
(B)	Develop communities which provide a sense of identity and social satisfaction in harmony with the environment and provide internal opportunities for shopping, employment, education, and recreation;	**S**
(C)	Encourage the reduction of environmental pollution which may degrade a community;	**S**
(D)	Foster safe, sanitary, and decent homes;	**S**
(E)	Recognize community appearances as major economic and aesthetic assets of the counties and the State; encourage green belts, plantings, and landscape plans and designs in urban areas; and preserve and promote mountain-to-ocean vistas.	**S**
(9)	EDUCATION AND CULTURE.	
(A)	Foster culture and the arts and promote their linkage to the enhancement of the environment;	**NA**
(B)	Encourage both formal and informal environmental education to all age groups.	**NA**
(10)	CITIZEN PARTICIPATION.	
(A)	Encourage all individuals in the State to adopt a moral ethic to respect the natural environment; to reduce waste and excessive consumption; and to fulfill the responsibility as trustees of the environment for the present and succeeding generations; and	**NA**
(B)	Provide for expanding citizen participation in the decision making process so it continually embraces more citizens and more issues.	**NA**

G. STATE ENVIRONMENTAL IMPACT STATEMENT REQUIREMENTS SIGNIFICANCE CRITERIA

HAR §11-200-12, establishes 13 significance criteria which agencies shall use in evaluating an action's impacts. The following is a discussion of how the proposed action relates to the 13 criteria.

(1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;

Analysis: The Project will result in the urbanization of approximately 485 acres of prime agricultural land. However, as documented in Section V.A.7 and Appendix G of the ~~DEIS~~ FEIS, the urbanization of this land should have minimal long-term impact on the availability of agricultural land within the County and/or State since an abundance of other land, of a similar or higher quality, is currently fallow and available for production elsewhere. In addition, the WCT's agricultural component includes nearly 1,077 acres of land that will remain in agricultural use. Of these lands, approximately 800 acres will be permanently dedicated to agricultural use with no residential structures to be permitted. The remaining 277 acres may be subdivided into as many as five large agricultural lots where a farm dwelling may be permitted. Within the agricultural lands, several hundred acres may be developed as a public and/or private agricultural park to help facilitate Maui's agricultural development. The establishment of a centrally located 800-acre agricultural reserve, comprising productive lands, affordable irrigation water and close proximity to inter-island and mainland shipping opportunities, should help Maui farmers compete in local, mainland and international markets.

(2) Curtails the range of beneficial uses of the environment;

Analysis: The range of beneficial uses of the property's environment is guided by the State Land Use District classification and the County's General Plan. The proposed project increases the range of beneficial uses for the environment by providing affordable and market-priced housing units, parks and open space, sites reserved for future school facilities, integration of future transit components, and potential connectivity with surrounding roads, infrastructure, services, and public facilities. It also includes the agricultural preserve, which includes the 800-acres to be dedicated in perpetuity for agriculture.

(3) Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders;

Analysis: The stated purpose of Chapter 344 is to establish a state policy which will encourage productive and enjoyable harmony between people and their environment, promote efforts which

will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, and enrich the understanding of the ecological systems and natural resources important to the people of Hawai'i. The proposed project complies with the policies, goals and guidelines of Chapter 344, as described in section 5.5 above. The project proposes to create a master planned mixed-use residential community that will be integrated with the regional transportation network and infrastructure systems, and improve the quality of life for residents by providing affordable housing near employment centers.

(4) Substantially affects the economic or social welfare of the community or state;

Analysis: Development of the property for residential purposes is consistent with State and County policies encouraging residential development near employment centers, infrastructure and public facilities. The project site is located within the MIPs Small Town Growth Boundary and is identified as a "Planned Growth Area" with an allocation of residential and commercial development to address the projected population growth of the County. The Project will have positive impacts on the social welfare of the Central Maui community and on the economic welfare of the community and the state through the creation of workforce and market priced housing and jobs.

(5) Substantially affects public health;

Analysis: The proposed project is anticipated to have negligible impact on public health. Infrastructure systems will be constructed to comply with applicable State DOH and County standards and regulations.

(6) Involves substantial secondary impacts such as population changes or effects on public facilities;

Analysis: The WCT encompasses about 1,433 units, supporting commercial development and infrastructure and public facilities. At buildout, the de facto population of the Project will be approximately ~~3,511~~ 4,085 persons, comprised of ~~3,362~~ 3,922 full-time residents and some ~~148~~ 163 part-time residents and second home owners. The project population represents from approximately 9.93 percent ~~8.40%~~ to ~~15.40%~~ 18.51 percent of the region's projected resident

population growth to 2035. It is not expected there will be meaningful in- migration to Maui as a direct result of the operating components of the project.

The Project population will increase demand on public infrastructure and facility systems. The Project impact on these systems will be mitigated through required Project sponsored improvements to infrastructure and public facility systems, payment of impact fees and taxation.

(7) Involves a substantial degradation of environmental quality;

Analysis: The proposed project will involve extensive ground disturbance, including grubbing and grading of the property. However, the property has been continuously tilled for decades to support plantation agriculture. As noted in the flora and fauna study, development of the subject property will not significantly impact threatened or endangered species of flora and fauna that will constrain development of the project site. During the construction phase, temporary BMPs will be implemented to mitigate the potential for non-point source pollution and deterioration of air quality. During the operation phase, permanent BMPs will be implemented to protect coastal water quality. Development of a mixed use community, with emphasis on active transportation modes, incorporation of renewable energy development, recycling and water and energy conservation will help to ensure that the Project minimizes its overall environmental impact.

(8) Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions;

Analysis: As documented in Section VI.B of the ~~DEIS~~ FEIS, the Project will produce both individual and cumulative impacts. Individual impacts will arise from the projected increase in demand upon the region's infrastructure and public facilities from the Project population. Cumulative impacts will also arise as this population growth is added to the growth in population associated with other regional developments. As documented in Section V.C and D of the ~~DEIS~~ FEIS, measures to increase the capacity of the region's schools, water supply, wastewater treatment capacity, and regional roadways will be necessary to accommodate the WCT together with other development expected over the next 20 years.

(9) Substantially affects a rare, threatened, or endangered species, or its habitat;

Analysis: No rare, threatened, or endangered species or related habitats will be impacted when the subject property is developed.

(10) Detrimentally affects air or water quality or ambient noise levels;

Analysis: The Project will increase motor vehicle use in the immediate area, which may affect air quality but not significantly. Wastewater from the project site will be handled, either using a private system and/or through connection to the county's facility. Runoff from the project site will be carefully managed using BMPs during the construction phase. During the operation phase, runoff will be contained on-site so that no increase in runoff will result from the project. Ambient noise levels may be impacted in the project area, but are not expected to exceed acceptable levels due to the residential community nature of the development.

(11) Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;

Analysis: A portion of TMK Parcel Nos. 3-6-002:003 and 3-6-004:003, paralleling the Waikapū Stream, are located in Zones AEF, AE and XS. The project area located adjacent to the Waikapū Stream, within the Special Flood Hazard Area, is proposed to be set aside for parks, open space and agriculture. No structures will be will be located within Zone AEF.

Regarding earthquakes, Maui is rated as seismic hazard level IIb in the UBC (as compared to IV, the highest level for the island of Hawai'i and I for Kaua'i). Proposed structures in the development will conform to all relevant building code requirements, including applicable seismic and hurricane design standards.

(12) Substantially affects scenic vistas and viewplanes identified in county or state plans or studies;

Analysis: Chris Hart & Partners, Inc. prepared an island-wide Scenic Resources Inventory Study for the County of Maui, Department of Planning, in July 2006 in support of the General Plan 2030

Update. The purpose of the study was to inventory and rate the island's scenic resources so that appropriate advanced planning and mitigation strategies could be employed to protect these resources. The Scenic Resources Inventory Study identifies the area along Honoapi'ilani Highway, fronting the project site and continuing to Mā'alaea, as an area of "High" scenic resource value. In the study, areas of "Exceptional" and "High" resource value are described as having "dramatic and diverse resource values consistently throughout the corridor" and are "typically in a natural condition and unmarked by development."

The WCT will have approximately 12,243 feet, or 2.31 miles, of urban, rural and agricultural frontage along Honoapi'ilani Highway. The WCT will change the character of the existing open space, Haleakalā and West Maui Mountain views along the frontage of the Highway where urban and rural development is being proposed. The frontage that will be impacted stretches approximately 4,700 linear feet just south of Waikapū, from the northern boundary of the Maui Tropical Plantation. The views from this area, where not currently obstructed by existing vegetation within the right-of-way, are of agricultural lands and the West Maui Mountain in the background looking in a mauka direction. Looking in a makai direction views, where not obstructed by existing vegetation, are of Haleakalā and the Pacific Ocean can also be seen when the sugarcane has been harvested (See Section V.A.6 and Figure 35 ~~30~~, A-E).

While the existing character of the open space, Haleakalā and West Maui Mountain views will be impacted by the development, setbacks of at least 60-feet, and in some areas up to 100-feet, will be utilized along each side of the Honoapi'ilani Highway to separate the development from the public right-of-way. In order to mitigate the obstruction of views from the highway to the West Maui Mountains, buildings will be setback at least 75-feet from the highway and building heights will be limited to a maximum of 30-feet along the highway frontage. Buildings will also be separated, placed and oriented in a manner that will establish view corridors from the highway to the West Maui Mountains. Building setbacks and placement will help to mitigate the project's overall impact upon the existing views of Haleakalā and the West Maui Mountains.

While the development will produce an impact upon the character of views along Honoapi'ilani Highway, fronting the urban lands, it is important to note that the Applicant is also proposing to create a permanent 800-acre agricultural preserve that will exist on both the mauka and makai sides

of Honoapi'ilani Highway. The preserves frontage is approximately 7,550 linear feet along the highway. The approximate 800-acres of agricultural land will create a permanent open space buffer and permanent separation between Waikapū Town and Mā'alaea. Along this section of the highway, largely unobstructed views of Haleakalā, the West Maui Mountains and partial views of the Pacific Ocean will exist in perpetuity.

The Applicant is establishing wide setbacks from Honoapi'ilani Highway to allow for pedestrian and bicycle facilities and the establishment of landscape planting. As is common throughout Hawai'i, and especially on Maui, the planting of large canopy Monkey Pod trees, tropical shrubs and ground covers will be maintained to create a sense of separation and definition between the urban development and the highway. Separated from the highway, an approximate 10-foot wide shared pedestrian and bicycle track will meander along the roadways frontage. The overall effect will be to create a greenway with a variety of plant massing and color, and the presence of intermittent views of Haleakalā and the West Maui Mountains along the frontage of the development.

(13) Requires substantial energy consumption.

Analysis: Energy consumption will increase in relation to the proposed development. However, the Applicant intends, where both practical and feasible, to incorporate roof-top solar photovoltaic systems on residential and commercial structures and to develop solar farms in strategically located areas to help off-set the Project's demand for carbon based fuels. The Applicant will also encourage building design that conserves energy through building placement that takes advantage of natural cooling and sunlight, the use of energy efficient building materials and the incorporation of canopy shade trees to promote cooling. All single-family residential homes will be equipped with solar hot water heating and Energy-Star appliances, when applicable. Additionally, the WCT proposes to develop, in appropriate locations within the agricultural district, solar farms to help off-set the Project's demand for carbon emitting electrical energy. As an example, if forty percent of residential and commercial buildings install photovoltaic systems (generating approximately 11.9 GWh per year), demand for carbon-based fuels could be reduced by roughly 50 percent. Moreover, the WCT desires to install a limited number of solar farms in appropriate locations within the agricultural lands. If two solar farms of approximately 5-acres (0.75 MW each) each are developed, the electricity generated would be about 2.6 GWh per year, which could service approximately 236

residential units. Thus, the WCT could potentially generate about 70 percent of its energy consumption through renewables. However, the installation of such systems will depend upon the technical and financial viability of such systems at the time the project is being constructed.

H. MAUI COUNTY GENERAL PLAN

The General Plan of the County of Maui refers to a hierarchy of planning documents that together set forth future growth and policy direction in the County. The General Plan is comprised of the following documents: 1) County-wide Policy Plan; 2) Maui Island Plan; and 3) nine community plans.

The County-wide Policy Plan was adopted in March 2010 and is a broad policy document that identifies a vision for the future of Maui County. It establishes a set of guiding principles and provides comprehensive goals, objectives, policies and implementing actions that portray the desired direction of the County's future. The County-wide Policy Plan provides the policy framework for the development of the Maui Island Plan and nine Community Plans.

The MIP functions as a regional plan and addresses the policies and issued that are not confined to just one community plan area, including regional systems such as transportation, utilities and growth management, for the Island of Maui. Together, the Island and Community Plans develop strategies with respect to population density, land use maps, land use regulations, transportation systems, public and community facility locations, water and sewage systems, visitor destinations, urban design and other matters related to development. The MIP was adopted on December 28, 2012.

The WCT Master Plan, and request for land use entitlements, should be consistent with the goals, policies and actions found in the General Plan.

1. County-wide Policy Plan

The County-wide Policy Plan establishes a list of county-wide goals, objectives, policies, and implementing actions related to the following core themes:

- Protect the Natural Environment

- Preserve Local Cultures and Traditions
- Improve Education
- Strengthen Social and Healthcare Services
- Expand Housing Opportunities for Residents
- Strengthen the Local Economy
- Improve Parks and Public Facilities
- Diversify Transportation Options
- Improve Physical Infrastructure
- Promote Sustainable Land Use and Growth Management
- Strive for Good Governance

Table 62 ~~56~~: Countywide Policy Plan

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Protect the Natural Environment	
Goal: Maui County's natural environment and distinctive open spaces will be preserved, managed, and cared for in perpetuity.	
Objective:	**N/A**
(1) Improve the opportunity to experience the natural beauty and native biodiversity of the islands for present and future generations.	**S**
Policies:	
a. Perpetuate native Hawaiian biodiversity by preventing the introduction of invasive species, containing or eliminating existing noxious pests, and protecting critical habitat areas.	**S**
b. Preserve and reestablish indigenous and endemic species' habitats and their connectivity.	**NA**
c. Restore and protect forests, wetlands, watersheds, and stream flows, and guard against wildfires, flooding and erosion.	**S**
d. Protect baseline stream flows for perennial streams, and support policies that ensure adequate stream flow to support native Hawaiian aquatic species, traditional kalo cultivation, and self-sustaining ahupua'a.	**S**
e. Protect undeveloped beaches, dunes, and coastal ecosystems, and restore natural shoreline processes.	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
f. Protect the natural state and integrity of unique terrain, valued natural environments, and geological features.	**S**
g. Preserve and provide ongoing care for important scenic vistas, view planes, landscapes, and open-space resources.	**S**
h. Expand coordination with the State and non-profit agencies and their volunteers to reduce invasive species, replant indigenous species, and identify critical habitat.	**S**
Implementing Actions:	
a. Develop island-wide networks of greenways, watercourses, and habitat corridors.	**S**

ANALYSIS: The WCT is not located within the State's Special Management Area and no listed or endangered species of flora and fauna were identified on the property that will constrain development of the site. During build-out and during the operation phase BMPs will be implemented to mitigate non-point source pollution to Maui's coastal resources as well as to mitigate fugitive dust impacts. In addition, through the EIS and entitlement application processes mitigation measures will be identified to help address any environmental impacts that may arise from the project.

A riparian buffer with a minimum setback of about 100-feet, and in most areas significantly greater than this, has been established along the entire length of the Waikapū Stream. These areas will be kept in open space and will be used for open space, agriculture and passive park uses. The Project will seek to conserve potable ground water resources by utilizing a combination of surface water from the Waihee Ditch, non-potable agricultural wells and recycled water from the Project's WWRF to supply the agricultural lands and the landscape planting of proposed urban spaces. The use of any ground and surface water will be in strict compliance with any permits issued by the CWRM so as not to overdraw the sustainable yield of the Waikapū Aquifer or degrade the Waikapū stream. ~~The project will not require additional allocations of water from the Waikapū stream and all potable and non-potable wells developed on the property will comply with applicable State and County regulations so as not to overdraw the sustainable yield of the Waikapū Aquifer.~~

While the existing character of the open space, Haleakalā and West Maui Mountain views will be impacted by the development, setbacks of at least 60-feet, and in some areas up to 100-feet, will be utilized along each side of the Honoapi'ilani Highway to separate the development from the public right-of-way. In order to mitigate the

COUNTYWIDE POLICY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
obstruction of views from the highway to the West Maui Mountains, buildings will be setback at least 75-feet from the highway and building heights will be limited to a maximum of 30-feet along the highway frontage. Buildings will also be separated, placed and oriented in a manner that will establish view corridors from the highway to the West Maui Mountains. Building setbacks and placement will help to mitigate the project's overall impact upon the existing views of Haleakalā and the West Maui Mountains. While the development will produce an impact upon the character of views along Honoapi'ilani Highway, fronting the urban lands, it is important to note that the Applicant is also proposing to create a permanent 800-acre agricultural preserve that will exist on both the mauka and makai sides of Honoapi'ilani Highway. The preserves frontage is approximately 7,550 linear along the highway. The approximate 800-acres of agricultural land will create a permanent open space buffer and permanent separation between Waikapū Town and Mā'alaea. Along this section of the highway, largely unobstructed views of Haleakalā, the West Maui Mountains and partial views of the Pacific Ocean will exist in perpetuity. The Applicant is establishing wide setbacks from Honoapi'ilani Highway to allow for pedestrian and bicycle facilities and the establishment of landscape planting. As is common throughout Hawai'i, and especially on Maui, the planting of large canopy Monkey Pod trees, tropical shrubs and ground covers will be maintained to create a sense of separation and definition between the urban development and the highway. Separated from the highway, an approximate 10-foot wide shared pedestrian and bicycle track will meander along the roadways frontage. The overall effect will be to create a greenway with a variety of plant massing and color, and the presence of intermittent views of Haleakalā and the West Maui Mountains along the frontage of the development. From a site planning perspective, the WCT site plan carefully considers the natural topography of the site and incorporates unique natural areas into parks and open spaces throughout the WCT. Proposed buildings will be incorporated into the natural topography of the property and building layout is oriented to preserve view planes towards the Pacific Ocean, Haleakalā and the West Maui Mountains.	
Objective:	
(2) Improve the quality of environmentally sensitive, locally valued natural resources and native ecology of each	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
island.	
Policies:	**N/A**
a. Protect and restore nearshore reef environments and water quality	**S**
b. Protect marine resources and valued wildlife	**S**
c. Improve the connection between urban environments and the natural landscape, and incorporate natural features of the land into urban design.	**S**
d. Utilize land-conservation tools to ensure the permanence of valued open spaces.	**S**
e. Mitigate the negative effects of upland uses on coastal wetlands, marine life, and coral reefs.	**S**
f. Strengthen coastal zone management, re- naturalization of shorelines, where possible, and filtration or treatment of urban and agricultural runoff.	**S**
g. Regulate the use and maintenance of stormwater-treatment systems that incorporate the use of native vegetation and mimic natural systems.	**S**
h. Advocate for stronger regulation of fishing, boating, cruise ship, and ecotourism activities.	**NA**
i. Restore watersheds and aquifer-recharge areas to healthy and productive status, and increase public knowledge about the importance of watershed stewardship, water conservation, and ground water protection.	**NA**
Implementing Actions:	
a. Develop regulations to minimize runoff of pollutants into nearshore waters and reduce nonpoint and point source pollution.	**NA**
ANALYSIS: The WCT is not located within the State's Special Management Area and is not expected to impact the shoreline or reef environments. During build-out and during the operation phase BMPs will be implemented to mitigate non-point source pollution to Maui's coastal resources. In addition, through the EIS and entitlement application processes mitigation measures will be identified to help address any environmental impacts that may arise from the project. The site itself is not located within an area of critical habitat and surveys have confirmed that no threatened or endangered species of flora or fauna are on the property that will constrain development of the site. From a site planning perspective, the master plan design layout carefully considered the natural topography of the site and incorporated unique natural areas into parks and open spaces throughout the WCT. Proposed	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
buildings will be incorporated into the natural topography of the property and building layout is oriented to preserve view planes towards the Pacific Ocean, Haleakalā and the West Maui Mountains.	
Objective:	
(3) Improve the stewardship of the natural environment.	
Policies:	
a. Preserve and protect natural resources with significant scenic, economic, cultural, environmental, or recreational value.	**S**
b. Improve communication, coordination, and collaboration among government agencies, non-profit organizations, communities, individuals, and land owners that work for the protection of the natural environment.	**S**
c. Evaluate development to assess potential short-term and long-term impacts on land, air, aquatic, and marine environments.	**S**
d. Improve efforts to mitigate and plan for the impact of natural disasters, human influenced emergencies, and global warming.	**S**
e. Regulate access to sensitive ecological sites and landscapes.	**NA**
f. Reduce air, noise, light, land, and water pollution, and reduce Maui County's contribution to global climate change.	**S**
g. Plan and prepare for and educate visitors and residents about the possible effects of global warming.	**NA**
h. Provide public access to beaches and shoreline for recreational and cultural purposes where appropriate.	**NA**
i. Educate the construction and landscape industries and property owners about the use of best management practices to prevent erosion and nonpoint source pollution.	**S**
j. Support the acquisition of resources with scenic, environmental, and recreational value, and encumber their use.	**NA**
k. Improve enforcement activities relating to the natural environment.	**NA**
l. For each shoreline community, identify and prioritize beach conservation objectives, and develop action plans for their implementation.	**NA**
Implementing Actions:	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
a. Document, record, and monitor existing conditions, populations, and locations of flora and fauna communities.	**S**
b. Implement Federal and State policies that require a reduction of greenhouse-gas emissions.	**NA**
c. Establish a baseline inventory of available natural resources and their respective carrying capacity.	**NA**

ANALYSIS: The WCT is not located within the State's Special Management Area and no listed or endangered species of flora and fauna were identified on the property that will constrain development of the site. During build-out and during the operation phase BMPs will be implemented to mitigate non-point source pollution to Maui's coastal resources as well as to mitigate fugitive dust impacts. In addition, through the EIS and entitlement application processes mitigation measures will be identified to help address any environmental impacts that may arise from the project.

As discussed in Section IV.A.3 (Natural Hazards) the development of the WCT will not increase the possibility of natural hazards such as flooding, tsunami inundation, hurricanes and earthquakes. The WCT will be constructed in compliance with County, State and Federal standards.

As discussed in Section V.A.2 (Air Quality) the WCT may create short-term impacts on air quality directly and indirectly during construction, however mitigation measures will be implemented. It is anticipated that the WCT does not violate Federal or State air quality standards.

As discussed in Section V.D.2 (Electric, Telephone and Cable TV) the WCT will include energy-efficient design and conservation measures. Specifically, the design guidelines will encourage the use of energy efficient technology throughout the project; specifically, in lighting, air-conditioning, and building materials. Solar hot water heaters will be utilized throughout the residential portion of the development and installation of Photovoltaic Energy Systems will be encouraged in all areas of the WCT. Moreover, the WCT may incorporate a limited number of solar farms to help address some of the Project's demand for electricity.

In addition, the WCT is utilizing smart growth planning techniques that will help to reduce automobile trips and associated pollution. The design will help to minimize automobile trips by providing employment, goods, services

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
and housing all within walking or biking distance of each other. The WCT will provide a unified pedestrian and bicycle system within the Project area with safe and convenient connections between land uses, neighboring developments and the natural environment.	
Objective	
(4) Educate residents and visitors about responsible stewardship practices and the interconnectedness of the natural environment and people.	**NA**
Policies:	
a. Expand education about native flora, fauna, and ecosystems.	**NA**
b. Align priorities to recognize the health of the natural environment and the health of people.	**S**
c. Promote programs and incentives that decrease greenhouse-gas emissions and improve environmental stewardship.	**S**

ANALYSIS: The WCT is not located within the State's Special Management Area and no listed or endangered species of flora and fauna were identified on the property that will constrain development of the site. During build-out and during the operation phase BMPs will be implemented to mitigate non-point source pollution. In addition, through the EIS and entitlement application processes mitigation measures will be identified to help address any environmental impacts that may arise from the project.

As discussed in Section III.B.1-4 the WCT will create a settlement pattern that by its more compact and mixed-use character is less dependent on motorized transportation. The Plan also makes considerable investment into infrastructure that supports a unified pedestrian and bicycle system within the Project with safe and convenient connections between land uses, adjacent developments and the natural environment. The system will connect residential areas, neighborhood parks and employment areas.

As discussed in Section V.D.2 (Electric, Telephone and Cable TV) the WCT will include energy-efficient design and conservation measures. Specifically, the design guidelines will encourage the use of energy efficient technology throughout the Project; specifically, in lighting, air-conditioning, and building materials. Solar hot water heaters will be utilized throughout the residential portion of the development and installation of Photovoltaic Energy Systems will be encouraged in all areas of the WCT. Moreover, the WCT may incorporate a limited number of solar farms to help address some of the Project's demand for electricity.

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
B. Preserve Local Cultures and Traditions	
Goal: Maui County will foster a spirit of pono and protect, perpetuate, and reinvigorate its residents' multi-cultural values and traditions to ensure that current and future generations will enjoy the benefits of their rich island heritage.	
Objective:	**N/A**
(1) Perpetuate the Hawaiian culture as a vital force in the lives of residents.	**S**
Policies:	
a. Protect and preserve access to mountain, ocean, and island resources for traditional Hawaiian cultural practices.	**S**
b. Prohibit inappropriate development of cultural lands and sites that are important for traditional Hawaiian cultural practices, and establish mandates for the special protection of these lands in perpetuity.	**S**
c. Promote the use of ahupua'a and moku management practices.	**S**
d. Encourage the use of traditional Hawaiian architecture and craftsmanship.	**S**
e. Promote the use of the Hawaiian language.	**S**
f. Recognize and preserve the unique natural and cultural characteristics of each ahupua'a or district.	**S**
g. Encourage schools to promote broader incorporation of Hawaiian and other local cultures' history and value lessons into curriculum.	**S**
h. Ensure the protection of Native Hawaiian rights.	**S**
i. Promote, encourage, and require the correct use of traditional place names, particularly in government documents, signage, and tourism industry.	**S**
Implementing Actions:	
a. Establish alternative land use and overlay zoning designations that recognize and preserve the unique natural and cultural characteristics of each ahupua'a or district.	**NA**
b. Develop requirements for all County applicants to perpetuate and use proper traditional place names in all applications submitted.	**NA**
ANALYSIS: The WCT intends to create a sense of place within the community that reflects the cultural values, traditions and history of Hawai'i, and more specifically Waikapū. In preparing the ~~DEIS~~ FEIS, a Cultural Impact Assessment (CIA) was prepared to thoroughly document any potential impacts that the project could have upon	

COUNTYWIDE POLICY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
traditional and customary rights. The CIA recommends that the Applicant work with the Waikapū community to ensure that the Waikapū stream will not be impacted by the Development, that traditional access rights are maintained into the Waikapū Valley, and that existing kuleana land owner rights are protected. The Applicant is committed to protecting the Waikapū Stream by establishing a wide riparian buffer and greenway along the stream where development will not be permitted. The WCT will also have negligible impact upon existing stream flows as no requests for additional stream water will be made for the development. As noted in the ~~DEIS~~ FEIS, the WCT will be served by new wells that will be managed in strict compliance with County and State requirements. The Applicant also intends to work with the Waikapū community to develop a cultural resources plan to ensure that local cultural values are incorporated into the fabric of the project. The cultural resources plan may include recommendations such as the appropriate naming of streets and places within the WCT, identifying a site for a small museum depicting the history and culture of Waikapū, incorporating various features and artifacts reflecting Waikapū's past – such as traditional Hawaiian agricultural practices as well as remnants from the sugar industry – into the design of key buildings and sites, and maintaining and protecting access into the Waikapū Valley for the purpose of hunting, gathering, the replanting of native trees and vegetation. The Applicant also intends to facilitate the expansion of diversified agricultural activities, including the growing of traditional Hawaiian food staples such as wet and dryland kalo, banana, sweet potato, etc. within the Project's agricultural lands. Moreover, small community gardens will be dispersed throughout the project site so that residents can connect with the land and grow their own foods, including traditional Hawaiian staples, for their daily needs. The Applicant has also informed the DOE that the project would support having an immersion school, offering both English and Hawaiian language instruction, at the location of the proposed elementary school should the DOE determine that such a facility is warranted at that location.	
Objective:	
(2) Emphasize respect for our island lifestyle and our unique local cultures, family, and natural environment.	**S**
Policies:	
a. Acknowledge the Hawaiian culture as the host culture, and foster respect and humility among residents and visitors toward the Hawaiian people and their practices.	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
b. Perpetuate a respect for diversity, and recognize the historic blending of cultures and ethnicities.	**S**
c. Encourage the perpetuation of each culture's unique cuisine, attire, dance, music, and folklore, and other unique island traditions and recreational activities.	**NA**
d. Recognize the interconnectedness between the natural environment and the cultural heritage of the islands.	**S**
e. Protect and prioritize funding for recreational activities that support local cultural practices, such as surfing, fishing, and outrigger-canoe paddling.	**NA**
ANALYSIS: In preparing the ~~DEIS~~ FEIS, professionally prepared Cultural Impact Assessment and Archaeological Impact Assessment reports concluded that cultural and archaeological impacts would not be caused by the development should recommended mitigation be adopted by the Applicant. The Applicant is committed to implementing the mitigation measures recommended in the AIS and CIA reports. Moreover, the Applicant intends to promote and foster all aspects of Maui's unique ethnic cultures to blend harmoniously within the development.	
Objective:	
(3) Preserve for present and future generations the opportunity to know and experience the arts, culture, and history of Maui County.	**NA**
Policies:	
a. Foster teaching opportunities for cultural practitioners to share their knowledge and skills.	**NA**
b. Support the development of cultural centers.	**NA**
c. Broaden opportunities for public art and the display of local artwork.	**NA**
d. Foster the Aloha Spirit by celebrating the Hawaiian host culture and other Maui County cultures through support of cultural-education programs, festivals, celebrations, and ceremonies.	**NA**
e. Support the perpetuation of Hawaiian arts and culture.	**NA**
f. Support programs and activities that record the oral and pictorial history of residents.	**S**
g. Support the development of repositories for culture, history, genealogy, oral history, film, and interactive learning.	**NA**
Implementing Actions:	
a. Establish incentives for the display of public art.	**NA**
b. Establish centers and programs of excellence for the perpetuation of Hawaiian arts and culture.	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
ANALYSIS: As one aspect of the Cultural Resources Plan that the Applicant intends to prepare with the Waikapū community, a display that documents the unique history of the project site and the larger Waikapū Ahupua'a may be established within the project site an appropriate location.	
Objective:	
(4) Preserve and restore significant historic architecture, structures, cultural sites, cultural districts, and cultural landscapes.	**NA**
Policies:	
a. Support the development of island-wide historic, archaeological, and cultural resources inventories.	
b. Promote the rehabilitation and adaptive reuse of historic sites, buildings, and structures to perpetuate a traditional sense of place.	**NA**
c. Identify a sustainable rate of use and set forth specific policies to protect cultural resources.	**NA**
d. Protect and preserve lands that are culturally or historically significant.	**S**
e. Support programs that protect, record, restore, maintain, provide education about, and interpret cultural districts, landscapes, sites, and artifacts in both natural and museum settings.	**NA**
f. Perpetuate the authentic character and historic integrity of rural communities and small towns.	**S**
g. Seek solutions that honor the traditions and practices of the host culture while recognizing the needs of the community.	**NA**
h. Support the development of an Archaeological District Ordinance.	**NA**
i. Protect summits, slopes, and ridgelines from inappropriate development.	**NA**
j. Support the registering of important historic sites on the State and Federal historic registers.	**NA**
k. Provide opportunities for public involvement with restoration and enhancement of all types of cultural resources.	**NA**
l. Foster partnerships to identify and preserve or revitalize historic and cultural sites.	**NA**
Implementing Actions:	
a. Identify, develop, map, and maintain an inventory of locally significant natural, cultural, and historical resources for protection.	**S**
b. Prepare, continually update, and implement a cultural-management plan for cultural sites, districts, and landscapes, where appropriate.	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
c. Enact an Archaeological District Ordinance.	**NA**
d. Nominate important historic sites to the State and Federal historic registers.	**NA**
ANALYSIS: In preparing the ~~DEIS~~ FEIS, professionally prepared Cultural Impact Assessment and Archaeological Impact Assessment reports concluded that cultural and archaeological impacts would not be caused by the development should recommended mitigation be adopted by the Applicant. The Applicant is committed to implementing the mitigation measures recommended in the AIS and CIA reports. Moreover, the Applicant intends to promote and foster all aspects of Maui's unique ethnic cultures to blend harmoniously within the development.	
C. Improve Education	
Goal: Residents will have access to lifelong formal and informal educational options enabling them to realize their ambitions.	
Objective:	
(1) Encourage the State to attract and retain school administrators and educators of the highest quality.	
Policies:	
a. Encourage the State to provide teachers with nationally competitive pay and benefit packages.	**NA**
b. Encourage the State to ensure teachers will have the teaching tools and support staff needed to provide students with an excellent education.	**NA**
c. Explore Maui County district- and school-based decision making in public education.	**NA**
ANALYSIS: Objective 1 and its subordinate policies are not applicable to the WCT.	
Objective:	
(2) Provide nurturing learning environments that build skills for the 21st century.	
Policies:	
a. Expand professional-development opportunities in disciplines that support the economic-development goals of Maui County.	**NA**
b. Plan for demographic, social, and technological changes in a timely manner.	**NA**
c. Encourage collaborative partnerships to improve conditions of learning environments.	**NA**
d. Promote development of neighborhood schools and educational centers.	**S**
e. Integrate schools, community parks, and playgrounds, and expand each community's use of these facilities.	**S**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
f. Support coordination between land use and school-facility planning agencies.	**S**
g. Encourage the upgrade and ongoing maintenance of public-school facilities.	**NA**
h. Encourage the State Department of Education to seek reliable, innovative, and alternative methods to support a level of per-pupil funding that places Hawai'i among the top tier of states nationally for its financial support of public schools.	**NA**
i. Encourage the State to promote healthier, more productive learning environments, including by providing healthy meals, more physical activity, natural lighting, and passive cooling.	**NA**
j. Encourage the State to support the development of benchmarks to measure the success of Hawai'i's public-education system and clarify lines of accountability.	**NA**
k. Design school and park facilities in proximity to residential areas.	**S**
l. Support technology- and natural-environment-based learning.	**S**
m. Encourage the State to support lower student-teacher ratios in public schools.	**NA**
n. Encourage alternative learning and educational opportunities.	**NA**
Implementing Actions:	
a. Develop safe walking and bicycling programs for school children.	**S**
ANALYSIS: As discussed in Section V.C.5 (Schools) the project site is being designed to accommodate a public elementary school campus on 12-acres adjacent to the proposed 18.5-acre community park. In addition, in 2007, the Hawai'i Legislature enacted Act 245 as Section 302A, HRS, "School Impact Fees". Based upon this legislation, the Department of Education has enacted impact fees for residential developments that occur within identified school impact districts. The Project is within the boundaries of the Central Maui Impact Fee District and is within the Wailuku Cost Area of that district. Projects within the district and cost area pay a construction fee and either a fee-in-lieu of land or a land donation, at the DOE's discretion. At the appropriate time, the applicant will contact the DOE to enter into an impact fee agreement. The Applicant has also expressed a willingness to provide land for a Hawaiian Immersion school at the elementary school site should the DOE determine a need for such a facility at that location. It is also expected that privately run programs related to community gardening, the promotion of Hawaiian agricultural practices and other cultural-based learning opportunities may be offered within the WCT and on its' agricultural lands. Moreover, the project site is being planned to accommodate a robust active transportation network of pedestrian and bicycling infrastructure to link employment, residential, education, civic and commercial uses in order to reduce automobile usage and	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
promote greater health and wellbeing.	
Objective 3:	
Provide all residents with educational opportunities that can help them better understand themselves and their surroundings and allow them to realize their ambitions.	
Policies:	
a. Encourage the State to improve Maui Community College as a comprehensive community college that will serve each community.	**NA**
b. Broaden the use of technology and telecommunications to improve educational opportunities throughout the County.	**NA**
c. Attract graduate-level research programs and institutions.	**NA**
d. Promote the teaching of traditional practices, including aquaculture; subsistence agriculture; Pacific Island, Asian, and other forms of alternative health practices; and indigenous Hawaiian architecture.	**NA**
e. Integrate cultural and environmental values in education, including self-sufficiency and sustainability.	**S**
f. Foster a partnership and ongoing dialogue between business organizations, formal educational institutions, and vocational training centers to tailor learning and mentoring programs to County needs.	**NA**
g. Ensure teaching of the arts to all ages.	**NA**
h. Expand and develop vocational learning opportunities by establishing trade schools.	**NA**
i. Encourage the State to integrate financial and economic literacy in elementary, secondary, and higher-education levels.	**NA**
Implementing Actions:	
a. Encourage the State to establish a four-year university, and support the development of other higher-education institutions to enable residents to obtain bachelor degrees and postgraduate degrees in Maui County.	**NA**
ANALYSIS: Although the WCT will not directly establish education programs, the Project will seek to be an attractive location for such activities to occur, especially as these programs may relate to diversified agriculture and the promotion of traditional Hawaiian and sustainable agricultural practices.	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Objective:	
(4) Maximize community-based educational opportunities.	
Policies:	
a. Encourage the State and others to expand pre-school, after-school, and home-based (parent-child) learning.	**NA**
b. Support public-private partnerships to develop youth-internship, -apprenticeship, and -mentoring programs.	**NA**
c. Support the development of a wide range of informal educational and cultural programs for all residents.	**S**
d. Improve partnerships that utilize the skills and talents at Hawai'i's colleges and universities to benefit the County.	**NA**
e. Support career-development and job-recruitment programs and centers.	**NA**
f. Attract learning institutions and specialty schools to diversify and enhance educational opportunities.	**NA**
g. Expand education of important life skills for the general public.	**NA**
h. Support community facilities such as museums, libraries, nature centers, and open spaces that provide interactive-learning opportunities for all ages.	**S**
ANALYSIS: Although the WCT will not directly establish education programs, the Project will seek to be an attractive location for such activities to occur, especially as these programs may relate to diversified agriculture and the promotion of traditional Hawaiian and sustainable agricultural practices.	
D. Strengthen Social and Healthcare Services	
Goal: Health and social services in Maui County will fully and comprehensively serve all segments of the population.	
Objective:	
(1) In cooperation with the Federal and State governments and nonprofit agencies, broaden access to social and healthcare services and expand options to improve the overall wellness of the people of Maui County.	
Policies:	
a. Work with other levels of government and the nonprofit sector to expand services to address hunger, homelessness, and poverty.	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
b. Support the improvement of opportunities for disadvantaged youth, encourage the tradition of hānai relatives, and support expanded opportunities for foster care.	**NA**
c. Support expanded long-term-care options, both in institutions and at home, for patients requiring ongoing assistance and medical attention.	**NA**
d. Encourage the expansion and improvement of local hospitals, facilitate the establishment of new healthcare facilities, and facilitate prompt and high-quality emergency- and urgent-care services for all.	**NA**
e. Support broadened access to affordable health insurance and health care, and recognize the unique economic challenges posed to families when healthcare services are provided off-island.	**NA**
f. Encourage equal access to social and healthcare services through both technological and traditional means.	**NA**
ANALYSIS: The WCT does not include the creation of health or social services; therefore, this objective and these policies are not directly applicable. However, the WCT will allow for small medical services such as doctor offices, clinics, and ancillary services to be located within the Project's commercial districts.	
Objective:	
(2) Encourage the Federal and State governments and the private sector to improve the quality and delivery of social and healthcare services.	
Policies:	
a. Strengthen partnerships with government, nonprofit, and private organizations to provide funding and to improve counseling and other assistance to address substance abuse, domestic violence, and other pressing social challenges.	**NA**
b. Encourage the State to improve the quality of medical personnel, facilities, services, and equipment.	**NA**
c. Encourage investment to improve the recruitment of medical professionals and the quality of medical facilities and equipment throughout Maui County.	**NA**
d. Promote the development of continuum-of-care facilities that provide assisted-living, hospice, home-care, and skilled-nursing options allowing the individual to be cared for in a manner congruent with his or her needs and desires.	**NA**
e. Support improved social, healthcare, and governmental services for special needs populations.	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
f. Plan for the needs of an aging population and the resulting impacts on social services, housing, and healthcare delivery.	**NA**
g. Improve coordination among the police, the courts, and the public in the administration of social and healthcare services.	**NA**
h. Support programs that address needs of veterans.	**NA**
i. Support programs that address the needs of immigrants.	**NA**
Implementing Actions:	
a. Invest in programs designed to improve the general welfare and quality of life of Native Hawaiians.	**NA**
b. Assist and facilitate the State Department of Public Safety and others in efforts to strengthen programs and facilities that will improve the mental and social health of incarcerated people and assist in prison inmates' successful transition back into Maui County communities.	**NA**
c. Develop and maintain a comprehensive index that will measure the health and wellness needs of families.	**NA**
d. Provide heliports countywide for emergency health and safety purposes.	**NA**
ANALYSIS: The WCT does not include the creation of health or social services; therefore, this objective and these policies are not directly applicable. However, the WCT will allow medical services such as doctor offices, clinics and ancillary services to be located within the Project's commercial districts.	
Objective:	
(3) Strengthen public-awareness programs related to healthy lifestyles and social and medical services.	
Policies:	
a. Expand public awareness about personal safety and crime prevention.	**NA**
b. Encourage residents to pursue education and training for careers in the healthcare, social services, and community-development fields.	**NA**
c. Expand public awareness and promote programs to achieve healthy eating habits and drug-free lifestyles.	**NA**
ANALYSIS: The WCT does not include the creation of health or social services; therefore, this objective and these policies are not directly applicable. However, the WCT design layout promotes a healthy lifestyle by offering walking and bicycling pathways that connect residential areas to the commercial areas, school, and park spaces.	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
E. Expand Housing Opportunities for Residents	
Goal: Quality, island-appropriate housing will be available to all residents.	
Objective:	
(1) Reduce the affordable housing deficit for residents.	
Policies:	
a. Ensure that an adequate and permanent supply of affordable housing, both new and existing units, is made available for purchase or rental to our resident and/or workforce population, with special emphasis on providing housing for low- to moderate-income families, and ensure that all affordable housing remains affordable in perpetuity.	**S**
b. Seek innovative ways to lower housing costs without compromising the quality of our island lifestyle.	**S**
c. Seek innovative methods to secure land for the development of low- and moderate-income housing.	**S**
d. Provide the homeless population with emergency and transitional shelter and other supportive programs.	**NA**
e. Provide for a range of senior-citizen and special needs housing choices on each island that affordably facilitates a continuum of care and services.	**S**
f. Support the Department of Hawaiian Home Lands' development of homestead lands.	**NA**
g. Manage property-tax burdens to protect affordable resident homeownership.	**NA**
h. Explore taxation mechanisms to increase and maintain access to affordable housing.	**NA**
i. Improve awareness regarding available affordable homeowner's insurance.	**NA**
j. Redevelop commercial areas with a mixture of affordable residential and business uses, where appropriate.	**NA**
k. Ensure residents are given priority to obtain affordable housing units developed in their communities, consistent with all applicable regulations.	**S**
l. Establish pricing for affordable housing that is more reflective of Maui County's workforce than the United States Housing and Urban Development's median-income estimates for Maui County.	**NA**
m. Develop neighborhoods with a mixture of accessible and integrated community facilities and services.	**S**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
n. Provide alternative regulatory frameworks to facilitate the use of Kuleana lands by the descendants of Native Hawaiians who received those lands pursuant to the Kuleana Act of 1850.	**NA**
o. Work with lending institutions to expand housing options and safeguard the financial security of homeowners.	**NA**
p. Promote the use of the community land trust model and other land-lease and land-financing options.	**NA**
q. Support the opportunity to age in place by providing accessible and appropriately designed residential units.	**S**
ANALYSIS: As discussed in Section V.B.2 (Housing) the WCT will offer a mix of single and multi-family housing types to address the diverse housing needs of Maui residents. Due to the Project's Central Maui location and the expected lot and unit size configurations, the Applicant expects that the majority of the Project's market priced housing will be sold at prices considered affordable to Maui County residents earning between 100 and 140 percent of the County's median income as determined by the United States Department of Housing and Urban Development. The WCT will also include workforce housing units pursuant to Chapter 2.96, MCC, "Residential Workforce Housing Policy". These homes will be subject to price controls and resale restrictions to ensure that affordable homes remain available for full-time Maui residents. Housing types within the WCT may include multi-family condominiums, small cottage homes on small lots with common open spaces, traditional single-family lots within a variety of home and lot size configurations, rental apartments, townhomes and larger estate rural lots. The goal is to serve the demands of all Maui residents.	
Objective:	
(2) Increase the mix of housing types in towns and neighborhoods to promote sustainable land use planning, expand consumer choice, and protect the County's rural and small-town character.	
Policies:	
a. Seek innovative ways to develop `Ohana' cottages and accessory-dwelling units as affordable housing.	**S**
b. Design neighborhoods to foster interaction among neighbors.	**S**
c. Encourage a mix of social, economic, and age groups within neighborhoods.	**S**
d. Promote infill housing in urban areas at scales that capitalize on existing infrastructure, lower development costs, and are consistent with existing or desired patterns of development.	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
e. Encourage the building industry to use environmentally sustainable materials, technologies, and site planning.	**S**
f. Develop workforce housing in proximity to job centers and transit facilities.	**S**
g. Provide incentives to developers and owners who incorporate green building practices and energy-efficient technologies into their housing developments.	**S**
Implementing Actions:	
a. Revise laws to support neighborhood designs that incorporate a mix of housing types that are appropriate for island living.	**S**
ANALYSIS: The WCT Master Plan was conceived and developed by a team of locally based land use and urban design professionals with decades of experience in Hawai'i and on Maui. The site plan integrates diverse opportunities for housing, commercial, recreational and civic uses into a cohesive pattern that blends naturally with the abutting agricultural lands, West Maui Mountains and the small town of Waikapū. The Plan reduces automobile dependency from both within and outside of the Project by creating a "complete community" where most daily needs will be available within a five minute walk or bicycle ride of home or work. Moreover, recognizing the importance of locating jobs near housing, the WCT incorporates a diversity of housing opportunities, including single-family and various types of multi-family, within the project. While the proposed housing won't create a complete equilibrium of jobs-housing, it will significantly alleviate the necessity for vehicular trips to and from the project site. The WCT is also located close to regional shopping, recreation and educational facilities that with retail and civic uses programmed for the Project will make it a complete and distinct community within the larger Central Maui community. As discussed in Section V.B.2 (Housing) the WCT will offer a mix of single and multi-family housing types. Housing types within the WCT may include multi-family condominiums, small cottage homes on small lots with common open spaces, traditional single-family lots within a variety of home and lot size configurations, rental apartments, townhomes and larger estate rural lots. The goal is to serve the demands of all Maui residents.	
Objective:	
(3) Increase and maintain the affordable housing inventory.	
Policies:	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
a. Recognize housing as a basic human need, and work to fulfill that need.	**S**
b. Prioritize available infrastructure capacity for affordable housing.	**S**
c. Improve communication, collaboration, and coordination among housing providers and social-service organizations.	**NA**
d. Study future projected housing needs, monitor economic cycles, and prepare for future conditions on each island.	**NA**
e. Develop public-private and nonprofit partnerships that facilitate the construction of quality affordable housing.	**S**
f. Streamline the review process for high-quality, affordable housing developments that implement the goals, objectives, and policies of the General Plan.	**NA**
g. Minimize the intrusion of housing on prime, productive, and potentially productive agricultural lands and regionally valuable agricultural lands.	**S & NS**
h. Encourage long-term residential use of existing and future housing to meet residential needs.	**S**
Implementing Actions:	
a. Develop policies to even out the peaks and valleys in Maui County's construction-demand cycles.	**NA**

ANALYSIS: As discussed in Section V.B.2 (Housing) the WCT will offer a mix of single and multi-family housing types to address the diverse housing needs of Maui residents. Due to the Project's Central Maui location and the expected lot and unit size configurations, the Applicant expects that the majority of the Project's market priced housing will be sold at prices considered affordable to Maui County residents earning between 100 and 140 percent of the County's median income as determined by the United States Department of Housing and Urban Development. The WCT will also include workforce housing units pursuant to Chapter 2.96, MCC, "Residential Workforce Housing Policy". These homes will be subject to price controls and resale restrictions to ensure that affordable homes remain available for full-time Maui residents. Housing types within the WCT may include multi-family condominiums, small cottage homes on small lots with common open spaces, traditional single-family lots within a variety of home and lot size configurations, rental apartments, townhomes and larger estate rural lots. The goal is to serve the demands of all Maui residents.

The proposed action has been carefully analyzed for its short- and long-term impacts upon the agricultural industry. While the proposed action will result in the loss of prime agricultural lands, which is not supportive of

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Countywide Policy Plan Policy 3.g above, it will not significantly impact the short- or long-term viability of agriculture in Hawai'i since an abundance of currently fallow former sugar and pineapple land is currently available elsewhere. The project will, however, help to address the current shortage of agricultural park lots by establishing a new private and/or public agricultural park within Central Maui within the proposed 800 acre agriculture preserve. The entire project site lies within the MIPs Small Town Growth Boundary. The MIP identifies the project site as a "Planned Growth Area" and it directs approximately 1,433 residential units with supporting commercial, employment and civic uses to the project site. The MIPs purpose for establishing the subject Planned Growth Area was to proactively direct future urbanization to a suitable location that is within close proximity of employment and public services, is not constrained by sensitive environmental resources, is conducive for developing affordable housing and will not negatively impact the island's natural or cultural resources.	
Objective:	
(4) Expand access to education related to housing options, homeownership, financing, and residential construction.	
Policies	
a. Broaden access to information about County, State, and Federal programs that provide financial assistance to renters and home buyers.	**NA**
b. Expand access to information about opportunities for homeownership and self-help housing.	**NA**
c. Educate residents about making housing choices that support their individual needs, the needs of their communities, and the health of the islands' natural systems.	**NA**
d. Improve home buyers' education on all aspects of homeownership.	**NA**
ANALYSIS: The WCT does not directly expand access to education with regard to housing options, home-ownership, financing and residential construction; therefore this objective and these policies are not applicable.	
F. Strengthen the Local Economy	
Goal: Maui County's economy will be diverse, sustainable, and supportive of community values.	
Objective:	
(1) Promote an economic climate that will encourage diversification of the County's economic base and a sustainable rate of economic growth.	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Policies:	
a. Support economic decisions that create long-term benefits.	**S**
b. Promote lifelong education, career development, and technical training for existing and emerging industries.	**NA**
c. Invest in infrastructure, facilities, and programs that foster economic diversification.	**S**
d. Support and promote locally produced products and locally owned operations and businesses that benefit local communities and meet local demand.	**S**
e. Support programs that assist industries to retain and attract more local labor and facilitate the creation of jobs that offer a living wage.	**NA**
f. Encourage work environments that are safe, rewarding, and fulfilling to employees.	**NA**
g. Support home-based businesses that are appropriate for and in character with the community.	**S**
h. Encourage businesses that promote the health and well-being of the residents, produce value-added products, and support community values.	**S**
i. Foster an understanding of the role of all industries in our economy.	**NA**
j. Support efforts to improve conditions that foster economic vitality in our historic small towns.	**S**
k. Support and encourage traditional host-culture businesses and indigenous agricultural practices.	**S**
l. Support public and private entities that assist entrepreneurs in establishing locally operated businesses.	**S**
Implementing Actions:	
a. Develop regulations and programs that support opportunities for local merchants, farmers, and small businesses to sell their goods and services directly to the public.	**S**
b. Monitor the carrying capacity of the islands' social, ecological, and infrastructure systems with respect to the economy.	**S**
ANALYSIS: The WCT is expected to indirectly support Maui's existing economic base activities by providing much needed housing to serve the island's workforce. The WCT is intended to provide housing along with supporting commercial, employment and institutional uses that will allow for Maui's economic base industries to grow, diversify and become more sustainable - including the island's agricultural industry. The project will directly support the diversified agricultural sector by establishing an approximate 800-acre	

COUNTYWIDE POLICY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	

agricultural preserve on prime agricultural lands. These lands will be supplied with a readily available and affordable source of irrigation water. This centrally located agricultural park will help Maui's farmers better compete with mainland agricultural producers in Hawai'i's market, while also creating opportunities to expand export crops to the mainland and overseas. There are currently ~~two~~ four successful commercial farms farming the WCTs agricultural lands. These include Kumu Farms, Hoaloa Farms, Makani Olu Ranch, and Beef and Bloom. ~~and Hawai'i Taro LLC.~~ These farms have many years of experience farming in Hawai'i and have had success competing in local, mainland and export markets.

The project will also create direct, indirect and induced short- and long-term positive economic impacts. As discussed in Section V.B.3-4 (Economy), the WCT will bring in ~~$609.1~~ $ 644.1 million of new capital investment into the Maui economy. The construction of the WCT components will directly create an estimated ~~2,320~~ 2,476 "worker-years" of employment (the equivalent of 52 work weeks at 40 hours per week) in the trades and associated businesses during build-out, averaging about 165 Full Time Equivalent (FTE) per year for the 15 years of building. Most of these positions will not be new jobs for new businesses, but work flowing to existing contractors and suppliers. ~~positions 193 worker years annually, with an estimated $188.3 million in wages (averaging about $15.7 million per year).~~

The 169,000 square feet of new commercial operation will generate some 4,251 FTE worker years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions. These jobs will be new positions in the Maui economy. This total does not include the employment, wages or business activity contributions of the existing 29,250 square feet of commercial space in the Maui Tropical Plantation which will be retained.

The Project will require an estimated 66 worker years of maintenance and common area element employment on a continual basis, and will generate some 1,750 1,789 worker years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions. In aggregate, during the development of the WCT 8,750 8,946 worker years of employment will be created during construction and operations, on-site/direct and off-site/indirect, with stabilized employment after completion of 746 jobs. During the 15 years projection period, WCT will have a base economic impact on Maui of some $817.1 million in new monies with a stabilized annual

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
benefit of $32.1 million thereafter. By providing much needed housing in a format that will create a high quality of life for Maui's working families, and by generating both short- and long-term employment in the construction, trade and agricultural industries, the project is directly supportive of the State and County's economic development. ~~The on-going operations and maintenance of the business commercial and residential components will directly provide an estimated 4,251 FTE worker-years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions. The Project will require an estimated 66 worker years of maintenance and common area element employment on a continual basis, and will generate some 1,750 worker years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions. In aggregate, during the development of the WCT 8,750 worker years of employment will be created during construction and operations, on-site/direct and off-site/indirect, with stabilized employment after completion of 746 jobs. During the 15 years projection period, WCT will have a base economic impact of $1.3 billion with a stabilized annual benefit of $137.3 million thereafter.~~	
Objective:	
(2) Diversify and expand sustainable forms of agriculture and aquaculture.	
Policies:	
a. Support programs that position Maui County's agricultural products as premium export products.	**S**
b. Prioritize the use of agricultural land to feed the local population, and promote the use of agricultural lands for sustainable and diversified agricultural activities.	**S**
c. Capitalize on Hawai'i's economic opportunities in the ecologically sensitive aquaculture industries.	**NA**
d. Assist farmers to help make Maui County more self-sufficient in food production.	**S**
e. Support ordinances, programs, and policies that keep agricultural land and water available and affordable to farmers.	**S**
f. Support a tax structure that is conducive to the growth of the agricultural economy.	**NA**
g. Enhance County efforts to monitor and regulate important agricultural issues.	**NA**
h. Support education, research, and facilities that strengthen the agricultural industry.	**NA**
i. Maintain the genetic integrity of existing food crops.	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
j. Encourage healthy and organic farm practices that contribute to land health and regeneration.	**S**
k. Support cooperatives and other types of nontraditional and communal farming efforts.	**S**
l. Encourage methods of monitoring and controlling genetically modified crops to prevent adverse effects.	**NA**
m. Work with the State to ease the permitting process for the revitalization of traditional fish ponds.	**NA**
Implementing Actions:	
a. Redirect efforts in the Office of Economic Development to further facilitate the development of the agricultural section and to monitor agricultural legislation and issues.	**NA**
b. Publicly identify, with signage and other means, the field locations of all genetically modified crops.	**NA**
c. Create agricultural parks in areas distant from genetically modified crops.	**S**
ANALYSIS: The project will directly support the diversified agricultural sector by establishing an approximate 800-acre agricultural preserve on prime agricultural lands. These lands will be supplied with a readily available and affordable source of irrigation water. This centrally located agricultural park will help Maui's farmers better compete with mainland agricultural producers in Hawai'i's market, while also creating opportunities to expand export crops to the mainland and overseas. There are currently ~~two~~ four successful commercial farms farming the Project areas agricultural lands. These include Kumu Farms, Hoaloa Farms, Makani Olu Ranch, and Beef and Bloom ~~and Hawai'i Taro LLC.~~ These farms have many years of experience farming in Hawai'i and have had success competing in local, mainland and export markets. Once a public and/or private park is established, it is expected that several additional farmers will lease land for agricultural production.	
Objective 3:	
Support a visitor industry that respects the resident culture and the environment.	
Policies:	
a. Promote traditional Hawaiian practices in visitor-related facilities and activities.	**NA**
b. Encourage and educate the visitor industry to be sensitive to island lifestyles and cultural values.	**NA**
c. Encourage a spirit of welcome for residents at visitor facilities, such as by offering kama'āina incentives and discount programs.	**NA**
d. Support the renovation and enhancement of existing visitor facilities.	**NA**
e. Support policies, programs, and a tax structure that redirect the benefits of the visitor industry	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
back into the local community.	
f. Encourage resident ownership of visitor-related businesses and facilities.	**NA**
g. Develop partnerships to provide educational and training facilities to residents employed in the visitor industry.	**NA**
h. Foster an understanding of local cultures, customs, and etiquette, and emphasize the importance of the Aloha Spirit as a common good for all.	**NA**
i. Support the diversification, development, evolution, and integration of the visitor industry in a way that is compatible with the traditional, social, economic, spiritual, and environmental values of island residents.	**NA**
j. Improve collaboration between the visitor industry and the other sectors of Maui County's economy.	**NA**
k. Perpetuate an authentic image of the Hawaiian culture and history and an appropriate recognition of the host culture.	**NA**
l. Support the programs and initiatives outlined in the Maui County Tourism Strategic Plan 2006-2015.	**NA**
m. Promote water conservation, beach conservation, and open-space conservation in areas providing services for visitors.	**NA**
n. Recognize the important contributions that the visitor industry makes to the County's economy, and support a healthy and vibrant visitor industry.	**NA**
ANALYSIS: The WCT is not targeting the visitor industry; however a small business hotel may be established as a permitted use within the proposed commercial and/or mixed use district. Such a facility would be targeted to visitors desiring a Central Maui location, with convenient access to both Central and South Maui. Additionally a limited number of bed and breakfast operations may be permitted; which would help stimulate economic activity within the Project's commercial districts.	
Objective:	
(4) Expand economic sectors that increase living-wage job choices and are compatible with community values.	
Policies:	
a. Support emerging industries, including the following: • Health and wellness industry;	**S**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
• Sports and recreation industry; • Film and entertainment industry; • Arts and culture industry; • Renewable-energy industry; • Research and development industry; • High-technology and knowledge-based industries; • Education and training industry; • Ecotourism industry; and • Agritourism industry.	
ANALYSIS: By providing much needed housing in a format that will create a high quality of life for Maui's working families, and by generating both short- and long-term employment in the construction, trade and agricultural industries, the project is directly supportive of the State and County's economic development.	
G. Improve Parks and Public Facilities	
Goal: A full range of island-appropriate public facilities and recreational opportunities will be provided to improve the quality of life for residents and visitors.	
Objective 1:	
Expand economic sectors that increase living-wage job choices and are compatible with community values.	
Policies:	
a. Protect, enhance, and expand access to public shoreline and mountain resources.	**NA**
b. Expand and enhance the network of parks, multi-use paths, and bikeways.	**S**
c. Assist communities in developing recreational facilities that promote physical fitness.	**S**
d. Expand venue options for recreation and performances that enrich the lifestyles of Maui County's people.	**S**
e. Expand affordable recreational and after-school programs for youth.	**S**
f. Encourage and invest in recreational, social, and leisure activities that bring people together and build community pride.	**S**
g. Promote the development and enhancement of community centers, civic spaces, and gathering places throughout our communities.	**S**
h. Expand affordable access to recreational opportunities that support the local lifestyle.	**S**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Implementing Actions:	
a. Identify and reserve lands for cemeteries, and preserve existing cemeteries on all islands, appropriately accommodating varying cultural and faith-based traditions.	**NA**
ANALYSIS: The WCT will contribute to a high quality of life for future residents of the development and neighboring communities. The New Urbanism best practices reflected in the WCT Master Plan will help to create a more complete and vibrant community with employment opportunities, a range of housing types, parks and open spaces, and a bicycle and pedestrian network that will increase mobility while also promoting physical fitness and community wellbeing. These elements may encourage future residents to interact with one another, rely less on automobiles and enjoy the outdoors more than in more automobile-centric residential subdivisions. As discussed in Section III.B.1-4 of the ~~DEIS~~ FEIS, the WCT provides an extensive network of neighborhood and community parks, open spaces and separated pedestrian and bicycle facilities throughout the Project. The Project's park facilities will provide diverse opportunities for community and family gatherings, passive recreation and active recreation. The park system may include shaded areas for picnics and barbeques, developed tot lot facilities for families with young children, areas for community gardening, and areas for active recreation such as soccer, football, baseball and basketball. The WCTs approximate 8-mile network of trails, walkways and bikeways will provide additional open land recreational opportunities while connecting the Project's residential areas, neighborhood parks and employment areas together. The Project's agricultural lands may also offer opportunities for horseback riding, hiking, skeet shooting and mountain bike riding.	
Objective:	
(2) Improve the quality and adequacy of community facilities.	
Policies:	
a. Provide an adequate supply of dedicated shelters and facilities for disaster relief.	**NA**
b. Provide and maintain community facilities that are appropriately designed to reflect the traditions and customs of local cultures.	**NA**
c. Ensure that parks and public facilities are safe and adequately equipped for the needs of all ages and physical abilities to the extent reasonable.	**NA**
d. Maintain, enhance, expand, and provide new active and passive recreational facilities in ways that preserve the natural beauty of their locations.	**S**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
e. Redesign or retrofit public facilities to adapt to major shifts in environmental or urban conditions to the extent reasonable.	**NA**
ANALYSIS: The WCTs open spaces, parks and bicycle and pedestrian network will provide a variety of recreational options that provide recreational benefits and that help to preserve the natural environment, while also creating a more aesthetically pleasing community.	
Objective:	
(3) Enhance the funding, management, and planning of public facilities and park lands.	
Policies:	
a. Identify and encourage the establishment of regulated and environmentally sound campgrounds.	**NA**
b. Manage park use and control access to natural resources in order to rest sensitive places and utilize the resources in a sustainable manner.	**NA**
c. Provide public-recreational facilities that are clean and well-maintained.	**NA**
d. Develop partnerships to ensure proper stewardship of the islands' trails, public lands, and access systems.	**NA**
e. Ensure that there is an adequate supply of public restrooms in convenient locations.	**NA**
Implementing Actions:	
a. Encourage the State to allow for overnight fishing along the shoreline in accordance with management plans and regulations.	**NA**
b. Develop and regularly update functional plans, including those relating to public facilities, parks, and campgrounds.	**NA**
c. Develop and adopt local level-of-service standards for public facilities and parks.	**NA**
d. Identify, acquire, and develop lands for parks, civic spaces, and public uses.	**NA**
ANALYSIS: As discussed in Section III.B.1-4 of the ~~DEIS~~ FEIS, the WCT provides an extensive network of neighborhood and community parks, open spaces and separated pedestrian and bicycle facilities throughout the Project. The Project's park facilities will provide diverse opportunities for community and family gatherings, passive recreation and active recreation. The park system may include shaded areas for picnics and barbeques, developed tot lot facilities for families with young children, areas for community gardening, and areas for active recreation such as soccer, football, baseball and basketball. The WCTs approximate 8-mile network of trails, walkways and bikeways will provide additional open land recreational opportunities while connecting the	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Project's residential areas, neighborhood parks and employment areas together. The Project's agricultural lands may also offer opportunities for open land recreation opportunities such as horseback riding, hiking, and mountain bike riding.	
H. Diversify Transportation Options	
Goal: Maui County will have an efficient, economical, and environmentally sensitive means of moving people and goods.	
Objective:	
(1) Provide an effective, affordable, and convenient ground-transportation system that is environmentally sustainable.	
Policies:	
a. Execute planning strategies to reduce traffic congestion.	**S**
b. Plan for the efficient relocation of roadways for the public benefit.	**NA**
c. Support the use of alternative roadway designs, such as traffic-calming techniques and modern roundabouts.	**S**
d. Increase route and mode options in the ground-transportation network.	**S**
e. Ensure that roadway systems are safe, efficient, and maintained in good condition.	**S**
f. Preserve roadway corridors that have historic, scenic, or unique physical attributes that enhance the character and scenic resources of communities.	**NA**
g. Design new roads and roadway improvements to retain and enhance the existing character and scenic resources of the communities through which they pass.	**S**
h. Promote a variety of affordable and convenient transportation services that meet countywide and community needs and expand ridership of transit systems.	**S**
i. Collaborate with transit agencies, government agencies, employers, and operators to provide planning strategies that reduce peak-hour traffic.	**S**
j. Develop and expand an attractive, island-appropriate, and efficient public-transportation system.	**NA**
k. Provide and encourage the development of specialized transportation options for the young, the elderly, and persons with disabilities.	**S**
l. Evaluate all alternatives to preserve quality of life before widening roads.	**S**
m. Encourage businesses in the promotion of alternative transportation options for resident and	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
visitor use.	
n. Support the development of carbon-emission standards and an incentive program aimed at achieving County carbon-emission goals.	**NA**
Implementing Actions:	
a. Create incentives and implement strategies to reduce visitor dependence on rental cars.	**NA**
b. Establish efficient public-transit routes between employment centers and primary workforce residential areas.	**S**
c. Create attractive, island-appropriate, conveniently located park-and-ride and ride-share facilities.	**S**
ANALYSIS: The WCT's non-vehicular transportation strategy includes: 1) compact and mixed-use development patterns, 2) pedestrian oriented streets integrating street trees, sidewalks, and traffic calming, 3) both striped and separated bike lanes in appropriate locations, 4) a network of greenways and parkways to facilitate mobility, and 5) providing connectivity to adjacent developments, such as the existing town of Waikapū and the future town of Wai`ale. The Plan also includes transportation demand management measures, including supporting park and ride, ridesharing, carpooling, van pooling, regional and sub-regional shuttles.	
Objective:	
(2) Reduce the reliance on the automobile and fossil fuels by encouraging walking, bicycling, and other energy-efficient and safe alternative modes of transportation.	
Policies:	
a. Make walking and bicycling transportation safe and easy between and within communities.	**S**
b. Require development to be designed with the pedestrian in mind.	**S**
c. Design new and retrofit existing rights-of-way with adequate sidewalks, bicycle lanes, or separated multi-use transit corridors.	**S**
d. Support the development of a countywide network of bikeways, equestrian trails, and pedestrian paths.	**S**
e. Support the reestablishment of traditional trails between communities, to the ocean, and through the mountains for public use.	**S**
f. Encourage educational programs to increase safety for pedestrians and bicyclists.	**NA**
Implementing Actions:	
a. Design, build, and modify existing bikeways to improve safety and separation from automobiles.	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
b. Increase enforcement to reduce abuse of bicycle and pedestrian lanes by motorized vehicles.	**NA**
c. Identify non-motorized transportation options as a priority for new sources of funding.	**NA**
ANALYSIS: The WCT's non-vehicular transportation strategy includes: 1) compact and mixed-use development patterns, 2) pedestrian oriented streets integrating street trees, sidewalks, and traffic calming, 3) both striped and separated bike lanes in appropriate locations, 4) a network of greenways and parkways to facilitate mobility, and 5) providing connectivity to adjacent developments, such as the existing town of Waikapū and the future town of Wai`ale. The Plan also includes transportation demand management measures, including supporting park and ride, ridesharing, carpooling and van pooling, regional and sub-regional shuttles.	
Objective:	
(3) Improve opportunities for affordable, efficient, safe, and reliable air transportation.	
Policies:	
a. Discourage private helicopter and fixed-wing landing sites to mitigate environmental and social impacts.	**NA**
b. Encourage the use of quieter aircraft and noise-abatement procedures for arrivals and departures.	**NA**
c. Encourage the modernization and maintenance of air-transportation facilities for general-aviation activities.	**NA**
d. Encourage a viable and competitive atmosphere for air carriers to expand service and ensure sufficient intra-County flights and affordable fares for consumers.	**NA**
e. Continue to support secondary airports, and encourage the State to provide them with adequate funding.	**NA**
f. During Community Plan updates, explore the use of the smaller airports.	**NA**
g. Encourage the State to provide efficient, adequate, and affordable parking and transit connections within and around airports.	**NA**
ANALYSIS: The WCT does not include facilities for air transportation; therefore, this objective and these policies are not applicable.	
Objective:	
(4) Improve opportunities for affordable, efficient, safe, and reliable ocean transportation.	
Policies:	
a. Support programs and regulations that reduce the disposal of maritime waste and prevent spills	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
into the ocean.	
b. Encourage the upgrading of harbors to resist damage from natural hazards and disasters.	**NA**
c. Encourage the State to study the use of existing harbors and set priorities for future use.	**NA**
d. Explore all options to protect the traditional recreational uses of harbors, and mitigate harbor-upgrade impacts to recreational uses where feasible.	**NA**
e. Encourage the upgrading of harbors and the separation of cargo and bulk materials from passenger and recreational uses.	**NA**
f. Encourage the State to provide for improved capacity at shipping, docking, and storage facilities.	**NA**
g. Encourage the State to provide adequate parking facilities and transit connections within and around harbor areas.	**NA**
h. Encourage the redevelopment and revitalization of harbors while preserving historic and cultural assets in harbor districts.	**NA**
i. Encourage the State to provide adequate facilities for small-boat operations, including small-boat launch ramps, according to community needs.	**NA**
j. Support the maintenance and cleanliness of harbor facilities.	**NA**
k. Support the redevelopment of harbors as pedestrian-oriented gathering places.	**NA**
ANALYSIS: The WCT is not located on the coastline and does not include facilities for ocean transportation; therefore, this objective and these policies regarding ocean transportation are not applicable.	
Objective:	
(5) Improve and expand the planning and management of transportation systems.	
Policies:	
a. Encourage progressive community design and development that will reduce transportation trips.	**S**
b. Require new developments to contribute their *pro rata* share of local and regional infrastructure costs.	**S**
c. Establish appropriate user fees for private enterprises that utilize public-transportation facilities for recreational purposes.	**NA**
d. Support the revision of roadway-design criteria and standards so that roads are compatible with surrounding neighborhoods and the character of rural areas.	**NA**
e. Plan for multi-modal transportation and utility corridors on each island.	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
f. Support designing all transportation facilities, including airport, harbor, and mass-transit stations, to reflect Hawaiian architecture.	**NA**
g. Utilize transportation-demand management as an integral part of transportation planning.	**S**
h. Accommodate the planting of street trees and other appropriate landscaping in all public rights-of-way.	**S**
ANALYSIS: The WCT's non-vehicular transportation strategy includes: 1) compact and mixed-use development patterns, 2) pedestrian oriented streets integrating street trees, sidewalks, and traffic calming, 3) both striped and separated bike lanes in appropriate locations, 4) a network of greenways and parkways to facilitate mobility, and 5) providing connectivity to adjacent developments, such as the existing town of Waikapū and the future town of Wai`ale. The Plan also includes transportation demand management measures, including supporting park and ride, ridesharing, carpooling and van pooling, regional and sub-regional shuttles.	
I. Improve Physical Infrastructure	
Goal: Maui County's physical infrastructure will be maintained in optimum condition and will provide for and effectively serve the needs of the County through clean and sustainable technologies.	
Objective:	
(1) Improve water systems to assure access to sustainable, clean, reliable, and affordable sources of water.	
Policies:	
a. Ensure that adequate supplies of water are available prior to approval of subdivision or construction documents.	**S**
b. Develop and fund improved water-delivery systems.	**S**
c. Ensure a reliable and affordable supply of water for productive agricultural uses.	**S**
d. Promote the reclamation of gray water, and enable the use of reclaimed, gray, and brackish water for activities that do not require potable water.	**S**
e. Retain and expand public control and ownership of water resources and delivery systems.	**NA**
f. Improve the management of water systems so that surface-water and groundwater resources are not degraded by overuse or pollution.	**S**
g. Explore and promote alternative water-source-development methods.	**S**
h. Seek reliable long-term sources of water to serve developments that achieve consistency with the appropriate Community Plans.	**S**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Implementing Actions:	
a. Develop a process to review all applications for desalination.	**NA**
ANALYSIS: As documented in Section V.D.4 (Water), the WCT has developed three on-site potable wells and two on-site non-potable wells. Both of the non-potable wells have preliminarily shown low salinity levels, and testing is being conducted to determine the viability of those wells for domestic use. If not viable for domestic use, they will be used for non-potable agricultural use. Water pumped from the non-potable wells will be discharged into the Waihee Ditch or lined onsite reservoirs and used for irrigation purposes for the residential lots, agricultural farming, parks and open areas. A sixth well also exists to be used for monitoring. ~~to meet the Project's water demand.~~ Development of these wells is being done with input from the County's Department of Water Supply and the State Commission on Water Resources Management (CWRM). The Applicant proposes to supply the Project's potable water demand through its on-site wells, which will draw from the Waikapū Aquifer. It is expected that the WCT water system will have sufficient capacity to accommodate the Project and other potable water needs within the area. The Applicant proposes to meet its non-potable water demand for agriculture and irrigation of parks and open space through a combination of surface water provided from the Waihee Ditch system (subject to the issuance of surface water use permits from the CWRM), non-potable agricultural wells, and reclaimed wastewater. The Applicant is proposing to develop a dual water system for potable and irrigation water demand. The non-potable system will service the WCTs park lands, open space and landscape planting of individual residential and commercial lots. It is expected that the dual system will reduce potable water demand by at least one-third. Moreover, the WCT will incorporate other water conservation measures into the project, such as low flow toilets and shower heads. Water conserving irrigation practices including using draught tolerant plants and drip irrigation will also be utilized to conserve non-potable water resources. In the future, when reclaimed water becomes available, it will also be used within the project in appropriate areas.	
Objective:	
(2) Improve waste-disposal practices and systems to be efficient, safe, and as environmentally sound as possible.	
Policies:	
a. Provide sustainable waste-disposal systems and comprehensive, convenient recycling programs to reduce the flow of waste into landfills.	**S**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
b. Support innovative and alternative practices in recycling solid waste and wastewater and disposing of hazardous waste.	**NA**
c. Encourage vendors and owners of automobile, appliance, and white goods to participate in the safe disposal and recycling of such goods, and ensure greater accountability for large waste producers.	**NA**
d. Develop strategies to promote public awareness to reduce pollution and litter, and encourage residents to reduce, reuse, recycle, and compost waste materials.	**NA**
e. Pursue improvements and upgrades to existing wastewater and solid-waste systems consistent with current and future plans and the County's Capital Improvement Program.	**NA**
ANALYSIS: The WCT will support the County's recycling, reuse, and composting activities. The County of Maui's Integrated Solid Waste Management Plan (2009) provides strategies for diverting solid waste from landfills to reduce landfill dependency, save landfill capacity and improve operational efficiency. The WCT will implement these strategies by providing options for recycling, such as collection systems and bin space, within the Project, and promoting sound recycling practices among residents and businesses.	
Objective:	
(3) Significantly increase the use of renewable and green technologies to promote energy efficiency and energy self-sufficiency.	
Policies:	
a. Promote the use of local renewable energy sources, and reward energy efficiency.	**S**
b. Consider tax incentives and credits for the development of sustainable- and renewable-energy sources.	**NA**
c. Expand education about energy conservation and self-sufficiency.	**NA**
d. Encourage small-scale energy generation that utilizes wind, sun, water, biowaste, and other renewable sources of energy.	**S**
e. Expand renewable-energy production.	**S**
f. Develop public-private partnerships to ensure the use of renewable energy and increase energy efficiency.	**S**
g. Require the incorporation of locally appropriate energy-saving and green building design concepts in all new developments by providing energy-efficient urban design guidelines and amendments to	**S**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
the Building Code.	
h. Encourage the use of sustainable energy to power vehicles.	**S**
i. Promote the retrofitting of existing buildings and new development to incorporate energy-saving design concepts and devices.	**S**
j. Encourage green footprint practices.	**S**
k. Reduce Maui County's dependence on fossil fuels and energy imports.	**S**
l. Support green building practices such as the construction of buildings that aim to minimize carbon dioxide production, produce renewable energy, and recycle water.	**S**
m. Promote and support environmentally friendly practices in all energy sectors.	**S**
Implementing Actions:	
a. Adopt an energy-efficiency policy for Maui County government as a model for other jurisdictions.	**NA**
b. Adopt a Green Building Code, and support green building practices.	**NA**
ANALYSIS: The WCT will include energy-efficient design and conservation measures. Specifically, WCTs design guidelines will encourage the use of energy efficient technology throughout the project, specifically in lighting, air-conditioning, and building materials. Solar hot water heaters will be utilized throughout the residential portion of the development and installation of Photovoltaic Energy Systems will be encouraged, where appropriate, on residential and commercial buildings within the WCT. Additionally, the WCT proposes to develop, in appropriate locations within the agricultural district, solar farms to help off-set the Project's demand for carbon emitting electrical energy. Moreover, the WCT is utilizing smart growth planning techniques that will help to reduce automobile trips. Smart Growth helps to minimize automobile dependency by providing employment, goods, services and housing all within walking or biking distance of each other. The WCT will have a unified pedestrian and bicycle system throughout the Project that links the project site to its existing and future surroundings. The pedestrian and bicycle system will provide future residents an alternative to driving for traveling within the WCT and to neighboring developments.	
Objective:	
(4) Direct growth in a way that makes efficient use of existing infrastructure and to areas where there is available infrastructure capacity.	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Policies:	
a. Capitalize on existing infrastructure capacity as a priority over infrastructure expansion.	**S**
b. Planning for new towns should only be considered if a region's growth is too large to be directed into infill and adjacent growth areas.	**S**
c. Utilize appropriate infrastructure technologies in the appropriate locations.	**S**
d. Promote land use patterns that can be provided with infrastructure and public facilities in a cost-effective manner.	**S**
e. Support catchment systems and on-site wastewater treatment in rural areas and aggregated water and wastewater systems in urban areas if they are appropriately located.	**S**
Implementing Actions:	
a. Develop a streamlining system for urban infill projects.	**NA**
b. Identify appropriate areas for urban expansion of existing towns where infrastructure and public facilities can be provided in a cost-effective manner.	**NA**
ANALYSIS: The WCT will provide housing and employment opportunities for the growing population of Central Maui. The subject property is located within the MIP's Small Town Growth Boundary. Significant urban development is adjacent to the site's northern boundary and supporting infrastructure and public facilities will exist on the site and are also available within the urban area of Central Maui, which is in close proximity. As discussed in Section V.D (Infrastructure) the WCT will be responsible for all required infrastructure improvements including water source and system improvements for potable and non-potable water use, on-site drainage improvements, a portion of regional traffic related improvements attributable to the project, required on-site ~~and off-site~~ wastewater system improvements and utility upgrades as determined by the appropriate governmental agencies and public utility companies.	
Objective:	
(5) Improve the planning and management of infrastructure systems.	
Policies:	
a. Provide a reliable and sufficient level of funding to enhance and maintain infrastructure systems.	**S**
b. Require new developments to contribute their *pro rata* share of local and regional infrastructure costs.	**S**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
c. Improve coordination among infrastructure providers and planning agencies to minimize construction impacts.	**NA**
d. Maintain inventories of infrastructure capacity, and project future infrastructure needs.	**S**
e. Require social-justice and -equity issues to be considered during the infrastructure-planning process.	**NA**
f. Discourage the development of critical infrastructure systems within hazard zones and the tsunami-inundation zone to the extent practical.	**NA**
g. Ensure that infrastructure is built concurrent with or prior to development.	**S**
h. Ensure that basic infrastructure needs can be met during a disaster.	**S**
i. Locate public facilities and emergency services in appropriate locations that support the health, safety, and welfare of each community and that minimize delivery inefficiencies.	**S**
j. Promote the undergrounding of utility and other distribution lines for health, safety, and aesthetic reasons.	**S**
Implementing Actions:	
a. Develop and regularly update functional plans for infrastructure systems.	**NA**
b. Develop, adopt, and regularly update local or community-sensitive level-of-service standards for infrastructure systems.	**NA**
***ANALYSIS*:** The implementation of the WCT will increase demand for public infrastructure and facility systems. In response, mitigative measures will be implemented to address project induced impacts. For example, the WCT will make land available for schools, parks, and other necessary public facilities. In addition, the WCT will contribute off-site infrastructure improvements as warranted. The WCT will also pay impact fees for infrastructure and public facility systems, as law requires.	
J. Promote Sustainable Land Use and Growth Management	
Goal: Community character, lifestyles, economies, and natural assets will be preserved by managing growth and using land in a sustainable manner.	
Objective:	
(1) Improve land use management and implement a directed-growth strategy.	
Policies:	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
a. Establish, map, and enforce urban- and rural-growth limits.	**NA**
b. Direct urban and rural growth to designated areas.	**S**
c. Limit the number of visitor-accommodation units and facilities in Community Plan Areas.	**NA**
d. Maintain a sustainable balance between the resident, part-time resident, and visitor populations.	**S**
e. Encourage redevelopment and infill in existing communities on lands intended for urban use to protect productive farm land and open-space resources.	**NA**
f. Discourage new entitlements for residential, resort, or commercial development along the shoreline.	**NA**
g. Restrict development in areas that are prone to natural hazards, disasters, or sea-level rise.	**NA**
h. Direct new development in and around communities with existing infrastructure and service capacity, and protect natural, scenic, shoreline, and cultural resources.	**S**
i. Establish and maintain permanent open space between communities to protect each community's identity.	**S**
j. Support the dedication of land for public uses.	**S**
k. Preserve the public's rights of access to and continuous lateral access along all shorelines.	**NA**
l. Enable existing and future communities to be self-sufficient through sustainable land use planning and management practices.	**S**
m. Protect summits, slopes, and ridgelines from inappropriate development.	**S**
Implementing Actions:	
a. Regularly update urban- and rural-growth boundaries and their maps.	**NA**
b. Establish transfer and purchase of development rights programs.	**NA**
c. Develop and adopt a green infrastructure plan.	**NA**
d. Develop studies to help determine a sustainable social, environmental, and economic carrying capacity for each island.	**NA**
e. Identify and define resort-destination areas.	**NA**
***ANALYSIS*:** In December, 2012, the County of Maui adopted the MIP. The MIP establishes goals, objectives, policies and actions to direct growth and development on Maui through the year 2030. The MIP was based upon a comprehensive analysis of population growth, economic conditions, development capacity of existing entitled lands, and extensive community outreach.	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
The Project Area is located within the MIP's Small Town Growth Boundary. The MIP allocates 1,433 residential units, plus or minus ten percent, to the project site and establishes a net residential density guideline of 9 to 12 units per acre. The Project Area is proximate to Wailuku-Kahului, which is the Island's primary civic and employment center. Central Maui supports an urban level of infrastructure and public facilities including schools, parks, police and fire support services. Moreover, the Project Area is characterized by topography and soils that are highly suited for development and the project site is not significantly constrained by the presence of sensitive environmental or cultural resources. To guide development of future urban lands, the MIP sets forth policies requiring higher urban densities, a greater balance between single- and multi-family housing types, mixed-use development, vehicular and pedestrian connectivity between land uses, and the incorporation of parks, schools, open space and affordable housing into future developments. The WCT conforms to MIP policies through the incorporation of best planning practices for the design of new residential communities. The Project includes a diverse mix of residential housing types to accommodate all market segments – including County required workforce housing, affordable "market priced" housing, and upmarket housing. The WCT also includes sufficient commercial and employment space to balance the increase in demand for employment, retail and services that will be created by the development. By bringing jobs, retail and services close to housing, commuting distances at the WCT will be reduced, which will increase pedestrian and bicycle travel and reduce travel by motorized modes of transportation. When developed, the WCT is envisioned to be a "complete community", where Maui residents can afford to purchase or rent a home of their choice, live close to jobs, parks and schools, feel safe to walk and bike throughout their community, and be surrounded by green actively farmed agricultural lands, the West Maui Mountains and Haleakalā.	
Objective:	
(2) Improve planning for and management of agricultural lands and rural areas.	
Policies:	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
a. Protect prime, productive, and potentially productive agricultural lands to maintain the islands' agricultural and rural identities and economies.	**S & NS**
b. Provide opportunities and incentives for self-sufficient and subsistence homesteads and farms.	**S**
c. Discourage developing or subdividing agriculturally designated lands when non-agricultural activities would be primary uses.	**S**
d. Conduct agricultural-development planning to facilitate robust and sustainable agricultural activities.	**S**
Implementing Actions:	
a. Inventory and protect prime, productive, and potentially productive agricultural lands from competing non-agricultural land uses.	**S**

Analysis: The proposed action has been carefully analyzed for its short- and long-term impacts upon the agricultural industry. While the proposed action will result in the loss of prime agricultural lands, it will not significantly impact the short- or long-term viability of agriculture in Hawai'i since an abundance of currently fallow former sugar and pineapple land is currently available elsewhere. The project will, however, help to address the current shortage of agricultural park lots by establishing a new private and/or public agricultural park within Central Maui.

It has been commonly expressed that a significant impediment to agricultural development on Maui, and throughout the state, is the scarcity of agricultural land, with irrigation water, that is both readily available and affordable for long-term lease to diversified farmers. The WCT's agricultural component includes nearly 1,077 acres of land that will remain in agricultural use. Of these lands, approximately 800 acres will be permanently dedicated to agricultural use with no residential structures to be permitted. The remaining 277 acres may be subdivided into as many as five large agricultural lots where a farm dwelling may be permitted. It is currently planned that a public and/or private agricultural park will be established within the agricultural preserve to help facilitate Maui's agricultural development. The establishment of a centrally located agricultural park within the preserve, with access to affordable irrigation water, should help Maui farmers develop economically viable farms that can compete in local, mainland and international markets.

Objective:

(3) Design all developments to be in harmony with the environment and to protect each community's sense of

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
place.	
Policies:	
a. Support and provide incentives for green building practices.	**NA**
b. Encourage the incorporation of green building practices and technologies into all government facilities to the extent practicable.	**NA**
c. Protect and enhance the unique architectural and landscape characteristics of each Community Plan Area, small town, and neighborhood.	**S**
d. Ensure that adequate recreational areas, open spaces, and public-gathering places are provided and maintained in all urban centers and neighborhoods.	**S**
e. Ensure business districts are distinctive, attractive, and pedestrian-friendly destinations.	**S**
f. Use trees and other forms of landscaping along rights-of-way and within parking lots to provide shade, beauty, urban-heat reduction, and separation of pedestrians from automobile traffic in accordance with community desires.	**S**
g. Where appropriate, integrate public-transit, equestrian, pedestrian, and bicycle facilities, and public rights-of-way as design elements in new and existing communities.	**S**
h. Ensure better connectivity and linkages between land uses.	**S**
i. Adequately buffer and mitigate noise and air pollution in mixed-use areas to maintain residential quality of life.	**S**
j. Protect rural communities and traditional small towns by regulating the footprint, locations, site planning, and design of structures.	**S**
k. Support small-town revitalization and preservation.	**NA**
l. Facilitate safe pedestrian access, and create linkages between destinations and within parking areas.	**S**
Implementing Actions:	
a. Establish design guidelines and standards to enhance urban and rural environments.	**S**
b. Provide funding for civic-center and civic-space developments.	**NA**
c. Establish and enhance urban forests in neighborhoods and business districts.	**NA**
Analysis: In accordance with the above policies and actions, the Project will encourage the use of green building practices for both employment and residential uses; incorporate bicycle and pedestrian infrastructure	

COUNTYWIDE POLICY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
throughout; utilize street trees for beautification, heat reduction, and traffic calming; and will ensure better connectivity and linkages between land uses than what is possible through traditional suburban development practices.	
Objective:	
(4) Improve and increase efficiency in land use planning and management.	
Policies:	
a. Assess the cumulative impact of developments on natural ecosystems, natural resources, wildlife habitat, and surrounding uses.	**S**
b. Ensure that new development projects requiring discretionary permits demonstrate a community need, show consistency with the General Plan, and provide an analysis of impacts.	**S**
c. Encourage public and private partnerships to preserve lands of importance, develop housing, and meet the needs of residents.	**S**
d. Promote creative subdivision designs that implement best practices in land development, sustainable management of natural and physical resources, increased pedestrian and bicycle functionality and safety, and the principles of livable communities.	**S**
e. Coordinate with Federal, State, and County officials in order to ensure that land use decisions are consistent with County plans and the vision local populations have for their communities.	**S**
f. Enable greater public participation in the review of subdivisions.	**S**
g. Improve land use decision making through the use of land- and geographic-information systems.	**NA**
Implementing Actions:	
A. Institute a time limit and sunsetting stipulations on development entitlements and their implementation.	**NA**
ANALYSIS: During the preparation of the WCT site plan, a site environmental constraint analysis was conducted to ensure that urban development would mitigate impacts to the natural and cultural environment. The subject project is consistent with the County's General Plan. The subject EIS assesses the cumulative impact of the development and its potential impacts to natural ecosystems, natural resources, wildlife habitat and surrounding land uses.	
K. Strive for Good Governance	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Goal:	
Objective:	
(1) Strengthen governmental planning, coordination, consensus building, and decision making.	
Policies:	
a. Plan and prepare for the effects of social, demographic, economic, and environmental shifts.	**NA**
b. Plan for and address the possible implications of Hawaiian sovereignty.	**NA**
c. Encourage collaboration among government agencies to reduce duplication of efforts and promote information availability and exchange.	**NA**
d. Expand opportunities for the County to be involved in and affect State and Federal decision making.	**NA**
e. Plan and prepare for large-scale emergencies and contingencies.	**NA**
f. Improve public awareness about preparing for natural hazards, disasters, and evacuation plans.	**NA**
g. Improve coordination among Federal, State, and County agencies.	**NA**
Implementing Actions:	
a. Develop policies, regulations, and programs to protect and enhance the unique character and needs of the County's various communities.	**NA**
b. Evaluate and, if necessary, recommend modifications to the County Charter that could result in a possible change to the form of governance for Maui County.	**NA**
c. Study and evaluate the feasibility and implications of district voting in Maui County Council elections.	**NA**
d. Study and evaluate the feasibility of authorizing town governments in Maui County.	**NA**
ANALYSIS: The WCT will not directly develop government services; therefore this objective and these policies are not applicable. However, the WCT build out will have a significantly positive impact on the Maui County economy and will contribute to increased County revenues in the form of increased property taxes, general excise taxes, and income taxes.	
Objective:	
(2) Promote civic engagement.	
Policies:	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
a. Foster consensus building through in-depth, innovative, and accessible public-participatory processes.	
b. Promote and ensure public participation and equal access to government among all citizens.	**NA**
c. Encourage a broad cross-section of residents to volunteer on boards and commissions.	**NA**
d. Encourage the State to improve its community-involvement processes.	**NA**
e. Support community-based decision making.	**NA**
f. Expand advisory functions at the community level.	**NA**
g. Expand opportunities for all members of the public to participate in public meetings and forums.	**S**
h. Facilitate the community's ability to obtain relevant documentation.	**S**
i. Increase voter registration and turnout.	**NA**
Implementing Actions:	
a. Implement two-way communication using audio-visual technology that allows residents to participate in the County's planning processes.	**NA**
b. Ensure and expand the use of online notification of County business and public meetings, and ensure the posting of all County board and commission meeting minutes.	**NA**
c. Explore funding mechanisms to improve participation by volunteers on boards and commissions.	**NA**
d. Develop a project-review process that mandates early and ongoing consultation in and with communities affected by planning and land use activities.	**NA**
ANALYSIS: The public participation program involved numerous participatory meetings with key stakeholders, community groups, neighboring property owners and governmental agencies at various stages of the master planning process. These meetings provided opportunity for the public to ask questions and present concerns about the project prior to the submittal of the ~~DEIS~~ FEIS. Further review of the WCT will include review of the ~~DEIS~~ FEIS and land use entitlement change application by the State Land Use Commission, Maui Planning Commission and Maui County Council. These steps provide for agency and public input and comments, as well as opportunities for the public and decision makers to ask for more information to address any additional concerns that may arise.	
Objective:	
(3) Improve the efficiency, reliability, and transparency of County government's internal processes and	

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
decision making.	
Policies:	
a. Use advanced technology to improve efficiency.	**NA**
b. Simplify and clarify the permitting process to provide uniformity, reliability, efficiency, and transparency.	**NA**
c. Improve communication with Lana`i and Moloka`i through the expanded use of information technologies, expanded staffing, and the creation and expansion of government-service centers.	**NA**
d. Ensure that laws, policies, and regulations are internally consistent and effectuate the intent of the General Plan.	**NA**
Implementing Actions:	
a. Update the County Code to be consistent with the General Plan.	**NA**
b. Identify and update County regulations and procedures to increase the productivity and efficiency of County government.	**NA**
c. Develop local level-of-service standards for infrastructure, public facilities, and services.	**NA**
d. Implement plans through programs, regulations, and capital improvements in a timely manner.	**NA**
e. Expand government online services.	**NA**
ANALYSIS: The WCT will not directly improve government processes, decision making and standards; therefore this objective and these policies are not applicable. However, the WCT build out will have a significantly positive impact on the Maui County economy by creating short- and long-term employment opportunities.	
Objective:	
(4) Adequately fund in order to effectively administer, implement, and enforce the General Plan.	
Policies:	
a. Adequately fund, staff, and support the timely update and implementation of planning policy, programs, functional plans, and enforcement activities.	**NA**
b. Ensure that the County's General Plan process provides for efficient planning at the County, island, town, and neighborhood level.	**NA**
c. Encourage ongoing professional development, education, and training of County employees.	**NA**
d. Encourage competitive compensation packages for County employees to attract and retain County personnel.	**NA**

COUNTYWIDE POLICY PLAN	**RATING**
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
e. Enable the County government to be more responsive in implementing our General Plan and Community Plans.	**NA**
f. Review discretionary permits for compliance with the Countywide Policy Plan.	**NA**
g. Strengthen the enforcement of County, State, and Federal land use laws.	**NA**
Implementing Actions:	
a. Establish penalties to ensure compliance with County, State, and Federal land use laws.	**NA**
ANALYSIS: The WCT will not directly improve government administration, programs, or plans; therefore this objective and these policies are not applicable. However, the WCT build out will have a significant positive impact on the Maui County economy by creating short- and long-term employment.	
Objective 5:	
Strive for County government to be a role model for implementing cultural and environmental policies and practices.	
Policies:	
a. Educate residents on the benefits of sustainable practices.	**NA**
b. Encourage the retention and hiring of qualified professionals who can improve cultural and environmental practices.	**NA**
c. Incorporate environmentally sound and culturally appropriate practices in government operations and services.	**NA**
d. Encourage all vendors with County contracts to incorporate environmentally sound and culturally appropriate practices.	**NA**
***ANALYSIS*:** The WCT will not directly improve government policies and practices; therefore this objective and these policies are not applicable. However, the WCT build out will have a significant positive impact on the Maui County economy by creating short- and long-term employment.	

2. Maui Island Plan (MIP)

The MIP serves as the regional plan for the Island of Maui. The Plan is comprised of the following nine elements: 1) Population; 2) Heritage Resources; 3) Natural Hazards; 4) Economic Development; 5) Housing; 6) Infrastructure and Public Facilities; 7) Land Use; 8) Directed Growth Plan; 9) Monitoring and

Evaluation; and 10) Implementation. Each element contains goals, objectives, policies and implementing actions. The Directed Growth Plan identifies the location of future development through 2030. The Directed Growth Plan is intended to guide the location and general character of future urban development and will direct future zoning changes and guide the development of the County's short-term and long-term capital improvement plan budgets.

Table 63 ~~57~~: Maui Island Plan Goals, Objectives and Policies

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
CHAPTER 1 - POPULATION		
GOAL		
1.1	Maui's people, values, and lifestyles thrive through strong, healthy, and vibrant island communities.	
Objectives:		
1.1.1	Greater retention and return of island residents by providing viable work, education, and lifestyle options.	**S**
1.1.1.a	Expand programs that enable the community to meet the education, employment, housing, and social goals of youth and young adults.	**NA**
1.1.1.b	Expand housing, transportation, employment, and social opportunities to ensure residents are able to comfortably age within their communities.	**S**
1.1.1.c	Measure and track resident satisfaction through surveys and community indicators.	**NA**
1.1.1.d	Support funding for transportation, housing, health care, recreation, and social service programs that help those with special needs (including the elderly and disabled).	**NA**
Implementing Actions:		
1.1.1-Action 1	Use an existing agency to facilitate education, employment, housing, social	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	services, and other programs that help retain young adults on Maui.	
1.1.1-Action 2	Identify existing and develop new funding sources for youth and family services (e.g., recreation, health care, education, housing, child care, etc.) and integrate such resources to achieve an effective outcome.	**NA**
1.1.1-Action 3	Develop and regularly conduct a Community Satisfaction Survey to measure residents' quality-of-life, facilitate the development of informed policies/programs, and improve service delivery.	**NA**
ANALYSIS: According to the Project's Market Study, (See Appendix A) it is estimated that in 2021 there will be a shortfall in housing supply of between 2,351 to 9,518 new residential units. The Developer expects that the majority of the Project's market priced housing will be sold at prices deemed affordable to Maui County residents earning between 100 and 140 percent of the County's median income as determined by the United States Department of Housing and Urban Development. By providing much needed housing in a format that will create a high quality of life for Maui's working families, and by generating both short- and long-term employment in the construction, trade and agricultural industries, the project should help facilitate the retention and return of island residents by providing viable work, education, and lifestyle options. Moreover, by providing a diversity of housing types, greater opportunity should be made available for residents to comfortably age within the WCT community.		
CHAPTER 2 – HERITAGE RESOURCES		
CULURAL, HISTORICAL AND ARCHAELOGICAL RESOURCES		
GOAL		
2.1	Our community respects and protects archaeological and cultural resources while perpetuating diverse cultural identities and traditions.	
Objectives:		
2.1.1	An island culture and lifestyle that is healthy and vibrant as measured by the ability of residents to live on Maui, access and enjoy the natural environment,	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	and practice Hawaiian customs and traditions in accordance with Article XII, Section 7, Hawai`i State Constitution, and Section 7-1, Hawai`i Revised Statutes (HRS).	
Policies:		
2.1.1.a	Perpetuate the spirit of aloha and celebrate the host Hawaiian culture and other ethnic cultures.	**S**
2.1.1.b	Perpetuate a respect for diversity and recognize the broad blending of cultures and ethnicities as vital to the quality of life on Maui.	**NA**
2.1.1.c	Ensure traditional public access routes, including native Hawaiian trails, are maintained for public use.	**S**
2.1.1.d	Support the education of visitors and new residents about the customs and etiquette of the Hawaiian culture, as well as other cultures.	**NA**
Implementing Actions:		
2.1.1-Action 1	Provide staffing and funding to support cultural resource planning, strengthen enforcement, support cultural programs and educational activities, and utilize the generational knowledge of Native Hawaiian advisory bodies, when appropriate.	**NA**
2.1.1-Action 2	Establish a program to support the reconstruction, restoration, repair, rebuilding, or preservation of historic sites.	**NA**
2.1.1-Action 3	Incorporate the following areas of expertise into the Cultural Resources Commission: (1) Generational knowledge; and (2) Kūpuna with traditional knowledge of land and ocean practices.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
2.1.1-Action 4	Develop, expand, and support educational programs, festivals, celebrations, and folklore that foster the spirit of aloha.	**NA**
Objectives:		
2.2	A more effective and efficient planning and review process that incorporates the best available cultural resources inventory, protection techniques, and preservation strategies.	**NA**
Policies:		
2.1.2.a	Ensure that the island has a comprehensive and up-to-date inventory of historic and archaeological resources, and their cultural significance.	**S**
2.1.2.b	Require the update of existing planning and regulatory mechanisms to protect the natural, cultural, scenic, and historic resources within designated Heritage Areas (see Cultural Resources Overlay/Scenic Corridor Protection Technical Reference Map).	**NA**
2.1.2.c	Ensure that cultural, historic, and archaeological resources are protected for the benefit of present and future generations.	**S**
Implementing Actions:		
2.1.2-Action 1	Commission cultural landscape studies of the entire island to assess areas as potential Heritage Areas.	**NA**
2.1.2-Action 2	Inventory potential Thematic Cultural Resource areas and submit nominations for State and/ or National Register of Historic Places.	**NA**
2.1.2-Action 3	Prepare every ten years or whenever necessary an update to the Historic and Cultural Resources Plan and Inventory/Mapping Project that documents existing cultural and historic sites.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
2.1.2-Action 4	Develop and adopt a Heritage Area Management Program to protect the natural, cultural, scenic, and historic resources to include: (1) A Heritage Area Plan with protection standards for Heritage Areas identified on the Cultural/ Scenic Resources technical reference map; (2) A process to require a Cultural Landscape Report for developments within Heritage Areas; and (3) Consultation with Native Hawaiian advisory bodies, when appropriate.	**NA**
Objective:		
2.3	Enhance the island's historic, archaeological, and cultural resources.	**NA**
Policies:		
2.1.3.a	Identify and pursue a listing of the properties and sites on the State and National Register of Historic Places.	**NA**
2.1.3.b	Support the use of easements, dedications, and other mechanisms to acquire, maintain, and protect lands with cultural, archaeological, and historic significance.	**NA**
2.1.3.c	Support regulations to require developers, when appropriate, to prepare an Archaeological Inventory Survey, Cultural Impact Assessment, and Ethnographic Inventories that are reviewed and commented upon by the Office of Hawaiian Affairs, Native Hawaiian advisory bodies, the State Historic Preservation Division (SHPD), and the Office of Environmental Quality Control, and systematically comply with the steps listed in SHPD's administrative rules, including consultation and monitoring during construction phases of projects.	**NA**
2.1.3.d	Promote the rehabilitation and adaptive reuse of historic sites, buildings, and structures.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
2.1.3.e	Encourage property owners to register historic and archaeological sites on the State and National Register.	**NA**
2.1.3.f	Support opportunities for public involvement with the intent to facilitate the protection and restoration of historic and archeological sites, including consultation with stakeholders.	**S**
2.1.3.g	Ensure compliance with historic preservation laws, and discourage demolition of properties that are determined to be eligible for listing on the National or State Register of Historic Places.	**NA**
2.1.3.h	Develop a comprehensive program for protection of cultural, historic and archaeological sites through the acquisition of easements, use of Transfer of Development Rights/Purchase of Development Rights, and other protective mechanisms.	**NA**
Implementing Actions:		
2.1.3-Action 1	Amend regulations to provide additional protection of lands that are important for traditional native Hawaiian uses including subsistence food gathering, traditional access, agriculture, and religious uses.	**NA**
2.1.3-Action 2	Establish additional Historic and Archaeological Districts and ensure that land use regulations are implemented to ensure their protection.	**NA**
2.1.3-Action 3	Develop a program to identify and list Historic Places on the State and National Historic Register.	**NA**
ANALYSIS: The ~~DEIS~~ FEIS includes an Archaeological Inventory Survey (AIA) and a Cultural Impact Assessment (CIA) for the area proposed for urbanization. By conducting an AIS and CIA in support of the ~~DEIS~~ FEIS, an extensive documentation of the history of the subject area together with documentation of past and existing archaeological and cultural resources was completed. The research that was done will add to the Public's knowledge of the history and		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
cultural resources of the planning area. The AIS and CIA also documented mitigation measures that are needed to ensure that the development will not significantly impact important archaeological and cultural resources. As noted in Section V.A.5 of the ~~DEIS~~ FEIS, the Applicant also intends to work with the Waikapū community to develop a cultural resources plan to ensure that local cultural values are incorporated into the fabric of the project. The Cultural Resources Plan may include recommendations such as the naming of streets and places within the WCT, identifying a site for a small museum depicting the history and culture of Waikapū, incorporating various features and artifacts reflecting Waikapū's past – such as remnants from the sugar industry – into the design of key buildings and sites, and maintaining and protecting access into the Waikapū Valley for the purpose of hunting, gathering, the replanting of native trees and vegetation. The Applicant also intends to facilitate the expansion of diversified agricultural activities, including the growing of traditional Hawaiian food staples such as wet and dryland kalo, banana, sweet potato, etc. within the Project's agricultural lands. Moreover, small community gardens may be dispersed throughout the project site so that residents can connect with the land and grow their own foods, including traditional Hawaiian staples, for their daily needs.		
CHAPTER 2 – HERITAGE RESOURCES		
SHORELINE, REEFS AND NEARSHORE WATERS		
GOAL		
2.2	An intact, ecologically functional system of reef, shoreline, and nearshore waters that are protected in perpetuity.	
Objectives:		
2.2.1	A more comprehensive and community-based ICZM program.	**NA**
Policies:		
2.2.1.a	Encourage a management system that protects and temporarily rests the reef ecosystems from overuse.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
2.2.1.b	Support the establishment of additional MMAs and reef replenishment areas.	**NA**
2.2.1.c	Work with appropriate agencies and community members to protect any special managed conservation areas from overuse and ensure that surrounding land uses do not contribute to the degradation of the natural resources, such as `Ahihi-Kina`u Natural Area Reserve, Honolua-Mokulē`ia Bay Marine Life Conservation District, and Mākena State Park.	**NA**
2.2.1.d	Incorporate the following into the MIP, where consistent with the MIP: (1) Beach Management Plan for Maui; (2) Coastal Nonpoint Pollution Control Program Management Plan; (3) Implementation Plan for Polluted Runoff Control; and (4) Ocean Resource Management Plan.	**NA**
2.2.1.e	Support greater coordination among governmental agencies involved with the protection of the island's marine resources.	**NA**
Implementing Actions:		
2.2.1-Action 1	Seek funding and work with other agencies and organizations to establish and prioritize MMAs around Maui's coastline.	**NA**
2.2.1-Action 2	Establish an advisory committee to advocate the conservation and management of coastal resources, including members with generational knowledge; kūpuna with traditional and/or area knowledge; and those possessing traditional knowledge of land or ocean practices.	**NA**
Objective:		
2.2.2	Improved reef health, coastal water quality, and marine life.	**S**
Policies:		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
2.2.2.a	Create additional mechanisms where needed to contain and control runoff and pollution.	**S**
2.2.2.b	Allow extraction of high quality, Class A, low silt sands only when they will be used to protect or restore Maui's shorelines and beaches.	**NA**
2.2.2.c	Carefully manage beach nourishment activities to protect the coastal and marine ecosystem.	**NA**
2.2.2.d	Require, where appropriate, a buffer between landscaped areas and the shoreline, gulches, and streams to reduce the runoff of fertilizers, pesticides, herbicides, and other pollutants into coastal waters.	**S**
2.2.2.e	Strictly regulate shoreline armoring in accordance with adopted Shoreline Rules, with an intent to protect the coastal and marine ecosystem.	**NA**
2.2.2.f	Support greater protection of Keālia Pond National Wildlife Refuge through the following: (1) Enhancement of marine ecosystems; (2) Beach and sand dune restoration; and (3) Expansion of habitat for Maui's threatened or endangered sea turtles, birds, and other species.	**NA**
2.2.2.g	Support the development of regulations to prevent the excessive depletion of fish stocks due to non-sustainable practices and gear such as SCUBA spear-fishing and lay nets, within the context of nearshore ecosystems.	**NA**
2.2.2.h	Encourage the State to conduct a regular census of fish populations and monitor coral health.	**NA**
2.2.2.i	Encourage the State to significantly increase the number of park rangers,	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	enforcement officers, and marine biologists to protect coastal resources.	
2.2.2.j	Encourage the State to prohibit the collection and exportation of fish, coral, algae, and other marine species for the ornamental and aquarium trade.	**NA**
Implementing Actions:		
2.2.2-Action 1	Adopt coastal landscaping provisions that include standards such as setbacks, buffers, and other measures that promote the use of native plants and xeriscaping.	**NA**
2.2.2-Action 2	Develop a master plan and feasibility study for the preservation and enhancement of the Ma`alaea Beach recreation area and Keālia Pond National Wildlife Refuge to include the possible mauka realignment of North Kīhei Road.	**NA**
2.2.2-Action 3	Work with appropriate agencies, landowners, and community groups to identify Maui's Hawaiian fishponds and develop a management plan for their protection, repair, restoration, and use.	**NA**
2.2.2-Action 4	Implement a Reef Protection Restoration Plan.	
Objectives:		
2.2.3	Water quality that meets or exceeds State Clean Water Act standards.	**S**
Policies:		
2.2.3.a	Reduce the amount of impervious surface and devise site plan standards that aim to minimize storm runoff and NPS pollution.	**S**
2.2.3.b	Support the revision of existing regulations to require an Erosion and Sedimentation Control Plan (ESCP) for development activities that may pose a threat to water quality.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
2.2.3.c	Require an on-site monitoring program, where applicable, when grading may pose a threat to water quality or when recommended in the ESCP.	**NA**
2.2.3.d	Avoid development actions that impair Maui's reef systems and remove identified stressors.	**NA**
2.2.3.e	Phase out cesspools and restrict the use of septic systems in ecologically sensitive coastal areas by converting to environmentally-friendly alternative sewage treatment systems, and connecting to central sewerage systems when and where feasible.	**NA**
2.2.3.f	Prohibit the development of new wastewater injection wells, except when unavoidable for public health and safety purposes.	**NA**
2.2.3.g	Ensure that the County upholds its affirmative duty under the Clean Water Act by monitoring and reducing point and NPS pollution to help safeguard coastal waters.	**NA**
Implementing Actions:		
2.2.3-Action 1	Transition from the use of wastewater injection wells to appropriate, environmentally sound methods of wastewater disposal, and promote the beneficial reuse of wastewater effluent.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
2.2.3-Action 2	Revise regulations: (1) Require the approval of an ESCP for development activities that may pose a threat to water quality. (2) Require an on-site monitoring program, where applicable, when grading may pose a threat to water quality or when recommended in the ESCP. (3) Devise site plan standards using innovative tools. (4) Control the pollutant load by imposing standards that are more restrictive than the State water quality control standards.	**NA**
Objective:		
2.2.4	Acquire additional shoreline lands and shoreline access rights.	**NA**
Policies:		
2.2.4.a	Promote the use of conservation easements, land trusts, transfer and purchase of development rights, and mitigation banking.	**NA**
2.2.4.b	Require the dedication of public beach and rocky shoreline access ways to and along the shoreline where it serves a practical public interest as a condition of development or subdivision approval; future subdivisions and developments shall be consistent with and effectuate, to the extent practicable, the *Shoreline Access Inventory Update - Final Report* (March 2005), and its updates.	**NA**
2.2.4.c	Incorporate the *Shoreline Access Inventory Update - Final Report* (March 2005), and its regular updates, into this plan.	**NA**
2.2.4.d	Identify access points while further acquiring key shoreline parcels and easement rights to enhance and protect beach access and shoreline recreation.	**NA**
Implementing Actions:		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
2.2.4-Action 1	Revise subdivision and development regulations to: (1) Increase linear frequency for public access to and along the shoreline; and (2) Require access to and along the shoreline as a condition of subdivision, land use entitlement, and/or discretionary development approval.	**NA**
2.2.4-Action 2	Prioritize the acquisition of shoreline parcels in accordance with the recommendations of the Shoreline Access Inventory Update – Final Report (March 2005), and other plans funded by the Coastal Zone Management Program.	**NA**
2.2.4-Action 3	Implement the Pali to Puamana Plan to facilitate the restoration of shoreline and coastal resources along the eight-mile stretch of seashore from Ukumehame to Puamana.	**NA**
2.2.4-Action 4	Acquire development rights for the lands adjoining Ho`okipa Beach Park, to enhance coastal zone management.	**NA**
2.2.4-Action 5	Acquire coastal lands between the Central Maui Wastewater Reclamation Facility and Pā`ia Town in accordance with the recommendations of the Northshore Greenway Master Plan.	**NA**
2.2.4-Action 6	Develop and adopt funding mechanisms to finance the acquisition of additional shoreline lands in South and West Maui, and other areas as they urbanize.	**NA**
ANALYSIS: In accordance with the County's "Rules for the Design of Storm Water Treatment Best Management Practices", the design of WCTs stormwater system will include water quality treatment to reduce the discharge of pollutants to the maximum extent practicable. Some examples of stormwater best management practices (BMPs) include: • ***Grassed Swales***. Grassed swales will be implemented within the landscaped areas where practical. Grass and groundcover provides natural filtration and allows for		

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	

percolation into the underlying soils.

- ***Open Space and Parks***. Open space and parks will be maintained with grass or other landscape materials, thereby reducing the amount of impervious surfaces and promoting infiltration.

- **Stormwater Detention** collects stormwater allowing some of the suspended solids to settle out. The stored runoff infiltrates into the underlying soils and recharges groundwater. In accordance with the County's *"Rules for the Design of Storm Drainage Facilities"*, the design of the drainage systems with retention basins shall be based on the following design conditions:

> *"In areas where the existing drainage systems are inadequate, the existing system shall be upgraded to handle runoff from the new project area or a new system shall be provided to connect to an adequate outlet. When there is no existing drainage system or adequate outlet to connect to, the additional runoff generated by the development may be retained on-site in a temporary retention basin with the following design conditions:*
>
> > *A. Storage volume of an infiltration basin, infiltration trench piping, or retention basin shall equal at least the total additional runoff volume for the appropriate storm intensity.*
> >
> > *B. Soil percolation shall not be used in satisfying required storage volumes.*
> >
> > *C. Fifty percent (50%) of voids within the rock envelope for subsurface drains may be used in satisfying required storage volume provided that filter fabric is installed around the pipe and at the interface of the rock envelope and soil.*
> >
> > *D. Sumps, detention and retention facilities will remain private.*

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
E. Detention or retention ponds with embankment heights equal to or in excess of 50 acre-feet shall conform to all state and federal requirements relative to dams". • ***Runoff from Agricultural Lands into the Waikapū Stream.*** The Applicant is working with Waikapū community stakeholders to address concerns regarding stormwater runoff from the agricultural lands that may be contributing to sedimentation of the Waikapū Stream. The implementation of on-site low impact development techniques (LID's) may help to mitigate these concerns. LID's that may be feasible along the upper reaches of the Waikapū Stream include: 1) a landscaped buffer and or riparian zone adjacent to the stream that is planted with vegetation to promote filtration and infiltration; 2) grass swales; and 3) bio-retention systems. All of these techniques are proven to promote infiltration and filtration of groundwater. • ***Post-Construction Water Quality Goals and Standards.*** The Project's drainage system will be designed to meet the County's drainage and water quality standards. The project will also be required to comply with Ordinance 3902, which requires subdivisions to comply with Section 18.20.130 Post Construction Storm Water Quality Best Management Practices of the Maui County Code. The criteria for sizing of storm water quality facilities are: *"(a) The criteria can be met by:* *(1) Either detaining storm water for a length of time that allows storm water pollutants to settle (detention treatment from such methods as extended detention wet and dry ponds, created wetlands, vaults/tanks, etc.);* *(2) By use of filtration or infiltration methods (flow-through based treatment from such methods as sand filters, grass swales, other media filters, and infiltration);* *(3) Short-term detention can be utilized with a flow-through based*	

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
treatment system (e.g., a detention pond designed to meet flows through a swale of filter) to meet the criteria; or *(4) Upstream flow-through treatment and detention treatment can be utilized.* *(b) Other proposals to satisfy the water quality criteria may be approved by the director if the proposal is accompanied by a certification and appropriate supporting material from a civil engineer, licensed in the State of Hawai'i, that verifies compliance with one of the following (by performance or design):* *(1) After construction has been completed and the site is permanently stabilized, reduce the average annual total suspended solid ("TSS") loadings by eighty percent. For the purposes of this measure, an eighty percent TSS is to be determined on an average annual basis for the two-year/twenty-four hour storm.* *(2) Reduce the post development loadings of TSS so that the average annual TSS loadings are no greater than predevelopment loadings."* BMPs will consist of grassed swales and retention basins sized adequately to promote infiltration and filter pollutants to meet water quality standards. Other Low Impact Development Techniques (LID's) will also be explored to help reduce runoff volumes, promote infiltration and filtration of groundwater. Some of these measures may include promoting rain gardens, the use of rain barrels, developing green roofs, and use of permeable paving surfaces, where appropriate, within residential, commercial, and institutional developments. The Applicant will also explore the opportunity of utilizing bio-retention swales with native plantings at appropriate locations within the street network to reduce and filter stormwater runoff and to take advantage of natural drainage for irrigation. A maintenance plan will be developed for the stormwater BMPs. The plan will include the requirements for removal of the accumulated debris and sediment, maintaining vegetation, and	

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
performing inspections to insure that the BMPs are functioning properly. Moreover, stormwater runoff during site preparation will be controlled in compliance with the County Code Chapter 20.08 "Soil Erosion and Sediment Control Minimum BMPs". During the construction period, temporary erosion control measures will be incorporated to minimize dust and soil erosion. Additional controls will be implemented to protect Waikapū Stream. Temporary BMPs include the construction of diversion berms and swales, dust fences, silt fences, stabilized construction entrances, truck wash down areas, inlet protection, temporary grassing of graded areas, and slope protection. Water trucks and temporary sprinkler systems will be used to minimize dust generated from the graded areas. A National Pollution Discharge Elimination System (NPDES) permit will be required by the Department of Health prior to approval of the grading permit. The drainage design criteria will be to minimize any alterations to the drainage pattern of the existing onsite surface runoff. No additional runoff will be allowed to sheet flow toward Keālia Pond.		
CHAPTER 2 – HERITAGE RESOURCES		
WATERSHEDS, STREAMS AND WETLANDS		
GOAL		
2.3	Healthy watersheds, streams, and riparian environments.	
Objectives:		
2.3.1	Greater protection and enhancement of watersheds, streams, and riparian environments.	**S**
Policies:		
2.3.1.a	All present and future watershed management plans shall incorporate concepts of ahupua`a management based on the interconnectedness of upland and coastal ecosystems/species.	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
2.3.1.b	Continue to support and be an active member of watershed partnerships.	**S**
2.3.1.c	Support the establishment of regional water trusts, composed of public and private members, to manage water resources.	**NA**
2.3.1.d	Support regulations to require developments to utilize ahupua`a management practices.	**NA**
2.3.1.e	Work with private and non-profit entities to educate the public about the connection between upland activities within the watershed and the impacts on nearshore ecosystems and coral reefs.	**S**
2.3.1.f	Provide adequate funding and staff to develop and implement watershed protection plans and policies, including acquisition and management of watershed resources and land.	**NA**
2.3.1.g	Encourage the State to mandate instream assessment to provide adequate water for native species.	**S**
2.3.1.h	Maui will protect all watersheds and streams in a manner that guarantees a healthy, sustainable riparian environment.	**S**
Implementing Actions:		
2.3.1-Action 1	Develop, regularly update, and adopt watershed management plans for regions of the island not covered by existing plans.	**NA**
2.3.1-Action 2	Work with the State and Federal government to ensure instream assessment to assure the reproductive system/cycle for Native species and for other purposes.	**NA**
Objective:		
2.3.2	Decreased NPS and point source pollution.	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
Policies:		
2.3.2.a	Enforce water pollution related standards and codes.	**NA**
2.3.2.b	Support the use of LID Techniques such as those described in the State of Hawai`i LID Practitioner's Guide (June 2006), as amended.	**S**
2.3.2.c	Encourage farmers and ranchers to use agricultural BMPs to address NPS pollution.	**S**
Implementing Actions:		
2.3.2-Action 1	Adopt standards to reduce the amount of nutrients that enter watersheds, and encourage the reduction of landscape fertilizers and pesticides.	**NA**
2.3.2-Action 2	Develop updated grading BMPs that are appropriate for Maui.	**NA**
2.3.2-Action 3	Implement the Pollution Prevention Plan (PPP) program, which provides incentives for agricultural operations to prevent runoff and nonpoint source pollution.	**S**
Objective:		
2.3.3	Preserve existing wetlands and improve and restore degraded wetlands.	**NA**
Policies:		
2.3.3.a	Prohibit the destruction and degradation of existing upland, mid-elevation, and coastal wetlands.	**NA**
2.3.3.b	Support and fund wetland protection and improvement, and restoration of degraded wetlands.	**NA**
2.3.3.c	Where applicable, require developers to provide a wetland protection buffer and/or other protective measures around and between development and	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	wetland resources.	
Implementing Actions:		
2.3.3-Action 1	Develop standards for appropriate buffers and/or other protective measures for development near or around wetlands.	**NA**
2.3.3-Action 2	Enact ordinances to ensure no net loss of wetlands.	**NA**
2.3.3-Action 3	Enforce no net loss of wetlands and improve degraded wetlands.	**NA**
2.3.3-Action 4	Assist in the preservation and enhancement of Keālia and Kanahā-Mauoni Ponds; Lā'ie, Kalepolepo, Nu'u, Ukumehame, Olowalu, Launiupoko, and Mākena wetlands; and other wetland areas.	**NA**
Objective:		
2.3.4	Greater preservation of native flora and fauna biodiversity to protect native species.	**S**
Policies:		
2.3.4.a	Work with appropriate agencies to eliminate feral ungulate populations and invasive species.	**S**
2.3.4.b	Encourage the State to provide adequate funding to preserve biodiversity, protect native species, and contain or eliminate invasive species.	**NA**
2.3.4.c	Support the work of conservation groups and organizations that protect, reestablish, manage, and nurture sensitive ecological areas and threatened indigenous ecosystems.	**S**
Implementing Actions:		
2.3.4-Action 1	Develop tree protection regulations that restrict the removal of vegetation	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	outside of identified building envelopes/protected areas.	
2.3.4-Action 2	Develop strategic partnerships with conservation groups and organizations to maximize Federal, State, County, and private funding; and increase cooperation to achieve conservation goals.	**NA**
Objective:		
2.3.5	Limited development in critical watershed areas.	**S**
Policies:		
2.3.5.a	Discourage development and subdivision of land within critical watersheds and in areas susceptible to high erosion and sediment loss.	**S**
2.3.5.b	Designate critical watershed areas as conservation lands.	**NA**
2.3.5.c	Strongly encourage new subdivisions and developments that are proximate to environmentally sensitive watershed resources to prepare and implement CSD plans.	**S**
Implementing Actions:		
2.3.5-Action 1	Develop tools, such as CSD plans, to protect watershed resources and sensitive habitats.	**NA**
2.3.5-Action 2	Identify and map critical watersheds, sensitive habitats, and those areas susceptible to high erosion and sediment loss.	**S**
Objective:		
2.3.6	Enhance the vitality and functioning of streams, while balancing the multiple needs of the community.	**S**
Policies:		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
2.3.6.a	Protect and enhance natural streambeds and discourage stream alteration.	**S**
2.3.6.b	Work with appropriate agencies to establish minimum stream flow levels and ensure adequate stream flow to sustain riparian ecosystems, traditional kalo cultivation, and self-sustaining ahupua`a.	**S**
2.3.6.c	Respect and participate in the resolution of native Hawaiian residual land and water rights issues (kuleana lands, ceded lands, and historic agricultural and gathering rights).	**S**
2.3.6.d	Ensure that stream flows implement laws and policies found in the State Constitution and Water Code.	**NA**
2.3.6.e	Work with appropriate agencies and stakeholders to establish minimum stream flow levels, promote actions to support riparian habitat and the use of available lo`i, and maintain adequate flows for the production of healthy kalo crops.	**S**
ANALYSIS: The WCT Master Plan sets aside open space that buffers the mauka urban and rural development from the Waikapū Stream and the Waikapū Watershed. The highest point of the proposed rural development boundary is located approximately 3,200 feet makai of the entrance to the Waikapū Valley and the highest point of the urban boundary is just under a mile makai of the valley's entrance. Along the approximate 1.5 miles of the Project's Waikapū Stream frontage, a riparian buffer of at least 100-feet, but in most areas significantly wider, has been established. WCT land along the Waikapū Stream will be kept in open space, used for agriculture and for active and passive recreation. As noted in Section V.D3 of the ~~DEIS~~ FEIS, BMPs will be used to mitigate the discharge of non-point source pollution from the project site during the construction and operation phases. Moreover, agricultural land management BPMs will be implemented to minimize soil loss and sedimentation during agricultural operations, especially when crops are harvested and rotated and the land is being tilled. Agricultural operations will also be required to abide by all State and Federal laws regulating the use of pesticides, and will be required to implement		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
appropriate BMPs to ensure that such treatments do not impact the natural environmental and or the public's health. The Applicant is supporting the on-going work of neighboring Kuleana farmers that have leased land in the Waikapū Watershed from the Applicant. On these leased lands, the Hui Mālama o Waikapū non-profit community group has restored a few of the loʻi kalo and a native dryland koai`a forest and are conducting invasive species eradication. The WCT is also a binding party to the Nā Wai ʻEhā settlement agreement and the instream flow standards established by the Commission on Water Resources Management (CWRM). The Applicant is an active partner with the Community to minimize the Project's impact to stream flows, and to ensure that sufficient water is available for Kuleana farmers and stream restoration activities.		
Implementing Actions:		
2.3.6-Action 1	Compile and update data on the needs of the multiple users of water.	
CHAPTER 2 – HERITAGE RESOURCES		
WILDLIFE AND NATURAL AREAS		
GOAL		
2.4	Maui's natural areas and indigenous flora and fauna will be protected.	
Objectives:		
2.4.1	A comprehensive management strategy that includes further identification, protection, and restoration of indigenous wildlife habitats.	**S**
Policies:		
2.4.1.a	Identify and inventory the following: (1) Natural, recreational, and open space resources; (2) Flora and fauna with medium, high, and very high concentrations of threatened or endangered species; and	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	(3) Location and extent of invasive species.	
2.4.1.b	Require flora and fauna assessment and protection plans for development in areas with concentrations of indigenous flora and fauna; development shall comply with the assessment and protection plan and shall use the avoidance, minimization, and mitigation approach respectively, with an emphasis on avoidance.	**NA**
2.4.1.c	Support the implementation of Hawai`i's Comprehensive Wildlife Conservation Strategy (October 2005).	**NA**
Implementing Actions:		
2.4.1-Action 1	Develop, and regularly update, an island-wide Environmental Resources Sites' database to serve as a basis for decision making to include the following: natural preserves; watersheds; wetlands; streams; dryland forests; critical habitat areas; natural barrier resources; and other sensitive landforms and features on an Environmental Resources Map.	**NA**
2.4.1-Action 2	Prepare the following, in coordination with the State and resource partnerships: (1) An inventory of key habitats that lack regulatory protections; and (2) An inventory of NAPP-eligible lands.	**NA**
2.4.1-Action 3	Increase wildlife and natural area planning expertise throughout the County government.	**NA**
2.4.1-Action 4	Amend existing regulations to require flora and fauna assessments and protection plans for development in areas with identified concentrations of indigenous flora and fauna.	**NA**
Objective:		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
2.4.2	A decrease in invasive species through programs and partnerships that eradicate undesirable species and protect native habitat.	**NA**
Policies:		
2.4.2.a	Prevent the introduction of invasive species at all of Maui's airports and harbors.	**NA**
2.4.2.b	Encourage the State to increase funding in support of invasive species interception, control, and eradication.	**NA**
2.4.2.c	Encourage the State to develop programs that allow students to participate in invasive species eradication projects.	**NA**
Implementing Actions		
2.4.2-Action 1	Work with Federal and State agencies to develop and implement procedures for the inspection of incoming cargo, passenger baggage, and vehicles for invasive species and prohibited plants and animals.	**NA**
2.4.2-Action 2	Pursue Federal and other dedicated funding for invasive species intervention at harbors and airports.	**NA**
2.4.2-Action 3	Pursue Federal and other funding for public/private partnerships to develop and implement environmental protection programs.	**NA**
Objective:		
2.4.3	Greater protection of sensitive lands, indigenous habitat, and native flora and fauna.	**S**
Policies:		
2.4.3.a	Secure an interconnected network of sensitive lands, greenways, watercourses,	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	and habitats.	
2.4.3.b	Protect Maui's sensitive lands (see Sensitive Lands on Protected Areas Diagrams).	**S**
2.4.3.c	Promote innovative environmental-planning methods and site-planning standards that preserve and re-establish indigenous flora and fauna habitat, to preserve and restore connected habitat corridors and open space.	**S**
2.4.3.d	Utilize protection tools such as conservation easements, land trusts, land banks, Purchase of Developments Rights (PDRs), Transfer of Development Rights (TDRs), and other stewardship tools to acquire natural areas.	**NA**
2.4.3.e	Encourage discussions with communities to designate heritage areas that protect recreational and cultural lifestyles and resources.	**S**
2.4.3.f	Support the expansion of Haleakalā National Park, and the creation of new national parks, where appropriate and supported by local communities.	**NA**
2.4.3.g	Encourage reforestation efforts that increase native species' habitat.	**S**
2.4.3.h	Utilize the Natural Area Partnership Program (NAPP) and other programs to protect natural lands.	**S**
2.4.3.i	Support increased dedicated funding for the acquisition, protection, restoration, or preservation of important natural areas or open space through the following: grants from the Land and Water Conservation Fund; dedicated funding from real property taxes or other appropriate revenues; bond issues; real estate transfer tax; revenues from the Transient Accommodations Tax; development mitigation fees; and other appropriate funding sources.	**NA**
Implementing Actions:		

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
2.4.3-Action 1 Develop management plans for the reforestation of native species' habitats and institute rest periods for designated areas threatened by overuse.	**NA**
2.4.3-Action 2 Develop an inventory of lands, and prioritize urban and rural wilderness areas that are threatened by human impacts and are strong candidates for preservation.	**NA**
ANALYSIS: In order to avoid having the proposed development impact endangered and threatened species of flora and fauna, a Biological Resources Survey was conducted as part of the ~~DEIS~~ FEIS (**See:** Section IV.A.4 and Appendix B). The objectives of the Biological Resources Survey were to: 1. Document the types of plant and animal species that exist on the property; 2. Identify the presence or likely presence of native flora and fauna; 3. Identify the presence or likely presence of federally listed Threatened or Endangered species and what on-site habitats might be essential for these species; 4. Determine if the project area contains any special habitats, which if lost or altered, might result in a significant negative impact on the flora and fauna found on the property. The Biological Resources Survey determined that there is little of botanical concern on the subject property. The study states that the project is not expected to have a significant negative impact on the botanical resources on the site or in the immediate area and no recommendations are recommended in the study. In addition to conducting a Biological Resources Survey, the WCT site plan also places a significant buffer between the Waikapū Valley and Waikapū Stream and the area proposed for development. Moreover, as noted in Section V.D.3 of the ~~DEIS~~ FEIS, BMPs will be used to mitigate the discharge of non-point source pollution from the project site during the	

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
construction and operation phases. Moreover, agricultural land management BPMs will be implemented to minimize soil loss and sedimentation during agricultural operations, especially when crops are harvested and rotated and the land is being tilled. Agricultural operations will also be required to abide by all State and Federal laws regulating the use of pesticides, and will be required to implement appropriate BMPs to ensure that such treatments do not impact the natural environmental and or the public's health.		
CHAPTER 2 – HERITAGE RESOURCES		
SCENIC RESOURCES		
GOAL		
2.5	Maui will continue to be a beautiful island steeped in coastal, mountain, open space, and historically significant views that are preserved to enrich the residents' quality of life, attract visitors, provide a connection to the past, and promote a sense of place.	
Objectives:		
2.5.1	A greater level of protection for scenic resources.	**S**
Policies:		
2.5.1.a	Protect views to include, but not be limited to, Haleakalā, `Īao Valley, the Mauna Kahalawai (West Maui Mountains), Pu`u Ō`la`i, Kaho`olawe, Molokini, Moloka`i, and Lāna`i, Mauna Kea, Mauna Loa, sea stacks, the Pacific Ocean, and significant water features, ridgelines, and landforms.	**S**
2.5.1.b	Identify, preserve, and provide ongoing management of important scenic vistas and open space resources, including mauka-to-makai and makai-to-mauka view planes.	**S**
2.5.1.c	Protect "night sky" resources by encouraging the implementation of ambient light ordinances and encouraging conversion of all sources that create excessive	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	light pollution, affecting our ability to view the stars.	
2.5.1.d	Protect ridgelines from development where practicable to facilitate the protection of public views.	**NA**
2.5.1.e	Protect scenic resources along Maui's scenic roadway corridors.	**S**
Implementing Actions:		
2.5.1-Action 1	Adopt a Scenic Roadway Corridor Overlay District to establish special controls to mitigate the impact of development on scenic resources.	**NA**
2.5.1-Action 2	Establish a Scenic Roadway Corridor Management Plan and Design Guidelines to guide the development within the Overlay District.	**NA**
2.5.1-Action 3	Adopt a management plan that identifies right-of-way improvements, utility controls, roadside maintenance activities, signage, potential new vehicular turnoffs, and land acquisition opportunities that would protect the resource.	**NA**
2.5.1-Action 4	Establish design guidelines that integrate techniques such as development clustering, greenbelts, and open space buffers, site plan configuration to protect view planes, building design and height limitations, setbacks from public roadways, landscaping, and other techniques.	**S**
2.5.1-Action 5	Create thresholds for new subdivision of land or building permit which is within a Scenic Roadway Corridor viewshed (as mapped by the County) to make them subject to assessment of the projects visual impact and compliance with the design guidelines.	**NA**
2.5.1-Action 6	The County shall use the management plan and design guidelines to review site designs, development applications, and capital improvement programs to ensure that they do not degrade Maui's scenic roadways and resources.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
2.5.1-Action 7	Develop and adopt standards to protect ridgelines, slopes, and view planes from development.	**NA**
2.5.1-Action 8	Develop and adopt regulations to protect night-sky resources from encroachment by the built environment, and limit night-light emissions and light-intensity levels.	**NA**
Objective:		
2.5.2	Reduce impacts of development projects and public-utility improvements on scenic resources.	**S**
Policies:		
2.5.2.a	Enforce the policies and guidelines of the SMA regarding the protection of views.	**NA**
2.5.2.b	Require any new subdivision of land, development, or redevelopment adjacent to a "high" or "exceptional" scenic corridor to submit an impact assessment of the project's scenic impacts; this assessment shall use the avoidance, minimization, and mitigation steps respectively, with an emphasis on avoidance.	**S**
2.5.2.c	Require appropriate building setbacks and limits on wall heights to protect views along scenic corridors.	**S**
2.5.2.d	Encourage the State of Hawai`i Board of Land and Natural Resources to deny any development within the State Conservation District that interferes with a scenic landscape or disrupts important open space resources.	**NA**
2.5.2.e	Require Urban Design and Review Board (UDRB) review and approval of utility poles, facilities, and other visible infrastructure improvements along scenic corridors.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
2.5.2.f	Ensure little or no effect on scenic resources from utility improvements, primarily power poles.	**NA**
2.5.2.g	Protect scenic vistas from intrusion by power poles.	**NA**
Implementing Actions:		
2.5.2-Action 1	Develop, adopt, and implement a Scenic Resources Management Plan and design guidelines.	**NA**
2.5.2-Action 2	Develop and adopt an ordinance that requires Scenic Resource Impact Assessments for projects that may have potential impact on scenic resources.	**NA**
2.5.2-Action 3	Develop and adopt standards and processes to: (1) Ensure that the location and design of utility poles, facilities, and infrastructure do not degrade scenic resources; (2) Require utilities to be placed underground, whenever feasible; and (3) Require UDRB to review and approve the installation of utilities along scenic corridors.	**NA**
Objective:		
2.5.3	Greater protection of and access to scenic vistas, access points, and scenic lookout points.	**NA**
Policies:		
2.5.3.a	Protect, enhance, and acquire access to Maui's scenic vistas and resources.	**NA**
Implementing Actions:		
2.5.3-Action 1	Revise land use regulations to: (1) Require access, where appropriate, to scenic vistas and resources,	**NA**

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
provided such access is culturally acceptable; (2) Limit the height of walls; and (3) Require appropriate setbacks and site design along scenic corridors.	
2.5.3-Action 2 Develop additional Scenic Lookout points.	**NA**
ANALYSIS: As discussed in Section V.A.6 (Visual Resources) the WCT will have approximately 12,243 feet, or 2.31 miles, of urban, rural and agricultural frontage along Honoapi'ilani Highway. The WCT will change the character of the existing open space, Haleakalā and West Maui Mountain views along the frontage of the Highway where urban and rural development is being proposed. The frontage that will be impacted stretches approximately 4,700 linear feet just south of Waikapū, from the northern boundary of the Maui Tropical Plantation. The views from this area are partially obstructed by vegetation within the right-of-way, but where not obstructed the views are of agricultural lands and the West Maui Mountain in the background looking in a mauka direction. Looking in a makai direction, where not obstructed by existing vegetation within the right-of-way, the views are of Haleakalā and the Pacific Ocean can be seen when the sugarcane has been harvested. In order to mitigate the obstruction of views from the highway to the West Maui Mountains, buildings will be setback at least 75-feet from the highway and building heights will be limited to 30-feet along the highway frontage. Buildings will also be separated, placed and oriented in a manner that will establish view corridors from the highway to the West Maui Mountains. Building setbacks and placement will help to mitigate the project's overall impact upon the existing views of Haleakalā and the West Maui Mountains. The Applicant is establishing wide setbacks from Honoapi'ilani Highway to allow for pedestrian and bicycle facilities and the establishment of landscape planting. As is common throughout Hawai'i, and especially on Maui, the planting of large canopy Monkey Pod trees, tropical shrubs and bushes and ground cover will be maintained to create a sense of separation and definition between the urban development and the highway. Separated from the highway, an	

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
approximate 10-foot wide shared pedestrian and bicycle track will meander along the roadways frontage. The overall effect will be to create a greenway with a variety of plant massing and color, and the presence of intermittent views of Haleakalā and the West Maui Mountains along the frontage of the development. In order to fully document the impact to scenic resources along Honoapi'ilani Highway fronting the project site, photographic simulations were prepared to show before and after conditions. The simulations clearly show that the existing views over agricultural lands towards Haleakalā and the West Maui Mountain will be impacted by the development. However, the large setback along the highway, together with building height limitations and building separation, will preserve views of Haleakalā and the West Maui Mountains. Moreover, landscape planting of canopy shade trees along with tropical shrubs and the placement of a separated bicycle and pedestrian path within the highway's frontage, will expand opportunities for the public to experience these visual resources in the future (See Figure 35 ~~30~~, A-E). Beyond the Project's urban frontage and extending towards Mā'alaea, a permanent 800-acre agricultural preserve will exist on each side of Honoapi'ilani Highway. The preserve will have approximately 7,550-feet of frontage along the highway. The preserve will create a permanent open space buffer and permanent separation between Waikapū Town and Mā'alaea. Along this section of the highway, largely unobstructed views of Haleakalā, the West Maui Mountains and partial views of the Pacific Ocean will exist in perpetuity.	
CHAPTER 3 – NATURAL HAZARDS	
GOAL	
3.1 Maui will be disaster resilient.	
Objectives:	
3.1.1 Increased inter-agency coordination.	**NA**
Policies:	

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
3.1.1.a	Reinforce the island's preparedness capacity by: (1) Applying the latest data-gathering techniques/technology; (2) Pursuing funding opportunities; (3) Improving monitoring and advance warning systems; (4) Fostering public awareness; and (5) Working with external agencies to coordinate disaster mitigation and response.	**NA**
Implementing Actions:		
3.1.1-Action 1	Consolidate and update the geographic information systems (GIS) hazards data bank in the Maui County Emergency Operations Center. Allow for the use of outside data to be included in the data bank.	**NA**
3.1.1-Action 2	Acquire the latest GIS technology in hazard, risk, and vulnerability assessments.	**NA**
3.1.1-Action 3	Establish a standing County Hazard Mitigation Committee, comprised of representatives from all levels of government and the private sector.	**NA**
Objective:		
3.1.2	Greater protection of life and property.	**S**
Policies:		
3.1.2.a	Identify critical infrastructure, lifelines, roads, and populations that are vulnerable to coastal hazards, and encourage strategic retreat and relocation to safer areas.	**NA**
3.1.2.b	Consider the location of dams, reservoirs, holding ponds, and other water-containing entities that are upstream of inhabited areas to anticipate, avoid,	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	and mitigate inundation risks, and discourage new development in areas where possible inundation hazards may exist.	
3.1.2.c	Strengthen current development standards to minimize destruction of land and property.	**NA**
3.1.2.d	Encourage the use of construction techniques that reduce the potential for damage from natural hazards.	**S**
3.1.2.e	Increase the County's resilience to drought.	**NA**
3.1.2.f	Increase food and energy security through local production and storage.	**S**
Implementing Actions:		
3.1.2-Action 1	Develop an Emergency Management Center in Central Maui.	**NA**
3.1.2-Action 2	Implement the HMP, and subsequent updates, to the extent it is consistent with MIP.	**NA**
3.1.2-Action 3	Develop a Post-Disaster Recovery and Reconstruction Plan that will ensure Maui's resilience to coastal hazards.	**NA**
3.1.2-Action 4	Develop plans and/or incentives to do the following: (1) Encourage rebuilding inland as an alternative to shoreline hardening; (2) Streamline the reconstruction of structures that are moved substantially inland; (3) Encourage the relocation of existing structures so they are away from shoreline areas; and (4) Encourage the relocation of vulnerable coastal roads that are susceptible to destruction from natural hazards, such as a portion of North Kīhei Road and the Pali to Puamana realignment.	**BA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
3.1.2-Action 5	Periodically update the shoreline rules to enable the Maui Planning Commission to provide safe setbacks from the shorelines and incorporate best management practices.	**NA**
3.1.2-Action 6	Use and update the Federal Emergency Management Agency-Digital Flood Insurance Rate Maps (DFIRM) in the permitting process to minimize development in flood-prone areas.	**NA**
3.1.2-Action 7	Following each coastal erosion disaster, identify and document the new shoreline position to be used for reviewing future development.	**NA**
3.1.2-Action 8	Following each natural disaster, gather data to plan for future disaster events.	**NA**
3.1.2-Action 9	Update coastal-planning requirements to factor in incremental effects of rising sea levels.	**NA**
3.1.2-Action 10	Increase water storage and development of additional capacity in Upcountry Maui and other areas susceptible to drought and encourage efficiency in conservation programs.	**NA**
Objective:		
3.1.3	A more coordinated emergency response system that includes clearly defined and mapped evacuation routes.	**NA**
Policies:		
3.1.3.a	Identify and expand shelter facilities and evacuation routes away from areas susceptible to natural hazards.	**NA**
Implementing Actions:		
3.1.3-Action 1	Develop an island-wide evacuation routes plan.	**NA**

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
3.1.3-Action 2 Identify and develop required shelter capacity.	**NA**
3.1.3-Action 3 Plan for opening and staffing the shelters to ensure that the facilities are made available at the time of evacuation orders.	**NA**
Objective:	
3.1.4 A more educated and involved public that is aware of and prepared for natural hazards.	**NA**
Policies:	
3.1.4.a Promote public education and involvement related to natural hazards awareness and preparedness.	**NA**
3.1.4.b Coordinate a multi-agency effort to establish and promote a comprehensive public education program that will focus on practical approaches to preparedness, damage prevention, and hazard mitigation.	**NA**
Implementing Actions:	
3.1.4-Action 1 Develop regularly scheduled mitigation training for public and private emergency responders and establish volunteer groups to elevate public awareness of emergency procedures.	**NA**
ANALYSIS: The portion of the project area that is located adjacent to the Waikapū Stream, within the Special Flood Hazard Area, is proposed to be set aside for parks, open space and agriculture. No structures will be will be located within Zone AEF. Moreover, all structures will be built to current standards to withstand potential threats from hurricanes and earthquakes. The Project's agricultural component will help facilitate greater agricultural self-sufficiency, which is consistent with the County's policy to increase food and energy security through local production and storage.	

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
CHAPTER 4 – ECONOMIC DEVELOPMENT		
GOAL		
4.1	Maui will have a balanced economy composed of a variety of industries that offer employment opportunities and well-paying jobs and a business environment that is sensitive to resident needs and the island's unique natural and cultural resources.	
Objectives:		
4.1.1	A more diversified economy.	**S**
Policies:		
4.1.1.a	Encourage an economy that is driven by innovation, research and development, and human resource development, including but not limited to, increasing technology- and knowledge-based sectors to be a major component in Maui County's economic base.	**NA**
4.1.1.b	Support the creation of new jobs and industries that provide a living wage.	**NA**
4.1.1.c	Facilitate and expedite permits and approvals.	**NA**
4.1.1.d	Develop linkages and partnerships among international research and development activities and Maui businesses.	**NA**
Objective:		
4.1.2	Increase activities that support principles of sustainability.	**S**
Policies:		
4.1.2.a	Support industries that are sustainable, and culturally and environmentally sensitive.	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
4.1.2.b	Encourage and support local businesses.	**S**
4.1.2.c	Substitute imports with locally-produced services and products where practicable.	**S**
4.1.2.d	Support the development of economic development clusters in targeted industry sectors.	**NA**
4.1.2.e	Encourage all businesses to save energy, water, and other resources.	**NA**
Implementing Actions:		
4.1.2-Action 1	Regularly study market trends with the intent to attract new industries that are environmentally/culturally appropriate for Maui.	**NA**
4.1.2-Action 2	Develop programs that brand all locally produced services and products or devise other measures to achieve import substitution.	**NA**
4.1.2-Action 3	Create a database of imports suitable for substitution by locally produced services and products and annually report on progress made towards import substitution.	**NA**
Objective:		
4.1.3	Improve the island's business climate.	**S**
Policies:		
4.1.3.a	Upgrade, maintain the quality of, and improve access to telecommunications infrastructure.	**NA**
4.1.3.b	Ensure an adequate supply of affordable workforce housing.	**S**
4.1.3.c	Develop neighborhoods and communities that are attractive to the workforce of a diversified economy.	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
4.1.3.d	Encourage, nurture, and reward entrepreneurship and innovation.	**NA**
4.1.3.e	Encourage employers to establish incentive programs. Support flexibility in workforce policies compatible with business and quality of life goals.	**NA**
4.1.3.f	Assist community development organizations with revitalization and development of neighborhoods and communities that are attractive to the workforce of a diversified economy.	**NA**
Implementing Actions:		
4.1.3-Action 1	Develop and implement innovative land use tools, public/private transportation incentives, and flexible business practices to reduce travel costs and job trips.	**NA**
ANALYSIS: The WCT is expected to indirectly support Maui's existing economic base activities by providing much needed housing to serve the island's workforce. The Project will provide housing along with supporting commercial, employment and institutional uses that will allow Maui's economic base industries to grow, diversify, and become more sustainable – including the agricultural sector. By providing much needed housing in a format that will create a high quality of life for Maui's working families, and by generating considerable short- and long-term employment in the construction, trade and agricultural industries, the project is directly supportive of the State and County's economic development.		
TOURISM – GOAL, OBJECTIVES AND POLICIES		**NA**
AGRICULTURE – GOAL, OBJECTIVES AND POLICIES		
GOAL		
4.3	Maui will have a diversified agricultural industry contributing to greater economic, food, and energy security and prosperity.	**S**
Objective:		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
4.3.1	Strive for at least 85 percent of locally-consumed fruits and vegetables and 30 percent of all other locally-consumed foods to be grown in-State.	**S**
Policies:		
4.3.1.a	Strive to substitute food/agricultural product imports with a reliable supply of locally-produced food and agricultural products.	**S**
4.3.1.b	Facilitate and support the direct marketing/sale of the island's agricultural products to local consumers, through farmers markets and similar venues.	**S**
4.3.1.c	Encourage growing a diverse variety of crops and livestock to ensure the stewardship of our land while safeguarding consumer safety.	**S**
4.3.1.d	Work with the State to regulate and monitor genetically-modified-organism (GMO) crops to ensure the safety of all crops and label all GMO products.	**NA**
Implementing Actions:		
4.3.1-Action 1	Encourage the development of community gardens, including gardens on greenbelts that separate communities.	**S**
4.3.1-Action 2	Establish benchmarks to monitor progress towards achieving island-wide food self-sufficiency.	**NA**
4.3.1-Action 3	Propose revisions to the zoning ordinance to allow the direct marketing of the island's agricultural products through farmers markets, "pick-your-own" farms, farm stands, and similar venues.	**NA**
Objective:		
4.3.2	Maintain or increase agriculture's share of the total island economy.	**S**
Policies:		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
4.3.2.a	Encourage the export of the island's agricultural products to offshore markets.	**S**
4.3.2.b	Support infrastructure investments at harbors, such as ferry service, airports, and other facilities for the rapid and cost-effective export of island-grown products.	**NA**
4.3.2.c	Encourage the continued viability of sugar cane production, or other agricultural crops, in central Maui and all of Maui Island.	**NA**
4.3.2.d	Work with the State to reduce excise taxes for commercial agricultural products produced within the State.	**NA**
4.3.2.e	Coordinate with appropriate State and Federal Departments and agencies, private shipping companies, and farmers associations to assist in the rapid and cost-effective export of Maui's agricultural products to off-island markets.	**NA**
Implementing Actions:		
4.3.2-Action 1	Bi-annually update the Maui Agricultural Development Plan to provide strategic direction for the expansion of agriculture on Maui and to determine ongoing direct and indirect benefits of agriculture on Maui.	**NA**
4.3.2-Action 2	Increase staffing within the Office of Economic Development to promote agricultural development, as financially feasible.	**NA**
Objective:		
4.3.3	Expand diversified agriculture production at an average annual rate of 4 percent.	**S**
Policies:		
4.3.3.a	Promote the development of locally-grown and ecologically-sound biofuels, aquaculture, and forest products.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
4.3.3.b	Support the development of farming associations/cooperatives.	**NA**
4.3.3.c	Work with educational institutions and appropriate agencies to provide education and training for farm owners and entrepreneurs.	**NA**
Implementing Actions:		
4.3.3-Action 1	Implement the Maui Agricultural Development Plan (July 2009) and its updates, when consistent with the MIP.	**NA**
4.3.3-Action 2	Develop a program to expand the seed crop industry consistent with safe GMO practices.	**NA**
ANALYSIS: The WCT's agricultural component includes nearly 1,077 acres of land that will remain in agricultural use. Approximately 800 acres of this area will be permanently dedicated to agricultural use with no residential structures to be permitted. The remaining 277 acres may be subdivided into as many as five agricultural lots. Within the agricultural lands, several hundred acres may be developed as a public and/or private agricultural park to help facilitate Maui's agricultural development. There are currently four ~~three~~ commercial farms farming MTP lands. These include Kumu Farms, Hoaloa Farms, Makani Olu Ranch, and Beef and Bloom. ~~Hawai'i Taro LLC, and HC&S.~~ The Maui County Agricultural Development Plan (July 2009) notes that a significant impediment to agricultural development on Maui, and throughout the state, is the scarcity of agricultural land, with irrigation water, that is both readily available and affordable for long-term lease to diversified farmers. The establishment of a centrally located 800-acre agricultural reserve, comprising productive lands, affordable irrigation water and close proximity to inter-island and mainland shipping opportunities, should help Maui farmers compete in local, mainland and international markets. The Project's agricultural component will also make opportunities available for direct marketing to consumers. It is envisioned that the WCT will include an on-site farmers market, fruit and produce stands, pick-your own opportunities and other community supported agricultural programs.		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
EMERGING SECTORS – GOAL, OBJECTIVES AND POLICIES		
Goal:		
4.4	A diverse array of emerging economic sectors.	**NA**
Objective:		
4.4.1	Support increased investment and expanded activity in emerging industries.	**NA**
Policies:		
4.4.1.a	Support the development of and access to state-of-the-art voice, video, and data telecommunications systems and high-speed Internet.	**NA**
4.4.1.b	Attract and assist industries to compete in high technology activities such as those related to renewable energy, green technologies, diversified agriculture, ocean sciences, health sciences, space technologies, and other knowledge-based industries.	**NA**
4.4.1.c	Support new industries that are environmentally and culturally sensitive such as health and wellness, sports and outdoor activities, cultural activities, the arts, film-making, entertainment, and digital media.	**NA**
4.4.1.d	Support a sustainable, culturally sensitive, astronomy industry.	**NA**
4.4.1.e	Support the continued development of the Maui Research and Technology Park in Kīhei, as a center for research and development, education, and diversified economic development, as provided by the Maui County Code.	**NA**
4.4.1.f	Work with appropriate organizations to support the development of high technology clusters around renewable energy, diversified agriculture, ocean sciences, health sciences, and other knowledge-based industries.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
Implementing Actions:		
4.4.1-Action 1	Develop streamlined permitting procedures for emerging industries.	**NA**
4.4.1-Action 2	Prepare a list of environmentally and culturally sensitive and appropriate industries that would potentially benefit Maui as listed in the updated CEDS report.	**NA**
Objective:		
4.4.2	Increase the development of renewable energy technologies that are supported by the local community.	**S**
Policies:		
4.4.2.a	Support the expansion of the renewable energy sector and the use of solar, wind, wave, and biofuel technologies.	**S**
4.4.2.b	Provide incentives to encourage renewable energy development, the use of green energy technologies, and energy conservation.	**S**
4.4.2.c	Ensure an adequate supply of land and facilitate permitting to meet the needs for renewable energy technologies such as solar, wind, wave, biofuel, and other technologies, provided that environmental, view plane, and cultural impacts are addressed.	**S**
4.4.2.d	Support the Maui County Energy Alliance Plan where consistent with the MIP.	**NA**
Implementing Actions:		
4.4.2-Action 1	Publicize renewable energy production opportunities to potential investors.	**NA**
4.4.2-Action 2	Support the implementation of a wheeling tariff.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
4.4.2-Action 3	Develop plans, programs, and incentives to: (1) Attract/strengthen/retain renewable energy businesses; and (2) Assist businesses and homeowners to obtain/install/use solar, wind, and other forms of renewable energy facilities.	**NA**
4.4.2-Action 4	Implement the goals and objectives of the Maui County Energy Alliance Plan where consistent with the MIP and financially feasible.	**NA**
ANALYSIS: The WCT will incorporate energy efficient technology throughout the project, specifically in lighting, air-conditioning, and building materials. Solar hot water heaters will be utilized throughout the residential portion of the development and installation of Photovoltaic Energy Systems will be encouraged, where appropriate, on residential and commercial buildings within the WCT. Additionally, the WCT proposes to develop, in appropriate locations within the agricultural district, solar farms to help off-set the project's demand for carbon emitting electrical energy. Small-scale wind farming and hydroelectric opportunities may also be pursued, if feasible, to mitigate the project's carbon footprint, while facilitating greater energy independence by relying on greater use of locally produced renewables.		
SMALL BUSINESS DEVELOPMENT – GOAL, OBJECTIVES AND POLICIES		
Goal:		
4.5	Small businesses will play a key role in Maui's economy.	
Objective:		
4.5.1	Increase the number of and revenue generated by small businesses and decrease the percentage of small business failures.	**NA**
Policies:		
4.5.1.a	Provide incentives and support for small businesses and entrepreneurs that incorporate sustainable technologies and practices into their operations, utilize	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	local materials, or produce and sell locally-made goods or services.	
4.5.1.b	Assist traditional "mom and pop" business establishments.	**NA**
4.5.1.c	Reduce barriers to small business development.	**NA**
4.5.1.d	Require, where feasible, the government procurement of goods and services from locally-owned, small businesses.	**NA**
4.5.1.e	Require, where feasible, the government procurement of goods and services from locally-owned, small businesses.	**NA**
4.5.1.f	Support community markets and venues that sell locally-made produce, goods, and services.	**S**
Implementing Actions:		
4.5.1-Action 1	Develop and market an online directory of local small businesses and their products/services.	**NA**
4.5.1-Action 2	Provide business assistance, workshops, and marketing programs to small businesses to establish and enhance their viability.	**NA**
4.5.1-Action 3	Review and revise regulations and procedures to improve Maui's small-business climate.	**NA**
4.5.1-Action 4	Develop a program and revise procedures to facilitate government procurement of goods and services from local businesses.	**NA**
4.5.1-Action 5	Develop and enhance programs that help locally-operated small businesses to market and provide goods and services to visitors and the visitor industry.	**NA**
4.5.1-Action 6	Adopt the UBC's Uniform Code for Building Conservation to reduce the cost of rehabilitating older structures for commercial and other uses.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
4.5.1-Action 7	Continue to work with small businesses and direct them to organizations that provide loans.	**NA**
ANALYSIS: The WCT is intended to be a "complete community", where employment opportunities within the project are roughly proportional to the project's working age population. The Master Plan will create a variety of commercial space opportunities for businesses to flourish. These spaces might range from live-work, to incubator space, to office, retail and light manufacturing in a variety of sizes and configurations. Moreover, by providing much needed housing and commercial opportunities in a format that will create a high quality of life for Maui's working families, and by generating considerable short- and long-term employment in the construction, trade and agricultural industries, the project is directly supportive of the State and County's economic development, which includes facilitating opportunities for small-business development.		
HEALTH CARE SECTOR – GOAL, OBJECTIVES AND POLICIES		**NA**
EDUCATION AND WORKFORCE DEVELOPMENT		**NA**
CHAPTER 5 – HOUSING		
GOAL		
5.1	Maui will have safe, decent, appropriate, and affordable housing for all residents developed in a way that contributes to strong neighborhoods and a thriving island community.	
Objectives:		
5.1.1	More livable communities that provide for a mix of housing types, land uses, income levels, and age.	**S**
Policies:		
2.1.1.e	Promote livable communities (compact/walkable/bikeable, access to transit)	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	that provide for a mix of housing types and land uses, including parks, open space, and recreational areas.	
2.1.1.f	Promote planning approaches that provide a mix of multifamily and single-family housing units to expand housing choices.	**S**
2.1.1.g	Discourage gated communities.	**S**
2.1.1.h	Provide incentives for the rehabilitation or adaptive reuse of historic structures to facilitate more housing choices.	**NA**
2.1.1.i	Use planning and regulatory approaches to provide higher housing densities.	**S**
Implementing Actions:		
5.1.1-Action 1	Amend development codes to facilitate different types of housing, including mixed use, mixed housing types, clustering, and conservation subdivisions.	**S**
5.1.1-Action 2	Do a study to determine optimum permit processing times on affordable housing development approvals while ensuring that community and environmental standards are addressed.	**NA**
5.1.1-Action 3	Establish the rules and mechanisms to establish a Maui "master list" of affordable housing projects and land entitled for affordable housing so that residents will be able to obtain an affordable unit in a fair and expeditious manner.	**NA**
5.1.1-Action 4	Study successful models of affordable housing projects/units and adopt appropriate minimum design standards that satisfy the needs of Maui's residents.	**NA**
5.1.1-Action 5	Amend zoning and historic preservation ordinances/rules to support adaptive reuse opportunities.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
5.1.1-Action 6	Develop incentives to promote projects that achieve the Leadership in Energy and Environmental Design (LEED) Silver or Gold certification.	**NA**
Objective:		
5.1.2	Better monitoring, evaluation, and refinement of affordable housing policy in conjunction with the economic cycle.	**NA**
Policies:		
5.1.2.a	Improve data on resident and nonresident housing.	**NA**
5.1.2.b	Utilize the following approaches to promote resident housing and to minimize off-shore market impacts: (1) Ensure that the future housing stock is composed of a mix of housing types (multifamily, small lots, 'Ohana units, co-housing, cottage houses, etc.); (2) Encourage new housing in proximity to jobs and services, in places that are conducive/affordable to island residents; and (3) Explore taxation alternatives and building fee structures.	**S**
Implementing Actions:		
5.1.2-Action 1	Develop appropriate incentives to encourage the production of required affordable housing during the different stages of an economic cycle.	**NA**
5.1.2-Action 2	Develop and maintain a reporting system/database and related maps for the following: (1) Existing/newly constructed housing units that are affordable to very low-, low-, and moderate-income households; (2) The location and quantity of housing that is used by visitors/second	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	home; and (3) Property tax information, including property land use designations, tax rates, acquisition price, and market value assessments.	
5.1.2-Action 3	Explore the benefits and costs of revising the County's property tax rates to make them more responsive to the needs of the citizens in the area of affordable housing.	**NA**
5.1.2-Action 4	Develop incentives for locating new workforce housing in proximity to jobs and services.	**NA**
Objectives:		
5.1.3	Provide affordable housing, rental or in fee, to the broad spectrum of our island community.	**S**
Policies:		
5.1.3.a	Consider regulations that can help keep affordable housing available at affordable rents.	**NA**
5.1.3.b	Seek to have ownership of affordable for-sale and rental housing vested in a non-profit community land trust, or other qualified housing provider, committed to keeping such housing affordable in perpetuity.	**NA**
5.1.3.c	Facilitate the use of public lands in urban areas that are suitable for affordable housing.	**NA**
5.1.3.d	Develop or support partnerships and initiatives that provide housing-related education/outreach.	**NA**
5.1.3.e	Support the continuing efforts of the County and its community partners to: (1) Disseminate information on different housing/financial assistance	**NA**

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
programs (loans, grants, etc.) including information on housing rehabilitation/restoration/adaptive reuse; (2) Provide housing-related counseling including budget, credit, and financial planning assistance; and (3) Create and maintain a comprehensive/master list of available affordable housing to help residents secure a unit that satisfies their need.	
Implementing Actions:	
5.1.3-Action 1 Consider the following actions in housing-related code amendments: (1) Give a higher priority to the construction of actual units and a lower priority to the provision of land, over the current alternative in-lieu fee payment; (2) Require recordation of a covenant to ensure that the required affordable units in a project remain affordable for perpetuity; (3) Consider that affordable houses be developed and available concurrently with market units; (4) Encourage the development of affordable "for-sale" and rental housing through incentives; (5) Consider a rent stabilization program to ensure that rental housing remains affordable; (6) For the sale prices of required affordable housing units, evenly distribute prices over the range of the subject income category; and (7) Expedite permitting for affordable housing projects approved pursuant	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	to the residential workforce housing ordinance.	
5.1.3-Action 2	Support/help in the creation of Community Development Corporations to facilitate the development and maintenance of affordable housing.	**NA**
5.1.3-Action 3	Enhance our existing affordable housing financing program to include the following elements: (1) An affordable housing assessment on commercial and residential properties. (2) A real estate transfer tax imposed on visitor units, TVRs, and residential housing that is not affordable for residents with household incomes of up to 200 percent of the island median household income.	**NA**
5.1.3-Action 4	Explore flexible funding for the affordable housing fund/program based on County tax revenues.	**NA**
5.1.3-Action 5	Actively pursue appropriate Federal, State, County, and private grants/subsidies to facilitate affordable housing projects.	**NA**
Objective:		
5.1.4	Provide infrastructure in a more timely manner to support the development of affordable housing.	**NA**
Policies:		
5.1.4.a	Prioritize the development of infrastructure that supports the development of affordable housing.	**NA**
5.1.4.b	Utilize appropriate financing approaches and assistance tools to encourage the development of infrastructure and public facilities.	**S**
5.1.4.c	Tailor infrastructure requirements to correspond with appropriate level-of-	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	service standards to help control housing costs and to maintain safety.	
Implementing Actions:		
5.1.4-Action 1	Prioritize Capital Improvement Projects that commit to building appropriately planned affordable housing-related projects.	**NA**
Objective:		
5.1.5	A wider range of affordable housing options and programs for those with special needs.	**NA**
Policies:		
5.1.5.a	Ensure that residents with special needs have access to appropriate housing.	**NA**
5.1.5.b	Encourage housing to be built or rehabilitated to allow the elderly and those with special needs to live in their homes.	**NA**
5.1.5.c	Ensure and facilitate programs to assist those with special needs from becoming homeless.	**NA**
5.1.5.d	Promote programs that stimulate the production of sustainable homeless shelters and alternative housing technologies.	**NA**
5.1.5.e	Support programs that offer home modification counseling on low-interest retrofit loans and grants to those with special needs.	**NA**
Implementing Actions:		
5.1.5-Action 1	Develop financing mechanisms to assist low-income elders and other high-risk/disadvantaged patients who need residential and institutional health care to remain in affordable housing that is part of a community development project.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
5.1.5-Action 2	Create or assist in creating programs that provide affordable housing to seniors, the disabled, and those returning from mental health institutions, correctional institutions, and drug rehabilitation.	**NA**
5.1.5-Action 3	Help in securing/leveraging federal grants, low income housing tax credits, and other resources that support affordable housing for special needs populations.	**NA**
5.1.5-Action 4	Develop and maintain indicators to monitor homelessness.	**NA**
5.1.5-Action 5	Partner with the private sector/nonprofit organizations to develop and maintain an adequate supply of emergency shelters and transitional housing.	**NA**
5.1.5-Action 6	Amend the Zoning/Subdivision Codes to streamline and facilitate the development of elder care/assisted living facilities, as well as housing/facilities that are Americans with Disabilities Act-compliant.	**NA**
5.1.5-Action 7	Waive County review fees to modify dwelling units to accommodate the needs of people with disabilities (reasonable accommodation).	**NA**
5.1.5-Action 8	Explore the adoption of an aging-in-place ordinance.	**NA**
Objective:		
5.1.6	Reduce the cost to developers of providing housing that is affordable to families with household incomes 160 percent and below of annual median income.	**NA**
Policies:		
5.1.6.a	Support fast-track processing procedures for the following housing-related entitlements: affordable housing projects/units; indigenous Hawaiian housing/units; and special-needs housing units (seniors, disabled, homeless, etc.).	**NA**
5.1.6.b	Require the construction of affordable for-sale and rental housing units as part	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	of the construction of new housing developments.	
5.1.6.c	Offer extra incentives in boom periods and withdraw incentives during slack periods.	**NA**
Implementing Actions:		
5.1.6-Action 1	Develop a comprehensive, flexible system of incentives to develop affordable housing, including: (1) Reduction or waiver of impact, assessment, and permit fees; (2) Density bonuses; (3) Exemptions from subdivision and zoning standards; (4) Building code modifications while maintaining health and safety; and (5) Possible use of publicly owned lands.	**NA**
5.1.6-Action 2	Streamline the permitting process as follows: (1) Within one year of this plan's adoption, adopt new administrative rules that streamline and clarify the permitting process; (2) Consider using outside consultants (third-party review); (3) Implement a one-stop permitting process; and (4) Adopt a set of standards so permitting is administrative and as ministerial as possible.	**NA**
Objective:		
5.1.7	Increased preservation and promotion of indigenous Hawaiian housing and architecture.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
Policies:		
5.1.7.a	Preserve, promote, and give priority to Hawaiian housing/architecture forms to preserve Hawaiian culture.	**S**
5.1.7.b	Provide for indigenous architecture as an allowable structure for native Hawaiian uses to include hula and lā`au lapa`au.	**NA**
Implementing Actions:		
5.1.7-Action 1	Revise regulations to allow for indigenous Hawaiian architectural practices, styles, customs, techniques, and materials, in accordance with Section 46-1.55, Hawai`i Revised Statutes.	**S**
5.1.7-Action 2	Encourage the use of alternative building materials (e.g., bamboo).	**S**
ANALYSIS: The WCT will offer a mix of single and multi-family housing types to address the diverse housing needs of Maui residents. As discussed in Section V.B.2 (Housing) the WCT will offer a mix of single and multi-family housing types to address the diverse housing needs of Maui residents. Due to the Project's Central Maui location and the expected lot and unit size configurations, the Applicant expects that the majority of the Project's market priced housing will be sold at prices considered affordable to Maui County residents earning between 100 and 140 percent of the County's median income as determined by the United States Department of Housing and Urban Development. The WCT will also include workforce housing units pursuant to Chapter 2.96, MCC, "Residential Workforce Housing Policy". These homes will be subject to price controls and resale restrictions to ensure that affordable homes remain available for full-time Maui residents. Housing types within the WCT may include multi-family condominiums, small cottage homes on small lots with common open spaces, traditional single-family lots within a variety of home and lot size configurations, rental apartments, townhomes and larger estate rural lots. The goal is to serve the demands of all Maui residents.		
CHAPTER 6 – INFRASTRUCTURE AND PUBLIC FACILITES		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
SOLID WASTE		
GOAL		
6.1	Maui will have implemented the ISWMP thereby diverting waste from its landfills, extending their capacities.	
Objectives:		
6.1.1	Meet our future solid waste needs with a more comprehensive planning and management strategy.	**NA**
Policies:		
6.1.1.a	Update and publicize the ISWMP every ten years.	**NA**
6.1.1.b	Strengthen inter-agency coordination including Planning and Environmental Management departments.	**NA**
6.1.1.c	Divert waste from the landfills and educate the public about the recommendations of the ISWMP.	**NA**
6.1.1.d	Minimize future active, unlined landfill cells to the extent feasible.	
Implementing Actions:		
6.1.1-Action 1	Implement the ISWMP through programs/improvements/upgrades of the solid waste management system and the Capital Improvement Project (CIP) budget in a timely manner.	**NA**
6.1.1-Action 2	Regularly update waste generation, reuse, recycling, and disposal data for monitoring and implementation purposes.	**NA**
6.1.1-Action 3	Educate the public about the importance and cost savings of solid waste reduction.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
Objective:		
6.1.2	Divert at least 60 percent of solid waste from the island's landfills.	**S**
Policies:		
6.1.2.a	Require residents and commercial enterprises that generate waste to pay a fair proportion of disposal costs.	**NA**
6.1.2.b	Encourage environmentally safe waste-to-energy solutions.	**NA**
6.1.2.c	Facilitate the reduction of solid waste generated by packaging, food service products, construction waste, etc.	**S**
6.1.2.d	Educate residents and visitors about the impacts of and methods to reduce, reuse, and recycle.	**S**
6.1.2.e	Discourage the disposal of landfill leachate by diversion to wastewater treatment plants, where practicable.	**NA**
Implementing Actions:		
6.1.2-Action 1	Implement a comprehensive, curbside recycling program.	**NA**
6.1.2-Action 2	Develop regulations, programs, funding opportunities, and/or incentives to: (1) Increase recycling of used appliances /furniture/ electrical/ components/clothing/other household items and recyclable materials; (2) Increase the number of composting centers; (3) Reduce solid wastes generated by packaging, food service products, home construction waste, etc.; (4) Construct materials recovery facilities (MRFs) including a facility in Central Maui, in accordance with the ISWMP, and investigate a cost-	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	recovery fee to meet funding needs; and (5) Discourage slow degradable materials, e.g., Styrofoam.	
6.1.2-Action 3	Develop public outreach/education/incentive programs to increase awareness to reduce, reuse, and recycle.	**NA**
6.1.2-Action 4	Prepare a study to assess the feasibility of a future waste to energy program.	**NA**
6.1.2-Action 5	Identify and develop a recycling/redemption facility at an appropriate location in West Maui	**NA**
ANALYSIS: The WCT will develop strategies for reducing solid waste delivered to the landfill by providing options for recycling and promoting recycling practices among residents and businesses.		
CHAPTER 6 – INFRASTRUCTURE AND PUBLIC FACILITES		
WASTEWATER		
GOAL		
6.2	Maui will have wastewater systems that comply with or exceed State and Federal regulations; meet levels-of-service needs; provide adequate capacity to accommodate projected demand; ensure efficient, effective, and environmentally sensitive operation; and maximize wastewater reuse where feasible.	
Objectives:		
6.2.1	A wastewater planning program capable of efficiently providing timely and adequate capacity to service projected demand where economically feasible and practicable.	**NA**
Policies:		
6.2.1.a	Encourage the use of renewable energy in support of wastewater treatment	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	facilities.	
6.2.1.b	Focus the expansion of wastewater systems to accommodate planned growth consistent with the MIP Directed Growth Strategy.	**S**
6.2.1.c	Establish new wastewater treatment plant(s) outside the tsunami zone.	**S**
Objective:		
6.2.2	Adequate levels of wastewater service with minimal environmental impacts.	**S**
Policies:		
6.2.2.a	Meet or exceed all State and Federal standards regulating wastewater disposal or reuse.	**S**
6.2.2.b	Encourage tertiary treatment for all municipal wastewater that is disposed through deep injection wells. Phase out all municipal and private injection wells in coordination with water reuse programs, where feasible, by 2020.	**NA**
6.2.2.c	Improve and upgrade the County's existing wastewater collection, treatment, and reuse facilities consistent with current and future plans and the County's CIP.	**NA**
6.2.2.d	Maintain an ongoing sewer inspection program for public and private multi-user systems to identify potential problems and forecast each system's residual life.	**NA**
6.2.2.e	Require all new developments to fund system improvements in proportion to the development impact and in accordance with the County's wastewater functional plan.	**S**
6.2.2.f	Require appropriate funding mechanisms, such as a sinking fund, to adequately maintain or replace aging water-system components.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
6.2.2.g	Strongly encourage the phase out of cesspools.	**NA**
Implementing Actions:		
6.2.2-Action 1	Implement the following to ensure effective, safe multi-user wastewater treatment systems: (1) Amend County regulations and plans to ensure adequate operating procedures, treatment standards, and monitoring programs; (2) Establish treatment and capacity requirements suitable for the required level of service/use; and (3) Require private treatment facilities or public-private funded facilities to provide financial assurance, including bonds, for the following: a. Repair, removal, or replacement of any system components reaching the end of intended service life; and b. Enforcement of other needed corrective action(s) or guaranteeing uninterrupted operation in case of bankruptcy, abandonment, or any other default on financial obligation.	**NA**
6.2.2-Action 2	Work with the State toward the phase out of cesspools.	**NA**
6.2.2-Action 3	Conduct and implement technical studies to identify appropriate level of service and potential funding mechanisms to augment the funding available for ongoing upgrade/maintenance of the wastewater system.	**NA**
Objective:		
6.2.3	Increase the reuse of wastewater.	**S**
Policies:		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
6.2.3.a	Strengthen coordination between the Department of Water Supply (DWS) and the WWRD to promote reuse/recycling of wastewater.	**NA**
6.2.3.b	Expand the reuse of wastewater from the Central Maui, Kīhei, Lāhainā, and other wastewater systems.	**NA**
Implementing Actions:		
6.2.3-Action 1	Identify potential new users of treated effluent and implement the necessary improvements to supply this water through the County CIP.	**NA**
6.2.3-Action 2	Amend County regulations to allow for the use of grey water for approved purposes.	**NA**
6.2.3-Action 3	Create education, marketing, and incentive programs that promote the reuse/recycling of wastewater.	**NA**
ANALYSIS: As described in Section V.D.5 of the DEIS FEIS, the Applicant proposes to develop an on-site wastewater reclamation facility to treat the Project's wastewater. The recycled water produced by the facility will be used for irrigation of the Project agricultural lands and may also be used for irrigation of urban parks, open spaces and landscape planting of commercial and residential lots. ~~The WCT will coordinate with the County of Maui, Department of Environmental Management, and if capacity is available, request treatment of up to 650 units at the Kahului Wastewater Treatment Facility, pursuant to the WCT making any necessary upgrades to the off-site transmission system.~~ ~~The WCT will also be developing its own private wastewater treatment facility, or developing a facility in association with the County and other neighboring landowners, to treat the additional wastewater generated by the project. If a joint facility is pursued, it would accommodate wastewater generated by several other large projects in Central Maui including Wai`ale and the County's regional park and governmental complex. Wastewater treated at the plant may be~~		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
~~treated to R-1 quality and the treated water used for landscape irrigation at the County's 310-acre regional park and on other open space lands within the WCT and neighboring developments. The treated wastewater would help to reduce demand for potable water, which might otherwise be used for landscape irrigation.~~		
CHAPTER 6 – INFRASTRUCTURE AND PUBLIC FACILITES		
WATER		
GOAL		
6.3	Maui will have an environmentally sustainable, reliable, safe, and efficient water system.	
Objectives:		
6.3.1	More comprehensive approach to water resources planning to effectively protect, recharge, and manage water resources including watersheds, groundwater, streams, and aquifers.	**NA**
Policies:		
6.3.1.a	Ensure that DWS actions reflect its public trust responsibilities toward water.	**NA**
6.3.1.b	Ensure the WUDP implements the State Water Code and MIP's goals, objectives, and policies.	**NA**
6.3.1.c	Regularly update the WUDP, to maintain compliance with the General Plan.	**NA**
6.3.1.d	Ensure that the County's CIP for water-source development is consistent with the WUDP and the MIP.	**NA**
6.3.1.e	Where desirable, retain and expand public ownership and management of watersheds and fresh-water systems.	**NA**
6.3.1.f	Encourage and improve data exchange and coordination among Federal, State, County, and private land use planning and water resource management	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	agencies.	
Implementing Actions:		
6.3.1-Action 1	Implement the WUDP.	**NA**
6.3.1-Action 2	Develop site selection studies for water storage and supply facilities for each community plan area.	**NA**
6.3.1-Action 3	Prepare and implement a plan to identify and prioritize infrastructure requirements needed to accommodate nonpotable water for irrigation.	**NA**
6.3.1-Action 4	Work with the State to set standards for the amount of water withdrawn from aquifers and other groundwater sources to ensure the long-term health and sustainability of the resource.	**NA**
6.3.1-Action 5	Produce an annual evaluation of the state of available water resources on the island.	**NA**
Objective:		
6.3.2	Increase the efficiency and capacity of the water systems in striving to meet the needs and balance the island's water needs.	**S**
Policies:		
6.3.2.a	Ensure the efficiency of all water system elements including well and stream intakes, water catchment, transmission lines, reservoirs, and all other system infrastructure.	**S**
6.3.2.b	Encourage increased education about and use of private catchment systems where practicable for nonpotable uses.	**NA**
6.3.2.c	Maximize the efficient use of reclaimed wastewater to serve nonpotable needs.	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
6.3.2.d	Work with appropriate State and County agencies to achieve a balance in resolving the needs of water users in keeping with the water allocation priorities of the MIP.	**NA**
6.3.2.e	Ensure water conservation through education, incentives, and regulations.	**NA**
6.3.2.f	Acquire and develop additional sources of potable water.	**S**
Implementing Actions:		
6.3.2-Action 1.	Develop programs to increase the efficiency of all water system elements.	**NA**
6.3.2-Action 2.	Develop, adopt, and implement water source development siting standards that implement the MIP Directed Growth Plan and the WUDP, and protect water quality for existing and future consumers.	**NA**
6.3.2-Action 3.	Revise County regulations to require high-efficiency, low-flow plumbing fixtures in all new construction.	**NA**
6.3.2-Action 4.	Pursue development of additional potable water sources to keep pace with the County's needs.	**S**
6.3.2-Action 5.	Identify and develop renewable energy systems to serve the DWS.	**NA**
6.3.2-Action 6.	Develop a water rate structure that encourages conservation and discourages the excessive use of water.	**NA**
6.3.2-Action 7.	Develop a comprehensive water conservation ordinance to include xeriscaping regulations to promote water conservation.	**NA**
6.3.2-Action 8.	Update DWS reliability and drought standards, and continue to evaluate as needed in light of updated regulation and rainfall and flow data.	**NA**
Objective:		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
6.3.3	Improve water quality and the monitoring of public and private water systems.	**NA**
Policy:		
6.3.3.a	Protect and maintain water delivery systems.	**NA**
Implementing Actions:		
6.3.3-Action 1	Ensure water quality and quantity report results are provided in a timely manner to consumers when water quality or quantity falls below standards.	**NA**
6.3.3-Action 2	Complete and implement DWS wellhead-protection program to protect the water quality of public and private wells.	**NA**
ANALYSIS: As documented in Section V.D.4 (Water), the WCT has developed three on-site potable wells and two on-site non-potable wells. Both of the non-potable wells have preliminarily shown low salinity levels, and testing is being conducted to determine the viability of those wells for domestic use. If not viable for domestic use, they will be used for non-potable agricultural use. Water pumped from the non-potable wells will be discharged into the Waihee Ditch or lined onsite reservoirs and used for irrigation purposes for the residential lots, agricultural farming, parks and open areas. A sixth well also exists to be used for monitoring. ~~to meet the Project's water demand.~~ Development of these wells is being done with input from the County's Department of Water Supply and the State Commission on Water Resources Management (CWRM). The Applicant proposes to supply the Project's potable water demand through its on-site wells, which will draw from the Waikapū Aquifer. It is expected that the WCT water system will have sufficient capacity to accommodate the project and other potable water needs within the area. Once developed, the Applicant may enter into an agreement that will transfer the ownership of the system to the County DWS. The Applicant proposed to meet its non-potable water demand for agriculture and irrigation of parks and open space through a combination of surface water provided from the Waihee Ditch system (subject to the issuance of surface water use permits from the CWRM), non-potable agricultural wells, and reclaimed wastewater.		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
The Applicant is proposing to develop a dual water system for potable and irrigation water demand. The non-potable system will service the WCTs park lands, open space and landscape planting of individual residential and commercial lots. It is expected that the dual system will reduce potable water demand by at least one-third. Moreover, the WCT will incorporate other water conservation measures into the project, such as low flow toilets and shower heads. Water conserving irrigation practices including using draught tolerant plants and drip irrigation will also be utilized to conserve non-potable water resources. ~~In the future, if reclaimed water becomes available, it will also be used within the project in appropriate areas.~~		
CHAPTER 6 – INFRASTRUCTURE AND PUBLIC FACILITES		
TRANSPORTATION		
GOAL		
6.4	An interconnected, efficient, and well-maintained, multimodal transportation system.	
Objectives:		
6.4.1	Provide for a more integrated island-wide transportation and land use planning program that reduces congestion and promotes more efficient (transit-friendly) land use patterns.	**S**
Policies:		
6.4.1.a	Plan for an integrated multi-modal transportation system comprised of public transit, bicycle, pedestrian, automobile, and other transportation modes.	**S**
6.4.1.b	Refocus transportation investment from the construction of additional roadways only for the automobile to the expansion of a multimodal transportation system.	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
6.4.1.c	Encourage the use of "complete streets" design methods.	**S**
6.4.1.d	Encourage employers to implement TDM strategies.	**NA**
Implementing Actions:		
6.4.1-Action 1	Explore the benefits and costs of establishing a Metropolitan Planning Organization to serve Maui's transportation needs.	**NA**
6.4.1-Action 2	Develop and implement in a timely manner appropriate Transportation System Management (TSM) and Transportation Demand Management (TDM) programs in accordance with a Comprehensive Long Range Multimodal Plan.	**S**
6.4.1-Action 3	Study the feasibility of High Occupancy Vehicle (HOV) lanes within or adjacent to major arterials.	**NA**
6.4.1-Action 4	Optimize traffic signal timing and coordination to reduce travel time and delay.	**NA**
6.4.1-Action 5	Establish additional park-n-ride facilities in key locations.	**NA**
Objective:		
6.4.2	Safe, interconnected transit, roadway, bicycle, equestrian, and pedestrian network.	**S**
Policies:		
6.4.2.a	Ensure transit-, roadway-, and pedestrian-facilities design and level-of-service standards respect the unique character of our communities.	**S**
6.4.2.b	Prioritize transportation improvements list to cost-effectively meet existing and future needs consistent with the MIP.	**NA**
6.4.2.c	Require new development, where appropriate, to integrate sidewalks, pathways, bikeways, and transit infrastructure into new commercial and	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	residential projects while enhancing community character.	
6.4.2.d	Identify and improve hazardous and substandard sections of roadways, drainage infrastructure, and bridges, provided that the historical integrity of the roads and bridges are protected.	**S**
6.4.2.e	Consider identification, acquisition where appropriate, and utilization of abandoned right-of-ways for bikeways, pedestrian pathways, and open-space networks.	**S**
6.4.2.f	Support the implementation of the *Central Maui Pedestrian & Bicycle Master Plan* (March 2012), when consistent with the MIP.	**S**
Implementing Actions:		
6.4.2-Action 1	Revise the subdivision ordinance to require developers, where appropriate, to integrate sidewalks, pathways, bikeways, and transit infrastructure into new commercial and residential projects, while enhancing community character.	**NA**
6.4.2-Action 2	Implement the Upcountry Greenway Master Plan (2004), and other approved greenway plans, consistent with the MIP, and County and State transportation plans.	**NA**
6.4.2-Action 3	Develop and adopt regulations to require developments to dedicate right-of-way consistent with State and County transportation plans prior to or as the phases of the developments become operational.	**S**
6.4.2-Action 4	Implement pedestrian and bikeway plans.	**S**
Objective:		
6.4.3	An island-wide, multimodal transportation system that respects and enhances the natural environment, scenic views, and each community's character.	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
Policies:		
6.4.3.a	Ensure that the roadway and transit alignments respect the natural environment and scenic views.	**S**
6.4.3.b	Ensure that roadways and transit systems in rural areas and small towns enhance community character.	**S**
6.4.3.c	Design all transit systems to respect visual corridors and Maui's character.	**S**
Implementing Actions:		
6.4.3-Action 1	Adopt and amend County regulations to incorporate design standards for roadways, transit, and pedestrian facilities that ensure protection of the natural environment and each community's sense of place.	**NA**
6.4.3-Action 2	Develop, adopt, and regularly update the mapping of Scenic Corridor Protection standards that implement the recommendations of the Scenic Roadway Corridors Management Plan and Design Guidelines.	**NA**
6.4.3-Action 3	Urge the State to relocate Honoapi`ilani Highway mauka between the Pali and Puamana, and develop a network of parks and open space on the makai side of the highway, in accordance with the Pali to Puamana Master Plan.	**NA**
ANALYSIS: The WCT will provide a variety of traffic related improvements that will address the traffic impacts resulting from the Project. In addition, the Applicant will coordinate with neighboring land owners and the State and County to address the need for regional improvements that will be warranted by development of the WCT, together with neighboring projects. Regional traffic improvements may include planning for the Wai`ale Bypass road and traffic signalization to enhance inter-regional mobility in Central Maui. The WCT's non-vehicular transportation strategy includes: 1) compact and mixed-use development patterns, 2) pedestrian oriented streets integrating street trees, sidewalks, and traffic calming, 3) both striped and separated bike lanes in appropriate locations, 4) a network		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
of greenways and parkways to facilitate mobility, and 5) providing connectivity to adjacent developments, such as the Wai`ale development and the State and County's proposed regional parks. In addition, transportation demand management measures may include: 1) encouraging alternate work schedules and off peak hours for employment generators, and 2) supporting park and ride, ridesharing, carpooling, van pooling, and regional and sub-regional shuttles.		
CHAPTER 6 – INFRASTRUCTURE AND PUBLIC FACILITES		
TRANSIT		
GOAL		
6.5	An island-wide transit system that addresses the needs of residents and visitors and contributes to healthy and livable communities.	
Objectives:		
6.5.1	An integrated transit system that better serves all mobility needs of Maui's residents and visitors.	**S**
Policies:		
6.5.1.a	Maximize access to public transit in town centers, commercial districts, and employment centers.	**S**
6.5.1.b	Expand regional and inter-regional transit services, where appropriate, in heavily traveled corridors and within communities.	**S**
6.5.1.c	Increase the frequency of current service, add additional bus routes as demand requires, and transition to nonpolluting transit vehicles, as funding permits.	**NA**
6.5.1.d	Provide adequate transit infrastructure (e.g., bus pullouts, waiting benches and shelters, signs) along existing and future transit right-of-ways.	**S**
6.5.1.e	Require new development where appropriate, to provide right-of-ways (ROWs)	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	to accommodate transit circulation and support facilities.	
6.5.1.f	Identify, protect, and preserve, or acquire corridors for future inter-community transit use, including but not limited to, rail and also multimodal use corridors.	**NA**
6.5.1.g	Establish transit corridors by planning for and securing right-of-way when appropriate for alternative modes of transportation (such as rail and water ferry service).	**NA**
6.5.1.h	Pursue improvements and upgrades to the existing transit system consistent with updated MDOT planning studies/transit plans (within the framework of comprehensive island-wide multimodal transportation plans).	**NA**
6.5.1.i	Increase inter-agency coordination between the Department of Planning, State Department of Transportation, County Department of Public Works, and other applicable agencies.	**NA**
Implementing Actions:		
6.5.1-Action 1	Amend the County subdivision and development regulations to require, where appropriate, transit-supportive roadway infrastructure.	**NA**
6.5.1-Action 2	Develop and adopt an ordinance to require developments, if appropriate, to provide private shuttle services connecting to public transit or appropriate impact fees for transportation improvements.	**NA**
6.5.1-Action 3	Prepare a study to: (1) Prioritize transit corridors and stations; (2) Develop an implementation program to preserve sites and ROWs for necessary facilities; and (3) Identify alternative funding approaches including public-private partnerships.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
6.5.1-Action 4	Regularly conduct transit system needs-assessment surveys to ensure community satisfaction, and provide opportunities for transit-system users to make suggestions on ways to improve services.	**NA**
6.5.1-Action 5	Work with rental car agencies to consider expansion of their agencies into high population areas such as West and South Maui.	**NA**
6.5.1-Action 6	Designate, map, and preserve, or develop corridors to support mass-transit solutions.	**NA**
Objective:		
6.5.2	Plan for a more diversified and stable funding base to support transportation goals.	**NA**
Policies:		
6.5.2.a	Support alternative methods and sources of funding transportation improvements (including impact fees, higher taxes, fare adjustments, dedicated sources of funding, and assessments).	**NA**
6.5.2.b	Collaborate with public-private entities or nonprofit organizations to reduce public transit operational expenses.	**NA**
6.5.2.c	Coordinate with appropriate Federal, State, and County agencies to fund transportation projects in areas where growth is anticipated.	**S**
Implementing Actions:		
6.5.2-Action 1	Conduct and implement technical studies to identify potential funding for ongoing maintenance and upgrades of transportation systems (transportation impact fees, community facilities districts, etc.).	**NA**
6.5.2-Action 2	Establish alternative financing programs such as transportation impact fees,	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	community facilities districts, transfer of development rights, or dedicated sources of funding.	
ANALYSIS: The Applicant will coordinate with the County DOT to accommodate public transit infrastructure, where best suited, within the project site. Such infrastructure might include bus pullouts, waiting benches and shelters, signs and transit right-of-ways.		
CHAPTER 6 – INFRASTRUCTURE AND PUBLIC FACILITES		
PARKS		
GOAL		
6.6	Maui will have a diverse range of active and passive recreational parks, wilderness areas, and other natural-resource areas linked, where feasible, by a network of greenways, bikeways, pathways, and roads that are accessible to all.	
Objectives:		
6.6.1	More effective, long-range planning of parks and recreation programs able to meet community needs.	**NA**
Policies:		
6.6.1.a	Support, consistent with the MIP, the implementation of open-space and recreational plans, such as the *Pali to Puamana Parkway Master Plan* and the *Upcountry Greenways Master Plan*.	**NA**
6.6.1.b	Utilize the ahupua`a approach by integrating mauka-to-makai natural landscapes into an island-wide parks and recreation functional plan.	**NA**
6.6.1.c	Provide a balanced mix of passive and active parks, including neighborhood, community, and regional parks, in each community plan area.	**S**
6.6.1.d	Support the expansion of Haleakalā National Park, where supported by affected communities.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
6.6.1.e	Support lo`i and dryland taro restoration in County, State, and Federal parks.	**S**
6.6.1.f	Encourage private landowners to dedicate land to Federal, State, or County governments, or nonprofit land trusts, for parks and open-space protection consistent with the MIP.	**S**
6.6.1.g	Strengthen inter-agency coordination including State and County departments, such as resolving joint use of facilities and properties.	**NA**
6.6.1.h	Work with the State to prepare and implement a master management plan for `Āhihi-Kīna`u and La Perouse-Keone`ō`io Bay to Kanaloa Point region.	**NA**
Implementing Actions:		
6.6.1-Action 1	Identify government ROWs to determine if they can be incorporated into an island-wide parks and recreation functional plan.	**NA**
6.6.1-Action 2	Identify community partners for the maintenance and ownership of community park facilities.	**NA**
6.6.1-Action 3	Develop, adopt and regularly update an island-wide parks and recreation functional plan that incorporates facilities, programs, and a financial component.	**NA**
6.6.1-Action 4	Institute regularly-held, inter-agency coordination meetings to facilitate the implementation of the functional plan.	**NA**
Objective:		
6.6.2	Achieve parks and recreation opportunities to meet the diverse needs of our community.	**S**
Policies:		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
6.6.2.a	Establish appropriate level-of-service standards at the neighborhood, community, and regional levels.	**NA**
6.6.2.b	Identify and acquire parks and recreational facilities that address existing park inadequacies and complement and enhance neighborhoods, communities, and natural-land features.	**NA**
6.6.2.c	Design park facilities to preserve and enhance natural site characteristics, maximize views, protect environmental and cultural sites, and minimize water demands.	**S**
6.6.2.d	Acquire lands along the shoreline, between coastal roadways and the ocean.	**NA**
6.6.2.e	Encourage the development of regional parks, district parks, and greenways in a manner that helps to contain sprawl, provide separation between distinct communities, or offer open space within urban communities.	**S**
6.6.2.f	Require large master-planned communities that incorporate a mixture of park facilities pursuant to parks standards and functional plans.	**S**
6.6.2.g	Support appropriate areas for cultural parks (e.g., Kepaniwai) in each community plan area.	**S**
6.6.2.h	Incorporate community input to determine the appropriate location, design, and long-term stewardship of parks and recreation facilities.	**S**
6.6.2.i	Manage commercial activities at public parks to minimize impacts to residents.	**NA**
6.6.2.j	Support public-private partnerships to implement the acquisition and development of parks when consistent with the General Plan.	**NA**
6.6.2.k	Support a coordinated program to improve, operate, and maintain joint-use facilities and grounds.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
Implementing Actions:		
6.6.2-Action 1	Develop and adopt LOS and design standards for parks and recreational facilities.	**NA**
6.6.2-Action 2	Identify and acquire appropriate park sites in accordance with a parks and recreation functional plan.	**NA**
6.6.2-Action 3	Implement parks and recreational plans, consistent with the MIP, including the North Shore Bikeway Master Plan; Upcountry Greenway Master Plan; South Maui Community Park and Open Space Master Plan; Pali to Puamana Parkway Master Plan; Shoreline Access and Inventory Update-Final Report; South Maui Heritage Corridor; and North Shore Corridor Report.	**NA**
6.6.2-Action 4	Develop a regional park and fairground in Central Maui, and regional parks in South and West Maui.	**NA**
6.6.2-Action 5	Amend County zoning and subdivision ordinances to require development to incorporate a mixture of park facilities into large master-planned communities.	**NA**
6.6.2-Action 6	Develop additional historical and cultural parks.	**S**
6.6.2-Action 7	Establish community-based advisory boards where necessary to help prioritize the purchase of park and recreational lands and facilities.	**NA**
Objective:		
6.6.3	An expanded network of greenways, trails, pathways, and bikeways.	**S**
Policies:		
6.6.3.a	Link existing and future park sites, natural areas, the shoreline, and residential areas with a network of bikeways, pedestrian paths, trails, and greenways.	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
6.6.3.b	Support the implementation of plans and programs that facilitate pedestrian mobility and access to active and passive recreation areas and sites.	**S**
6.6.3.c	Collaborate with the State and private land owners to ensure perpetual access and proper stewardship of traditional trails and access systems.	**S**
6.6.3.d	Facilitate the development of well-managed noncommercial campgrounds throughout the island.	**NA**
6.6.3.e	Consider requiring commercial bike rental businesses to provide funding that supports a mauka-to-makai Haleakalā bikeway improvement program.	**NA**
6.6.3.f	Ensure ADA compliance and seek opportunities to make all parks and recreational facilities accessible to people with disabilities.	**NA**
Implementing Actions:		
6.6.3-Action 1	Amend development regulations to ensure the construction of adequate parking with pathways near shoreline access points.	**NA**
6.6.3-Action 2	Amend the Maui County Code to provide better access and proper stewardship of traditional trails and access systems.	**NA**
6.6.3-Action 3	Develop an educational program for private land owners and the general public to ensure proper stewardship of the islands' trail and access systems.	**NA**
6.6.3-Action 4	Develop public campgrounds in suitable locations throughout the island.	**NA**
6.6.3-Action 5	Create opportunities to utilize portions of public parks for community gardens.	**S**
ANALYSIS: The WCT will create an extensive network of neighborhood and community parks, open spaces and separated pedestrian and bicycle facilities throughout the Project. The Project's park facilities will provide diverse opportunities for community and family gatherings, passive recreation and active recreation. The park system may include shaded areas for picnics		

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
and barbeques, developed tot lot facilities for families with young children, areas for community gardening and cultural activities, and areas for active recreation such as soccer, football, baseball and basketball. The WCTs approximate 8-mile network of trails, walkways and bikeways will provide additional open land recreational opportunities while connecting the Project's residential areas, neighborhood parks and employment areas together. The Project's agricultural lands may also offer opportunities for horseback riding, hiking, skeet shooting, camping, mountain bike riding and other forms of outdoor recreation.	
CHAPTER 6 – INFRASTRUCTURE AND PUBLIC FACILITES	
PUBLIC FACILITES – Goals, Objectives and Policies	**NA**
HEALTH CARE – GOALS, OBJECTIVES AND POLICIES	**NA**
CHAPTER 6 – INFRASTRUCTURE AND PUBLIC FACILITES	
ENERGY	
GOAL	
6.10 Maui will meet its energy needs through local sources of clean, renewable energy, and through conservation.	
Objectives:	
6.10.1 Reduce fossil fuel consumption. Using the 2005 electricity consumption as a baseline, reduce by 15 percent in 2015; 20 percent by 2020; and 30 percent by 2030.	**S**
Policies:	
6.10.1.a Support energy efficient systems, processes, and methods in public and private operations, buildings, and facilities.	**S**
6.10.1.b Support the Maui Solar Rooftop initiative.	**NA**
6.10.1.c Support Hawai`i Energy and other Public Utility Commission (PUC) approved energy efficiency programs.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
Implementing Actions:		
6.10.1-Action 1	Work with the Energy Management Program to: (1) Audit County facilities, operations, and equipment; (2) Develop programs and projects to achieve greater energy efficiency and reduction in fossil fuel use; (3) Develop and maintain data and reports on island energy consumption; (4) Phase out inefficient fossil-fueled vehicles; and (5) Assist homeowners and businesses in reducing fossil fuel consumption.	**NA**
Objective:		
6.10.2	Increase the minimum percentage of electricity obtained from clean, renewable energy sources. By 2015, more than 15 percent of Maui's electricity will be produced from locally-produced, clean, renewable energy sources, 25 percent by 2020, and 40 percent by 2030.	**S**
Policies:		
6.10.2.a	Evaluate available renewable energy resource sites and applicable technologies.	**S**
6.10.2.b	Encourage the installation of renewable energy systems, where appropriate.	**S**
6.10.2.c	Support the establishment of new renewable energy facilities at appropriate locations provided that environmental, view plane, and cultural impacts are addressed.	**S**
6.10.2.d	Encourage all new County facilities completed after January 1, 2015, to produce at least 15 percent of their projected electricity needs with onsite renewable energy.	**NA**
Objective:		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
6.10.3	Increased use of clean, renewable energy.	**S**
Policies:		
6.10.3.a	Support efforts in the PUC to upgrade Maui's power grid to integrate renewable energy from multiple sources and wheeling of electricity.	**NA**
6.10.3.b	Encourage the PUC to work with the County to implement and expedite community supported renewable energy projects.	**NA**
6.10.3.c	Encourage efforts to produce more renewable energy using distributed generation.	**S**
6.10.3.d	Encourage import substitution by MECO and the broader community to become more self-sufficient in energy production.	**S**
6.10.3.e	Educate the public on the economic and environmental benefits from the increased use of renewable energy.	**NA**
6.10.3.f	Encourage support from the Federal government, State, and the private sector for Maui's renewable energy objectives.	**NA**
6.10.3.g	Encourage incentives to support the development and use of renewable energy.	**NA**
Implementing Actions:		
6.10.3-Action 1	Install and maintain back-up power systems at County facilities for critical public health and safety purposes.	**NA**
6.10.3-Action 2	Establish incentives or exemptions for renewable energy production facilities except for public utility companies.	**NA**
Objective:		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
6.10.4	More efficient distribution of power throughout the island while preserving island beauty.	**S**
Implementing Actions:		
6.10.4-Action 1	Avoid the use of power poles where possible for new construction.	**S**
6.10.4-Action 2	Underground existing power transmission and distribution systems wherever possible or feasible when upgrades or new systems are needed.	**S**
6.10.4-Action 3	Strongly encourage the State PUC to initiate a new Integrated Resource Plan process.	**NA**
ANALYSIS: The WCT will include energy-efficient design and conservation measures. Specifically, WCT's design guidelines will encourage the use of energy efficient technology throughout the project, specifically in lighting, air-conditioning, and building materials. Solar hot water heaters will be utilized throughout the residential portion of the development and installation of Photovoltaic Energy Systems will be encouraged, where appropriate, on residential and commercial buildings within the WCT. Additionally, the WCT proposes to develop, in appropriate locations within the agricultural district, solar farms to help off-set the project's demand for carbon emitting electrical energy. Small scale wind generation and hydroelectric may also be incorporated into the Project's renewable energy portfolio, where feasible. Electric vehicle charging stations have also been installed within the Village Center, which will facilitate the use of electric vehicles within the project. Moreover, the WCT is utilizing smart growth planning techniques that will help to reduce automobile trips and therefore the demand for carbon based transportation fuels. Smart Growth helps to minimize automobile trips by providing employment, goods, services and housing all within walking or biking distance of each other. The WCT will have a unified pedestrian and bicycle system throughout the project that links the project site to its existing and future surroundings. The pedestrian and bicycle system will provide residents with an alternative to driving for traveling within the WCT and to neighboring developments.		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
HARBORS AND AIRPORTS – GOALS, OBJECTIVES AND POLICIES		**NA**
CHAPTER 7 – LAND USE		
AGRICULTURE		
GOAL		
7.1	Maui will have a prosperous agricultural industry and will protect agricultural lands.	
Objectives:		
7.1.1	Significantly reduce the loss of productive agricultural lands.	**S & NS**
Policies:		
7.1.1.a	Allow, where appropriate, the clustering of development on agricultural lands when approved as a CSD plan or similar approval mechanism.	**NA**
7.1.1.b	Require, where appropriate, the review and approval of CSD plans prior to the subdivision of agricultural land.	**NA**
7.1.1.c	Discourage developing or subdividing productive agricultural lands for residential uses in which the residence would be the primary use and any agricultural activities would be secondary uses.	**NA**
7.1.1.d	Consider requirements for public notification and review of the subdivision of agricultural land into four or more lots.	**NA**
7.1.1.e	Focus urban growth, to the extent practicable, away from productive and important agricultural lands.	**S & NS**
7.1.1.f	Strongly discourage the conversion of productive and important agricultural lands (such as sugar, pineapple, and other produce lands) to rural or urban use, unless justified during the General Plan update, or when other overriding	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	factors are present.	
7.1.1.g	Further develop the requirements for agricultural assessments found under Section 19.510, MCC.	**NA**
7.1.1.h	Provide incentives for landowners to preserve and protect agricultural lands from development through the use of TDR/PDR, tax credits, easement programs, or similar means.	**NA**
7.1.1.i	Promote the use of U.S.D.A. Farm and Ranch Lands Protection Program grants to fund the acquisition of conservation easements on eligible agricultural lands.	**NA**
7.1.1.j	Require all major developments adjacent to agricultural lands to provide an appropriate and site-specific agricultural protection buffer as part of a required site plan.	**S**
7.1.1.k	Support and promote the viability of Maui's agricultural businesses through property tax incentives and other programs and subsidies.	**NA**
7.1.1.l	Encourage future community plan efforts to identify lands within the County Agricultural zoning district that are primarily being used for large-lot residential or rural use and consider such lands for reclassification to an appropriate County Rural zone.	**NA**
Implementing Action:		
7.1.1-Action 1	Implement the Maui Island Directed Growth Strategy.	**S**
7.1.1-Action 2	Implement County responsibilities under Acts 183 (2005) and 233 (2008) to designate and establish Important Agricultural Lands (IAL) and the incentives therein.	**NA**
7.1.1-Action 3	Develop, adopt, and implement TDR and PDR Programs for, productive Agricultural Lands and IALs with a preference given to lands with a current or	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	recent history of productive agricultural uses.	
7.1.1-Action 4	Revise the Agricultural District Ordinance to allow for limited clustering and CSD, where appropriate.	**NA**
7.1.1-Action 5	Revise existing land use regulations to ensure that Prime Agricultural Lands are distinct from rural (primarily residential) land uses.	**NA**
7.1.1-Action 6	Consider developing or amending regulations to: (1) Reduce the subdivision of agricultural lands by strengthening applicable zoning and subdivision ordinances, and consider the creation of Agricultural categories to better reflect agricultural uses and land use patterns; (2) Require public notification and review of the subdivision of agricultural land into four or more lots; and (3) Require the preparation of a more detailed agricultural impact assessment for changes to the Urban Growth Boundary, Community Plan Amendments, and change in zoning requests of Prime agricultural land as required by Section 19.510, MCC.	**NA**
7.1.1-Action 7	Utilize farm land trust mechanisms to preserve agricultural lands and family farms.	**NA**
7.1.1-Action 8	Promote farm profitability by supporting programs or subsidies including: (1) Low-cost, reliable transportation for export agricultural products; (2) Hawai'i Farm Bureau Federation, Maui County; and farmers cooperatives; (3) Promotion of locally-grown products to hotels, restaurants, or other segments of the visitor industry; (4) The expansion of marketing efforts such as Grown on Maui to the mainland or Far East markets;	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	(5) Development of new or value-added products; and (6) Property tax incentives for commercial agricultural uses.	
Objective:		
7.1.2	Reduction of the island's dependence on off-island agricultural products and expansion of export capacity.	**S**
Policies:		
7.1.2.a	Coordinate with the agricultural community, associations/community groups, agricultural landowners, and the State to designate IALs.	**NA**
7.1.2.b	Support an incentive package for productive Agricultural Lands which aims to ensure agricultural viability for small- and commercial-scale agricultural producers.	**NA**
7.1.2.c	Actively look to acquire land and provide infrastructure to expand the agricultural park and establish new agricultural parks.	**S**
7.1.2.d	Support the designation of a research and development area within agricultural parks to help farmers stay attuned to new technology and research**.**	**S**
7.1.2.e	Support local cooperative extension services to facilitate timely technology transfer opportunities.	**NA**
7.1.2.f	Support plans and programs to develop additional sources of water for irrigation purposes.	**S**
7.1.2.g	Consider appropriate subdivision requirements (gravel roads, above-ground utilities, etc.) in those subdivisions creating Agricultural Parks where lots are limited to agricultural production with no dwellings.	**S**
7.1.2.h	Support the recommendations, policies, and actions contained within the Maui	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	Agricultural Development Plan, July 2009, when consistent with the MIP.	
7.1.2.i	Allow water and tax discounts for legitimate farming operations on rural and agricultural land.	**NA**
7.1.2.j	Give priority in delivery and use of agricultural water and agricultural land within County agricultural parks to cultivation of food crops for local consumption.	**NA**
7.1.2.k	Support programs that control pests and diseases that affect agriculture.	**NA**
7.1.2.l	Support the development of training and apprenticeship programs to encourage an adequate supply of agricultural workers.	**NA**
Implementing Actions:		
7.1.2-Action 1	Identify and acquire productive and community Agricultural Lands that are appropriate for the development of agricultural parks and community gardens in each community plan area.	**S**
7.1.2-Action 2	Coordinate with the State Department of Agriculture, the development of an Agricultural Water Strategy, and incorporate an agricultural component in the Water Use and Development Plan.	**NA**
7.1.2-Action 3	Revise the subdivision ordinance to create appropriate subdivision requirements for agricultural parks, and to promote research and development activities.	**NA**
7.1.2-Action 4	Coordinate with industry stakeholders to develop alternative sources of irrigation water including wastewater reuse, recycled stormwater runoff, and brackish well water.	**S**
Objective:		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
7.1.3	Support and facilitate connectivity between communities.	**S**
Policies:		
7.1.3.a	Evaluate the impact of gated communities on interconnectivity.	**NA**
7.1.3.b	Discourage land use and urban design that impedes interconnectivity between adjacent communities.	**NA**
ANALYSIS: The WCT Master Plan includes an agricultural development component. While 485 acres are proposed for urbanization, as prescribed in the MIP's Directed Growth Strategy, approximately 1,077 acres will remain in agricultural use. Of these lands to remain in agriculture, about 800 acres will be permanently dedicated to agricultural use with no residential structures to be permitted. The remaining 277 acres may be subdivided into as many as five agricultural lots where a farm dwelling may be permitted. Within the agricultural lands, several hundred acres will be developed as a public and/or private agricultural park to help facilitate Maui's agricultural development. The Agricultural Impact Assessment (Appendix G) notes that a significant impediment to agricultural development on Maui, and throughout the state, is the scarcity of agricultural land, with irrigation water, that is readily available and affordable for long-term lease to diversified farmers. The establishment of a centrally located 800-acre agricultural preserve that consists of highly productive lands with access to affordable irrigation water and close proximity to inter-island and mainland shipping opportunities, should help Maui farmers compete in local, mainland and international markets. The subject land was placed into the Small Town Growth Boundary during the General Plan 2030 update, when other overriding factors were present. These factors included the forecasted demand for additional urban lands to accommodate projected population growth and housing demand, the development suitability of the subject land, as well as its proximity to existing employment, infrastructure, public facility systems and existing urban development. The proposed action has been carefully analyzed for its short- and long-term impacts upon the		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
agricultural industry. While the proposed action will result in the loss of prime agricultural lands, it will not significantly impact the short- or long-term viability of agriculture in Hawai'i since an abundance of currently fallow former sugar and pineapple land is currently available elsewhere. The project will, however, help to address the current shortage of agricultural park lots by establishing a new private and/or public agricultural park within Central Maui.		
CHAPTER 7 – LAND USE		
RURAL		
GOAL		
7.2	Maui will have a rural landscape and lifestyle where natural systems, cultural resources and farm lands are protected and development enhances and compliments the viability and character of rural communities.	
Objectives:		
7.2.1	Reduce the proliferation and impact of residential development outside of urban, small town, and rural growth boundaries.	**NA**
Policies:		
7.2.1.a	Focus development to areas inside urban, small town, and rural growth boundaries to preserve natural, cultural, and agricultural resources.	**S**
7.2.1.a	Encourage cluster development with a mandatory buffer requirement/clear edge at the interface of country towns, agricultural uses, and surrounding rural landscapes.	**S**
7.2.1.b	Encourage or require, where appropriate, CSDs and the use of green spaces/natural separations to protect the character of rural landscapes.	**S**
7.2.1.c	Encourage basic goods/services in business country towns.	**S**
7.2.1.d	Allow for mixed uses, including residential uses, within Business Country Town	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	Districts.	
7.2.1.e	Encourage the use of alternative stormwater management techniques that minimize land disturbance and preserve natural drainage features.	**S**
7.2.1.f	Encourage green belts, open space buffers, and riparian zones to minimize conflicts between agriculture and residential uses.	**S**
7.2.1.g	Evaluate the impact of gated communities on inter-connectivity.	**NA**
Implementing Actions:		
7.2.1-Action 1	Coordinate with the State to develop and revise regulations for rural development, within the State Rural District, to encourage creative design and sustainable communities.	**NA**
7.2.1-Action 2	Revise the Country Town Business District Ordinance to allow mixed uses including small-scale residential uses.	**NA**
7.2.1-Action 3	Create new Country Town Business zoning sub-districts and design guidelines that reflect the unique character and land use patterns of Maui's Country Towns and that recognize rural villages.	**S**
7.2.1-Action 4	Revise subdivision regulations to permit clustering and CSD within the Rural Districts and extend Hawai'i Right to Farm Act protections to rural subdivisions.	**S**
Objective:		
7.2.2	More appropriate service/infrastructure standards to enhance and protect the island's rural character and natural systems.	**S**
Policies:		
7.2.2.a	Minimize impermeable surfaces within rural areas.	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
7.2.2.b	Protect and support the character, economic viability, and historic integrity of Maui's small towns.	**S**
7.2.2.c	Use infrastructure, public service, and design standards that are appropriate to rural areas.	**S**
7.2.2.d	Discourage land use and urban design that impede interconnectivity between adjacent communities.	**S**
Implementing Actions:		
7.2.2-Action 1	Develop and adopt regulations to establish rural infrastructure and public facility LOS standards.	**NA**
7.2.2-Action 2	Revise stormwater management regulations to allow for LID techniques and potential irrigation uses.	**NA**
7.2.2-Action 3	Develop and adopt appropriate procedures and standards for the public to review development in County rural zones.	**NA**
7.2.2-Action 4	Amend Chapter 19.36B, MCC, as it relates to pavement and parking requirements in rural areas.	**NA**
ANALYSIS: There are approximately 149.85-acres that are proposed for the State Rural District. The rural site plan was designed using Conservation Subdivision Design (CSD) techniques to cluster the rural residences and to preserve open land for community gardening, grazing of livestock, and to create opportunities for hiking, biking and other open land recreation pursuits. Approximately 25 acres of rural lands have been left in open space for such purposes. The rural lots are intended to serve as a transition between the urban and agricultural lands and to compliment the diversity of housing types that will be offered by the project. The subject lots will be at least one-half acre and agricultural activities will be permitted but not required as a condition of building a single-family residence. The rural lots will comprise about 5.6% of the		

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
residential units within the project. The rural land use will create a more diverse settlement pattern and help to serve the demand for large rural lots on Maui. While the Rural lots will be proximate to urban levels of infrastructure and public services, the lots will be developed utilizing rural subdivision standards so as to maintain a more rural and agricultural sense of place. The MIPs Directed Growth Strategy allocates 80-rural lots to the project area in order to help address the demand for these types of lots on Maui. Once developed, it is envisioned that the WCT will resemble a separate but distinct "country-town" village, encircled by the West Maui Mountains, community gardens, small farms and diversified agricultural operations farming WCTs abutting agricultural lands.		
CHAPTER 7 – LAND USE		
URBAN		
GOAL		
7.3	Maui will have livable human-scale urban communities, an efficient and sustainable land use pattern, and sufficient housing and services for Maui residents.	
Objectives:		
7.3.1	Facilitate and support a more compact, efficient, human-scale urban development pattern.	**S**
Policies:		
7.3.1.a	Ensure higher-density compact urban communities, infill, and redevelopment of underutilized urban lots within Urban Growth Boundaries.	**NA**
7.3.1.b	Maintain a distinct separation between communities, such as but not limited to, Wailuku and Waikapū; Wailuku and Waihe`e; Pukalani and Makawao; Pukalani and Kula; Makawao and Hāli`imaile; Lāhainā and Kā`anapali; Kīhei and Mā`alaea; and Mā`alaea and Waikapū, to protect the character and identity of	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	Maui's communities.	
7.3.1.c	Strengthen evaluation requirements for new urban expansion, new towns, and major urban infill projects within urban growth areas. Tailor submittal requirements to reflect the impact or scale of different projects.	**S**
7.3.1.d	Ensure future amendments to urban growth boundaries achieve the following: (1) provide a beneficial extension of the existing community; (2) are in areas where it is cost-effective to provide and operate infrastructure/public service facilities; and (3) do not promote automobile-oriented land use patterns.	**S**
7.3.1.e	Evaluate the impact of gated communities on inter-connectivity.	**NA**
7.3.1.f	Encourage the development and implementation of neighborhood design standards that are environmentally friendly, such as LEED for Neighborhood Development (LEED – ND) standards.	**S**
7.3.1.g	Discourage future pyramid zoning within the industrial zoning districts, while allowing accessory commercial uses and grandfathering existing uses.	**NA**
7.3.1.h	Promote agriculture by encouraging community gardening, community-supported agricultural programs, and farmers markets within and adjacent to urban areas.	**S**
7.3.1.i	Discourage land use and urban design that impedes inter-connectivity between adjacent communities.	**S**
Implementing Actions:		
7.3.1-Action 1	Establish minimum-density requirements and design standards within urban areas to support higher densities, infill development, and efficient land use patterns.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
7.3.1-Action 2	Update zoning and development regulations to achieve the following: (1) Facilitate environmentally friendly projects (LEED – ND); (2) Revise the application and reporting requirements in Title 19, Maui County Code (MCC), to strengthen evaluation requirements and establish design guidelines for new urban expansion, new towns, and major projects within UGBs; (3) Discourage future pyramid zoning within the industrial zoning districts, while allowing ancillary commercial uses; and (4) Consider the establishment of a new zoning category that strictly defines and limits uses for heavy industrial areas.	**NA**
Objective:		
7.3.2	Facilitate more self-sufficient and sustainable communities.	**S**
Policies:		
7.3.2.a	When developing new communities, provide sufficient lands for commercial, appropriate industrial, educational, spiritual, and non-profit uses to serve the daily needs of community residents.	**S**
7.3.2.b	Site community facilities such as schools, parks, libraries, and community centers within walking and biking distance of residences.	**S**
7.3.2.c	Facilitate self-sufficient communities and shorten commutes by: (1) Directing residential development to job-rich areas; (2) Allowing for appropriate commercial development and community services to shorten commutes; and (3) Allowing home occupations or home-based businesses that are compatible with surrounding neighborhoods and lifestyles.	**S**
7.3.2.d	Ensure, where appropriate, that affordable employee housing and multi-modal	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	transportation opportunities are located near major employment centers.	
7.3.2.e	Discourage the establishment of bedroom communities where long commutes are required to employment centers.	**NA**
7.3.2.f	Facilitate the development of housing by focusing projects in locations where land and infrastructure costs facilitate the development of affordably-priced housing.	**S**
7.3.2.g	Provide incentives to facilitate the development of multifamily housing.	**NA**
7.3.2.h	Encourage the placement of rental housing projects in the same areas as for-sale housing to facilitate mixed-income communities.	**S**
7.3.2.i	Develop communities that provide sufficient parks, schools, libraries, and other essential public facilities and services to serve resident needs.	**S**
7.3.2.j	Promote agriculture by encouraging community gardening, edible landscaping, community-supported agricultural programs, and farmers markets within and adjacent to urban areas.	**S**
Implementing Actions:		
7.3.2-Action 1	Develop and adopt a TDR Ordinance and a formal TDR program, and identify receiving areas within urban growth boundaries.	**NA**
7.3.2-Action 2	Amend the zoning ordinance to: (1) Reduce minimum lot sizes in urban areas; (2) Encourage a mix of single-family and multifamily lots within the same development; and (3) Facilitate the establishment of mixed-use towns/village centers.	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
7.3.2-Action 3	Update regulations to promote community gardens and edible landscapes.	**S**
7.3.2-Action 4	Consider standards to regulate the location, design, and massing of big-box retail stores.	**NA**
7.3.2-Action 5	Amend the Maui County Code (MCC) to reduce parking requirements, where appropriate, in mixed-use projects, encourage joint-use parking, and allow for the use of innovative methods to meet peak parking needs.	**S**
7.3.2-Action 6	Revise the zoning ordinance to allow for mixed-use development that is appropriate and in character with the existing community.	**NA**
Objective:		
7.3.3	Strengthen the island's sense of place.	**S**
Policies:		
7.3.3.a	Protect and enhance the unique architectural and landscape characteristics of each community.	**S**
7.3.3.b	Encourage Hawaiian architecture and tropical building designs.	**S**
7.3.3.c	Support the continued revitalization of historic country towns, Wailuku Town, and Kahului's commercial core and harbor-front without displacing traditional, cultural, recreational and customary uses.	**NA**
7.3.3.d	Strongly encourage the preservation of buildings, structures, and sites of historic significance.	**NA**
7.3.3.e	Require community input through Design Workshops for major new urban expansion, new towns, and major urban infill projects.	**S**
7.3.3.f	Require design enhancement, landscaping, and integration of park and rides, bicycle parking areas, and mass-transit infrastructure to mitigate the effect of	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	parking lots and structured parking on the urban landscape.	
7.3.3.g	Ensure that safe and attractive public spaces (e.g., plazas, parks, town/village squares) are provided throughout the island's urban areas.	**S**
Implementing Actions:		
7.3.3-Action 1	Implement the Wailuku Redevelopment Plan, and subsequent updates, and formulate plans for other appropriate areas.	**NA**
7.3.3-Action 2	Develop and adopt regulations to require Urban Design Review Board review of all major urban expansion, new towns, and urban infill, and redevelopment projects.	**S**
7.3.3-Action 3	Prepare general Urban Design Guidelines for Central, South, and West Maui.	**NA**
7.3.3-Action 4	As part of the Community Plan updates, prepare streetscape, pedestrian/bikeway/transit circulation, redevelopment and infill, and greenway infrastructure and master plan elements.	**NA**
7.3.3-Action 5	Develop community planning processes to establish standards and priorities for streetscape beautification, public amenities, pedestrian and bicycle circulation, parking, redevelopment target areas, transit amenities, and sense of place and building form/design guidelines.	**NA**
Objective:		
7.3.4	Strengthen planning and management for the visitor industry to protect resident quality of life and enhance the visitor experience.	**NA**
Policies:		
7.3.4.a	Discourage the conversion of hotel units to timeshares and fractional ownership.	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
7.3.4.b	Monitor and manage the amount of, and impacts from, timeshares and fractional ownership.	**NA**
7.3.4.c	Manage short-term rentals and bed-and-breakfast homes through a permitting and regulatory process in accordance with adopted ordinances and community plan policies.	**NA**
7.3.4.d	Limit large-scale resort development to the four existing resort destination areas of Wailea, Mākena, Kapalua and Kā`anapali. "Large Scale Resort" is defined as complexes that include multiple accommodation facilities, activity businesses, retail complexes, and other amenities.	**NA**
Implementing Actions:		
7.3.4-Action 1	Define and map the Resort Destination Areas of Wailea, Mākena, Kapalua, and Kā`anapali.	**NA**
Objective:		
7.3.5	Ensure that Maui's planning and development review process becomes more transparent, efficient, and innovative.	**NA**
Policies:		
7.3.5.a	Encourage greater community involvement in land use planning and decision making.	**S**
7.3.5.b	Establish a predictable and timely development review process that facilitates the approval of projects that meet planning and regulatory requirements.	**NA**
7.3.5.c	Increase inter-agency coordination between the Department of Planning and all State and County agencies responsible for infrastructure and public facilities provision, particularly as it relates to the mitigation of long-term cumulative	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	impacts resulting from development projects.	
7.3.5.d	Provide greater certainty and transparency in the development review process.	**NA**
7.3.5.e	Expand and maintain land use and geographic information system databases for improved decisions, and make data and products available to the public.	**NA**
Implementing Actions:		
7.3.5-Action 1	Develop and adopt regulations that: (a) mandate early consultation with communities affected by planning and land use activities; and (b) establish efficient and realistic review timelines.	**NA**
7.3.5-Action 2	Update the MIP and Community Plan land use designations and zoning maps with each update of the General Plan.	**S**
7.3.5-Action 3	Evaluate the establishment of time limitations on unused development entitlements for projects which have not commenced within a reasonable time period.	**NA**
ANALYSIS: The WCT is intended to implement the goals, objectives and policies of the MIPs Land Use and Directed Growth Strategy elements. The MIP designates the project area as a "Planned Growth Area". The Plan allocates 1,433 residential units to the Planned Growth Area together with supporting commercial, employment and public facility uses. The MIPs land use policies clearly articulate that future urban development should be proximate to supporting infrastructure, public facility systems and centers of employment. MIP policy also directs development to reduce reliance upon vehicular modes of transportation by developing more compact and mixed use communities, planning for jobs-housing balance, incorporating pedestrian and bicycling infrastructure into development projects and locating public facilities within close proximity to housing. MIP land use policy also supports measures to facilitate greater environmental sustainability of communities, increase public participation in planning for community development, and promoting urban design and architecture that		

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
reflects a Hawaiian sense of place. Moreover, the MIP strongly encourages programs that support agricultural development within proximity of urban areas. The WCT is located approximately 3-miles from Wailuku's governmental complex and about 5-road miles from Kahului's Kaahumanu Shopping Center. Within Wailuku-Kahului are the island's major shopping, governmental, regional transportation and employment centers. Once developed, the new community of Wai`ale, the State of Hawai'i's Central Maui Regional Sports Complex, and the County of Maui's proposed regional park and governmental campus will be located within a short commute of the WCT. The WCT Master Plan is intended to support a diverse range of socio-economic backgrounds by providing a host of housing types for all age and income categories. A diversity of commercial space configurations are also anticipated and these configurations may include live-work, small-business incubator spaces, retail, restaurant, light manufacturing, service and office space. It is expected that from 20- to 25-percent of the project's residential units will sold as "workforce" housing in compliance with MCC Chapter 2.96B. These units will be subject to price controls and resale restrictions. Based upon the Project's Central Maui location and the types and configurations of units to be sold, it is reasonably expected that up to 80 percent of the Project's residential units could be sold at prices deemed affordable to families earning 140-percent or less of the County's median income, as determined by the United States Department of Housing and Urban Development. The project also includes a 12-acre elementary school and nearly 83 acres of active and passive park space. The WCT incorporates a network of separated pedestrian and bicycle paths that link the project's residential neighborhoods with the elementary school, neighborhood and community parks, the "Village Center" and "Main Street". Through a combination of separated pedestrian and bicycle facilities and complete streets, the Project will safely accommodate pedestrians, bicyclists and vehicular traffic throughout the development. From the Project's mauka "Village Center" and from the makai "Main Street", all residential neighborhoods are within a five-minute walk and/or bicycle ride of commercial services and park facilities.	

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
In order to create a true "Country Town", while supporting the County's agricultural development, the WCT Master Plan keeps 1,077 acres within the State and County Agricultural Districts. About 800-acres of this area will be preserved in perpetuity through an agricultural conservation easement. A public and/or private agricultural park will be established within the 800-acre preserve and the existing WCT farmers – Bobby Pā'ia and Kumu Farms are expected to serve as the Park's anchor tenants. The agricultural preserve will also create a permanent open space buffer that separates Waikapū Town from Mā'alaea and preserves open space views towards the Pacific Ocean, Haleakalā and the West Maui Mountains. When fully developed, it is envisioned that the WCT will be bound by actively farmed agricultural lands and the West Maui Mountains. Urban residents may be able to experience an agricultural lifestyle through a network of hiking trails, bike paths and equestrian trails that would course around the perimeter of the rural and agricultural areas. It is environed that a farmers market will become a feature of the mauka "Village Center" and/or at an appropriate location along the makai "Main Street". Community gardening opportunities may also be provided within suitable areas of the WCTs park network and agricultural lands, should a demand exist for such facilities. The WCT will adopt measures to become a more sustainable community. The project will reduce carbon-based energy consumption by requiring that all residential buildings be equipped with solar hot water heating. Moreover, the project's design guidelines will promote the installation of photovoltaic systems on residential buildings, the orientation of buildings to take advantage of trade winds for natural cooling and sunlight for natural lighting. The use of energy efficient building materials and installation of Energy Star appliances will be required. The WCT may also incorporate strategically located solar farms within the agricultural lands to help generate renewable energy in order to reduce the project's carbon energy footprint. Water conservation is also an important goal for the project. To reduce potable water consumption, the WCT will install a dual water system. Non-potable water would be utilized for irrigation of the Project's parks, open space and for landscape planting of residential and commercial lots. Low flow fixtures will also be installed in all residential units. By not using	

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
potable water for irrigation, it is estimated that potable water demand could be reduced by one-third. The Waikapū community, State and County agencies and other community groups including Maui Tomorrow and the Sierra Club have been actively engaged in the project since February 2009. The WCT Team continues to meet with the Waikapū community and agency and other community stakeholders groups to discuss the project. The WCT Team expects to continue this dialogue through the environmental assessment and land use entitlement processes.		
CHAPTER 8 – DIRECTED GROWTH STRATEGY		
URBAN AND SMALL TOWN GROWTH AREAS		
GOAL		
8.1	Maui will have well-serviced, complete, and vibrant urban communities and traditional small towns through sound planning and clearly defined development expectations.	
Policies:		
8.1.a	The County, with public input, will be responsible for designating new growth areas where infrastructure and public facilities will be provided, consistent with the policies of the MIP and in accordance with State and County infrastructure plans.	**S**
8.1.b	Amendments to a UGB or STB shall be reviewed as a MIP amendment. A UGB or STB shall only be expanded if the island-wide inventory (maintained by the Department of Planning) of existing land uses (residential, commercial, industrial) indicates that additional urban density land is necessary to provide for the needs of the projected population growth within ten years of that inventory; or, during the decennial update of the MIP.	**NA**
8.1.c	Community plans shall provide for urban density land use designations only within UGBs and Small Towns. The County may only support and approve State	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	Urban Land Use Designations for areas within UGBs, STBs, and Rural Villages.	
8.1.d	The unique character and function of existing small towns shall be protected to retain and preserve their sense of place.	**S**
8.1.e	New development shall be consistent with the UGBs, STBs, and all other applicable policies of the MIP. New urban-density development shall not be allowed outside of a UGB or STB.	**S**
8.1.f	The County, as a condition of development approval, shall require developers of privately owned infrastructure systems to provide financial insurance (bonding, etc.) for the operation and maintenance of these systems.	**S**
8.1.g	The County shall implement a zoning program to comprehensively redistrict and rezone lands within UGBs according to updated community plan policies and map designations.	**NA**
8.1.h	The County will seek to focus capital improvements (schools, libraries, roads, and other infrastructure and public facilities) within the UGBs and STBs in accordance with the MIP.	**S**
8.1.i	The County will promote (through incentives, financial participation, expedited project review, infrastructure/public facilities support, etc.) appropriate urban infill, redevelopment and the efficient use of buildable land within UGBs to avoid the need to expand the UGBs.	**NA**
8.1.j	The MIP's UGBs and STBs shall not be construed or implemented to prohibit the construction of a single-family dwelling on any existing parcel where otherwise permitted by law.	**NA**
ANALYSIS: The MIP placed the subject property within a "Small Town Boundary" and provided the following description of the WCT "Planned Growth Area": *The Waikapū Tropical Plantation Town planned growth area is situated in the*		

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
vicinity of the Maui Tropical Plantation, and includes lands on both the mauka and makai sides of Honoapi`ilani Highway. Providing the urban character of a traditional small town, this area will have a mix of single-family and multi-family rural residences, park land, open space, commercial uses, and an elementary or intermediate school developed in coordination with the Wai`ale project. The area is located south of Waikapū along Honoapi`ilani Highway, and it will incorporate the integrated agricultural and commercial uses of the existing tropical plantation complex. This area is proximate to the Wai`ale planned growth area, providing additional housing in central Maui within the Wailuku-Kahului Community plan region. As part of this project, parcels to the south of the project (identified as Agricultural Preserve on Figure 8-1) shall be protected in perpetuity for agricultural use through a conservation easement. A portion of this area may be dedicated to the County as an agricultural park administered pursuant to County regulations. Alternatively, this area can be developed as a private agricultural park available to Maui farmers, and executed through a unilateral agreement between the landowner and Maui County. The rural lots mauka of Honoapi`ilani Highway are intended to be developed using a Conservation Subdivision Design (CSD) plan. The CSD plan shall provide access to uninterrupted walking and bicycling trails and will preserve mauka and makai views while protecting environmentally sensitive lands both along Waikapū Stream and mauka of the subdivision. *Keeping the Waikapū Tropical Plantation as its town core, this area will become a self-sufficient small town with a mix of single-family and multifamily housing units in a walkable community that includes affordable housing in close proximity to Wailuku's employment centers. Schools, parks, police and fire facilities, transit infrastructure, wastewater, water supply resources, and other infrastructure should be developed efficiently, in coordination with neighboring developments including Maui Lani, Kehalani, Pu`unani and Wai`ale. The Waikapū Tropical Plantation Town planned growth area is located on Directed*	

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Growth Map #C3. Table 8-9 ~~8~~ provides planning guidelines for this planned growth area: The WCT is being developed in accordance with the above-reverenced Planned Growth Area Description. More specifically, for the following reasons the WCT Master Plan is supportive of the MIPs vision for the area: • Proximity and convenience to major centers of employment, civic uses and transportation. • An urban design that promotes active transportation by locating residential neighborhoods close to commercial services, employment, parks, and schools. • A network of separated bicycle and pedestrian ways and "complete streets" that will safely accommodate non-motorized transportation. • A diversity of housing types that will include multi-family condominiums, small cottage homes on small lots with common open spaces, 'Ohana dwellings, traditional single-family lots within a variety of home and lot size configurations, rental apartments, townhomes and larger estate rural lots. • Approximately 1,077 acres of prime agricultural lands, of which 800 acres will be permanently protected through a conservation easement for agricultural use and the establishment of a public and/or private agricultural park. • Approximately 83-acres of active and passive recreation parks. • A 12-acre elementary school site. • A duel water system with non-potable water used for irrigation of parks and open space and residential and commercial landscaping, which will result in a one-third reduction of potable water demand.	

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
• On-site renewable energy development. • A commitment to architecture and landscape architecture that will tie the community to the unique sense of place that exists within Maui's small towns and elsewhere in the Hawaiian Islands.		
CHAPTER 8 – DIRECTED GROWTH STRATEGY		
RURAL GROWTH AREA		
GOAL		
8.2	Maui will maintain opportunities for agriculture and rural communities through sound planning and clearly defined development expectations.	
Policies:		
8.2.a	Amendments to a RGB shall be reviewed as an MIP amendment. A RGB shall only be expanded if an island-wide inventory of existing land uses (residential, commercial, industrial) indicates that additional lands are necessary to provide for the needs of the projected population growth within ten years of that inventory; or, during the decennial update of the MIP.	**NA**
8.2.b	New development shall be consistent with RGB and all other applicable policies and requirements of the MIP. Public, quasi-public, civic, and limited commercial or industrial uses may be allowed in the RGB when the proposed uses demonstrate a public need and are consistent with the Community Plan and zoning.	**S**
8.2.c	Environmental protection and compatibility will be a top priority in rural growth areas.	**S**
8.2.d	All development within rural growth areas should avoid encroachment upon prime agricultural land.	**S**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
8.2.e	Rural growth areas include Rural Residential Areas and Rural Villages. Rural residential areas may be designated when they are located in association with or on the border of urban growth areas or Small Towns; and/or when they provide for complete, self-sufficient rural communities with a range of uses to be developed at densities that do not require urban infrastructure.	**S**
8.2.f	Community plans shall provide for rural density land use designations only within RGBs; provided that limited community plan urban designations may be allowed within Rural Villages. New rural growth areas shall not be located where urban expansion may ultimately become necessary or desirable. New rural-density development shall not be allowed outside of a RGB.	**S**
8.2.g	New rural growth areas intended to be complete, self-sufficient rural communities must be located a significant distance from existing urban areas, distinctly separated by agricultural or open lands.	**NA**
8.2.h	Urban-scale infrastructure and public facilities shall not be provided in rural areas except as described in the defined Level-of-Service (LOS) standards. There should be no expectations of urban services in rural areas.	**S**
8.2.i	Urban development standards shall not be required within RGBs except in fulfillment of Federal law.	**S**
8.2.j	The unique character and function of existing small towns and rural communities shall be protected to retain and preserve their sense of place.	**NA**
8.2.k	Preserve rural landscapes in which natural systems, cultural resources, and agricultural lands are protected and development compliments rural character and contributes to the viability of communities and small towns.	**NA**
8.2.l	The MIP's RGBs shall not be construed or implemented to prohibit the construction of a single family dwelling on any existing parcel where otherwise	**NA**

MAUI ISLAND PLAN		RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable		
	permitted by law.	
8.2.m	The County shall implement a zoning program to comprehensively redistrict and rezone lands within RGBs, and to implement community plan policies and map designations.	**NA**
8.2.n	At the time of zoning from agricultural to rural, Council will consider prohibiting restrictions on agricultural activity.	**NA**
ANALYSIS: The purpose of the proposed rural lots is as described in MIP policy 8.2.e, which states: *"Rural growth areas include Rural Residential Areas and Rural Villages. Rural residential areas may be designated when they are located in association with or on the border of urban growth areas or Small Towns; and/or when they provide for complete, self-sufficient rural communities with a range of uses to be developed at densities that do not require urban infrastructure."* The rural lots are intended to serve as a transition between the urban and agricultural lands and to compliment the diversity of housing types that will be offered by the project. The subject lots will be at least one-half acre. Agricultural activities will be permitted but not required as a condition of building a single-family residence on a rural lot. The rural lots will comprise about 5.6% of the residential units within the WCT. The rural site plan was designed using Conservation Subdivision Design (CSD) techniques to cluster the rural residences and preserve agricultural land as well as open land for community gardening, grazing of livestock or horses, and areas for hiking, biking and other open land recreation pursuits. Approximately 25 acres of the rural lands have been left in open space for such purposes.		
PROTECTED AREA POLICY		
8.3.a	The Protected Areas in Diagrams **E-1, NW-1, N-1, NE-1, S-1, SE-1, and WC-1**	

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
should be concurrently reviewed with Table 8-2 and with any proposed land uses that may result in an adverse impact on a Protected Area. The County Council and the Administration should be notified if a Protected Area may be compromised by a development proposal.	
ANALYSIS: MIP Preservation Area Map WC-1 identifies a park at the southern boundary of the makai development area. At the request of the Waikapū Community, this park was relocated to the northern boundary of the project, parallel to the Waikapū Stream. The new location is preferred because it is located closer to the Waikapū Community, the elementary school site and the proposed higher density multi-family housing. In addition, the new location preserves additional open space along the Waikapū Stream. From the single-family neighborhoods located to the south of "Main Street" the park is connected by an approximate 40-feet wide greenway that will incorporate a separated pedestrian and bicycle facility.	
CHAPTER 8 – DIRECTED GROWTH STRATEGY	
GUIDING LAND USE PRINCLPLES	
1. **Respect and encourage island lifestyles, cultures, and Hawaiian traditions:** The culture and lifestyle of Maui's residents is closely tied to the island's beauty and natural resources. Maintaining access to shoreline and mountain resources and protecting culturally significant sites and regions perpetuates the island lifestyle and protects Maui's unique identity. One of the most vital components of the island lifestyle and culture is Maui's people. In an island environment where resources are finite, future growth must give priority to the needs of residents in a way that perpetuates island lifestyles.	
ANALYSIS: The WCT has been developed with considerable input from the Waikapū Community Association and with the input of other key stakeholders within Maui County. The WCT is intended to provide housing for the residents of Maui County. Considerable due-diligence has been taken to mitigate the Project's impact upon archaeological and cultural resources. The Waikapū Stream in being kept free from development and traditional Hawaiian practices along the stream and within the Waikapū Valley will be respected. The WCT Master Plan also seeks to mitigate the Project's visual impacts along Honoapi'ilani Highway. While it is	

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
inevitable that the character of existing views from the highway fronting the urban and rural development will be alternated, measures will be taken to maintain visual connectivity between the highway and the West Maui Mountains and the Pacific Ocean. Moreover, landscape planning of canopy Monkey Pod trees, tropical shrubs and other foliage within the right-of-way will create a "small town" ambiance, which is in character with Maui's historic plantation towns, including Waikapū and Wailuku.	
2. **Promote sustainable land use planning and livable communities:** Managing and directing future growth on Maui should promote the concept of sustainability, and the establishment of livable communities. Sustainable practices include: 1) Focusing growth into existing communities; 2) Taking advantage of infill and redevelopment opportunities; 3) Promoting compact, walkable, mixed-use development; 4) Revitalizing urban and town centers; 5) Providing transportation connectivity and multimodal opportunities; 6) Protecting and enhancing natural and environmental resources; 7) Protecting, enhancing, and expanding communities and small towns, where appropriate; and 8) Encouraging energy and water-efficient design and renewable energy technology.	
ANALYSIS: The WCT is consistent with best planning practices for designing livable and sustainable communities. The project site is proximate to the island's major centers of employment, government and transportation, which will help to reduce long vehicular commutes. The WCT is also being master planned to become as "complete" a community as is possible. The project will offer a diverse range of housing types and an assortment of commercial and employment space configurations. An important goal of the project is to promote a jobs/housing balance. The WCT Master Plan also includes an abundance of park and open space as well as an elementary school. A safe and convenient network of pedestrian and bicycle facilities will link all of these uses together in order to reduce vehicular traffic, add convenience and promote healthier lifestyles. The project has also been designed to mitigate its impact upon sensitive environmental and	

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
cultural resources. Inventory surveys were conducted to ensure that the project site would not be located within ecologically sensitive areas. The WCT will adopt measures to become a more sustainable community. The project will reduce carbon-based energy consumption by requiring that all residential buildings be equipped with solar hot water heating. Moreover, the project's design guidelines will promote the installation of photovoltaic systems on residential buildings, the orientation of buildings to take advantage of trade winds for natural cooling and sunlight for natural lighting. The use of energy efficient building materials and installation of Energy Star appliances will be required. The WCT may also include strategically located solar farms within the agricultural lands to help generate renewable energy in order to reduce the project's demand for imported carbon-based fuels. Water conservation is also an important goal for the project. To reduce potable water consumption, the WCT will install a dual water system. Non-potable water will be utilized for irrigation of the project's parks, open space and landscape planting of residential and commercial lots. Low flow fixtures will also be installed in all residential units. By not using potable water for irrigation, it is estimated that the project will use one-third less potable water.	
3. **Keep "urban-urban" and keep "country-country":** Given the high cost of developing public infrastructure and facilities to service remote areas, the significant environmental and social impacts associated with long vehicle commutes, and the desire to "keep the country-side country" it is preferable to develop compact communities and to locate development within or as close as possible to existing urban areas and employment centers.	
ANALSYIS: The Project site is close to urban infrastructure and public facilities. When developed, the WCT will help address the projected island-wide demand for housing. Residents of the project will live in a location that is convenient to the island's major centers of employment, government and transportation, but will find that the WCT provides for most of their daily needs. While the WCT will expand the County's existing urban footprint, it will also create an approximate 800-acre agricultural preserve that will contain urban development south of the project site and within the MIPs Small Town Growth Boundary. When developed,	

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
the WCT is envisioned to be a "complete" community, bound to the west by agricultural lands, the Waikapū Valley and the West Maui Mountains. To the north it will be bound by Waikapū. To the east it will be bound by the County's governmental complex and proposed Central Maui Regional Park. The Wai`ale community will be about one-half mile further east. To the south will be the 800-acre agricultural preserve and the small town of Mā'alaea beyond.	
4. **Protect traditional small towns:** Development within and adjacent to Maui's traditional towns should be compatible with and perpetuate their unique character. Hard edges should be maintained around new and existing communities through the use of greenbelts and significant open space.	
ANALYSIS: The WCT incorporates a hard edge to the development along its southern boundary with the creation of an 800-acre agricultural preserve. It is anticipated that the preserve will become a major diversified agricultural production zone. To the west of the urban and rural development will be about 277 acres of agricultural lands, which will be kept largely in open space with no more than five lots to be potentially developed. This land will buffer the development from the Waikapū Valley and the West Maui Mountains. Along the Waikapū Stream there will be wide riparian buffers and park lands. The open space will buffer the WCT from the existing town of Waikapū, however; convenient pedestrian and bicycle access between the two communities will be established so that Waikapū residents can access the WCT's commercial amenities, park network, and the elementary school. The WCT will also have its own Project District Zoning Ordinance and Design Guidelines. The Project's architectural theme will create a "small town" sense of place that will be in character with Maui's small plantation towns, including Waikapū and Wailuku.	
5. **Protect open space and working agricultural landscapes:** In light of continuing urbanization, the protection of agricultural and open-space resources will depend on a healthy agricultural industry and progressive planning and regulation. Planning should utilize agricultural lands as a tool to define the edges of existing and planned urban communities, apply innovative site design, create buffers along roadways, provide visual relief, and preserve scenic views.	

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
ANALYSIS: As noted, the WCT incorporates a hard edge to the development along its southern boundary with the creation of an 800-acre agricultural preserve. It has been noted that a significant impediment to agricultural development on Maui, and throughout the state, is the scarcity of agricultural land, with irrigation water, that is both readily available and affordable for long-term lease to diversified farmers. The establishment of a centrally located 800-acre agricultural preserve, with highly productive lands and affordable irrigation water, should help Maui farmers compete in local, mainland and international markets. It is anticipated that the preserve will become a major diversified agricultural production zone. To the west of the urban and rural development will be about 277 acres of agricultural lands, which will be kept largely in open space with no more than five lots proposed. This land will buffer the development from the Waikapū Valley and West Maui Mountains. Along the Waikapū Stream there will be wide riparian buffer.	
6. **Protect environmentally sensitive lands and natural resources:** Environmentally sensitive lands, natural areas, and valued open spaces should be preserved. Native habitat, floodways, and steep slopes should be identified so future growth can be directed away from these areas. It will be important to plan growth on Maui in a manner that preserves habitat connectivity, watersheds, undeveloped shoreline areas, and other environmentally sensitive lands.	
ANALYSIS: The project was designed to mitigate its impact upon sensitive environmental and cultural resources. Inventory surveys were conducted to ensure that the project site was not located within environmentally sensitive areas for species of flora and fauna. A wide riparian buffer has been established along the Waikapū Stream and development is being located approximately one-half mile makai of the entrance to the Waikapū valley. In addition, BMPs will be implemented during the construction and operation phases of the development to mitigate against the discharge of non-point source pollution from the project site.	
7. **Promote equitable development that meets the needs of each community:** Each region of the island should have a mix of housing types, convenient public transit, and employment	

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
centers. Where appropriate, all neighborhoods should have adequate parks, community centers, greenways, libraries, and other public facilities. No community should have a disproportionate share of noxious activities. Additionally, a fair, efficient, and predictable planning and regulatory process must be provided. A cornerstone of equitable development should reflect a focus on providing affordable housing for all of Maui's residents over developing nonresident housing.	
ANALYSIS: The WCT will incorporate a mix of housing types, parks, an elementary school and commercial and professional services and employment opportunities within the development. It is expected that from 20- to 25-percent of the Project's residences will be County "workforce" housing, which will be subject to affordability and resale guidelines. Given the Project's Central Maui location and proposed unit and lot size configurations, it can be reasonably expected that approximately 80 percent of the project's houses will be sold at prices deemed affordable to residents earning 140 percent or less of the County's median income.	
8. **Plan for and provide efficient and effective public facilities and infrastructure:** Many of Maui's public infrastructure systems and facilities were constructed decades ago and are in need of repairs and upgrades to meet current and future demand. Growth should be planned for areas with existing infrastructure, or where infrastructure can be expanded with minimal financial burden to the public. Transportation infrastructure should be designed to be in harmony with the surrounding area.	
ANALYSIS: The WCT is expected to pay its pro-rata share towards the cost of expanding regional infrastructure and public facility systems. The WCT will make off-site roadway improvements, develop wastewater treatment capacity, and develop water capacity to accommodate the project's demand. The WCT will also set aside 12-acres of land for an elementary school and pay impact fees to help construct this facility. The WCT also includes about 83-acres of active and passive park space. All on-site facilities, including roadways, water, wastewater and utilities will be paid for by the developer.	
9. **Support sustainable economic development and the needs of small business:** Land use decisions should promote and support sustainable business activities.	

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
ANALYSIS: The WCT is expected to indirectly support Maui's existing economic base activities by providing much needed housing to serve the island's workforce. The WCT is intended to provide housing along with supporting commercial, employment and institutional uses that will allow for Maui's economic base industries to grow, diversify and become more sustainable - including the island's agricultural industry. By providing much needed housing in a format that will create a high quality of life for Maui's working families, and by generating both short- and long-term employment in the construction, trade and agricultural industries, the project is directly supportive of the State and County's sustainable economic development.	
10. **Promote community responsibility, empowerment, and uniqueness:** The development of community plans should be a broad-based, inclusive process. The community plans shall be reviewed by the Community Plan Advisory Committees, the planning commissions, and approved by the Council. The MIP shall provide a framework for the updated community plans. Subsequent proposed community plan amendments should be subject, as much as possible, to local community input.	
ANALYSIS: NA	
CHAPTER 8 – DIRECTED GROWTH STRATEGY	
WAIKAPŪ TROPICAL PLANTATION TOWN (WAIKAPŪ COUNTRY TOWN)	
MIP DESCRIPTION	
The Waikapū Tropical Plantation Town planned growth area is situated in the vicinity of the Maui Tropical Plantation, and includes lands on both the mauka and makai sides of Honoapi`ilani Highway. Providing the urban character of a traditional small town, this area will have a mix of single-family and multifamily rural residences, park land, open space, commercial uses, and an elementary or intermediate school developed in coordination with the Wai`ale project. The area is located south of Waikapū along Honoapi`ilani Highway, and it will incorporate the integrated agricultural and commercial uses of the existing tropical plantation complex. This area is proximate to the Wai`ale planned growth area, providing additional housing in central Maui within the Wailuku-Kahului Community plan region. As part of this	

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
project, parcels to the south of the project (identified as Agricultural Preserve on Figure 8-1) shall be protected in perpetuity for agricultural use through a conservation easement. A portion of this area may be dedicated to the County as an agricultural park administered pursuant to County regulations. Alternatively, this area can be developed as a private agricultural park available to Maui farmers, and executed through a unilateral agreement between the landowner and Maui County. The rural lots mauka of Honoapi`ilani Highway are intended to be developed using a Conservation Subdivision Design (CSD) plan. The CSD plan shall provide access to uninterrupted walking and bicycling trails and will preserve mauka and makai views while protecting environmentally sensitive lands both along Waikapū Stream and mauka of the subdivision.	
PLANNED GROWTH AREA RATIONALE	
Keeping the Waikapū Tropical Plantation as its town core, this area will become a self-sufficient small town with a mix of single-family and multifamily housing units in a walkable community that includes affordable housing in close proximity to Wailuku's employment centers. Schools, parks, police and fire facilities, transit infrastructure, wastewater, water supply resources, and other infrastructure should be developed efficiently, in coordination with neighboring developments including Maui Lani, Kehalani, Pu`unani and Wai`ale. The Waikapū Tropical Plantation Town planned growth area is located on Directed Growth Map #C3. Table 8-9 ~~8~~ provides planning guidelines for this planned growth area:	
ANALYSIS: The WCT is being developed in accordance with the above-reverenced MIP project description and rationale. More specifically, for the following reasons the WCT Master Plan is supportive of the MIPs vision for the area: • Proximity and convenience to major centers of employment, civic uses and transportation. • An urban design that promotes active transportation by locating residential neighborhoods close to commercial services, employment, parks, and schools. • A network of separated bicycle and pedestrian ways and "complete streets" that will safely accommodate non-motorized transportation. • A diversity of housing types that will include multi-family condominiums, small cottage	

MAUI ISLAND PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
homes on small lots with common open spaces, 'Ohana dwellings, traditional single-family lots within a variety of home and lot size configurations, rental apartments, townhomes and larger estate rural lots. • Approximately 1,077 acres of prime agricultural lands, of which 800 acres will be permanently protected through a conservation easement for agricultural use and the establishment of a public and/or private agricultural park. • Approximately 83-acres of active and passive recreation parks. • A 12-acre elementary school site. • A duel water system with non-potable water used for irrigation of parks and open space and residential and commercial landscaping, which will result in a one-third reduction of potable water demand. • On-site renewable energy development. A commitment to architecture and landscape architecture that will tie the community to the unique sense of place that exists within Maui's small towns and elsewhere in the Hawaiian Islands.	
TROPICAL PLANTATION PLANNED GROWTH AREA TABLE 8-9 ~~8~~	**S**

Background Information:

Project Name:	Tropical Plantation Town	Directed Growth Map #: C3	
Type of Growth:	Small Town/Rural Expansion	Gross Site Acreage:	Small Town - 360 Acres Rural - 142 Acres

Planning Guidelines

Dwelling Unit Count:	Approximately 1,433 Units (Up to 80 of these units can be rural residences. 'Ohana units do not count towards the total units.[34]	Residential Product Mix:	Balance of SF and MF units The rural residential units are on the mauka side of the project.

[34] Additional units may be permitted through a transfer of development rights program or to provide affordable housing in excess of what is required by law. Unit counts may be further defined through the entitlement process in response to infrastructure and environmental constraints.

MAUI ISLAND PLAN			RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable			
			Small Town – 360 Acres Rural – 142 Acres
Net Residential De	9 – 12 du/acre	Parks and Open Space%[35]:	≥ 30%
		Commercial:	Convenience Shopping

ANALYSIS

Table 64 ~~58~~ compares WCT Master Plan with the MIP Planning Planned Growth Area Guidelines:

Table 64 ~~58~~: Comparison of the WCT Master Plan and MIP Guidelines

Guideline	WCT	MIP	Explanation
Small Town Acres	349.065	360[36]	Difference is a result of infield surveying of boundaries
Rural Acres	149.849	142[37]	Difference is a result of infield surveying of boundaries
Total Dwelling Units	1433	1433 (plus/minus 10%)	
Rural Dwelling Units	80 (of total units)	80 (of total units)	
'Ohana Units	146	'Ohana units do not count towards unit count	Project assumes 'Ohana units will be built on about 15% of the single family lots
Residential Product Mix	73.27%/SF; 26.73 MF	Balance of SF and MF	Ratio reflects a more

[35] The distinct boundaries of the parks and open space, specific location of the recreational uses, and the precise amenities will be further defined during the Wailuku – Kahului Community Plan Update and the project review and approval process.

[36] Not based upon a field survey of Small Growth Boundary.

[37] Not based upon a field survey of Rural Growth Boundary

MAUI ISLAND PLAN			RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable			
			"Country Town" sense of place
Net Residential Density	8.28 units/acre	9 – 12 units/acre	Ratio reflects a more "Country Town" sense of place
Parks and Open Space	107 / 21.4% or 75% if include agricultural lands	≥ 30%	Active and passive park Space exceeds existing LOS. Seventy-five percent of project site is in open space if AG lands are included.

3. Wailuku-Kahului Community Plan

Within Maui County, there are nine (9) community plan regions. From a General Plan implementation standpoint, each region is governed by a Community Plan, which sets forth desired land use patterns together with goals, objectives, policies and implementing actions for a number of functional areas including infrastructure-related parameters.

The WCT is located within the Wailuku-Kahului Community Plan region. The majority of the project area is designated Agriculture in the Community Plan, with a portion designated Wailuku-Kahului Project District 5 (Maui Tropical Plantation). Refer to Figure 10, "Community Plan Map". Community Plan Amendments will be sought to bring the entire project site into community plan designations that better align with the WCT Master Plan vision (**See**: Section I.D.6.e.3 of the ~~DEIS~~ FEIS).

Table 65 ~~59~~ analyzes the WCTs consistency with the Wailuku-Kahului Community Plan Goals, Objectives and Policies.

Table 65 ~~59~~: Wailuku-Kahului Community Plan Goals, Objectives and Policies

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Economic Activity	
Goal: *A stable and viable economy that provides opportunities for growth and diversification to meet long-term community and regional needs and in a manner that promotes agricultural activity and preserves agricultural lands and open space resources.*	
Objectives and Policies:	
1. Support agricultural production so agriculture can continue to provide employment and contribute to the region's economic well-being.	**S**
2. Support the revitalization of the Wailuku commercial core and adjacent areas by expanding the range of commercial services; improving circulation and parking; enhancing and maintaining the town's existing character through the establishment of a Wailuku Town design district; redevelopment of the Wailuku Municipal Parking Lot with emphasis on additional public parking; establishing urban design guidelines; and providing opportunities for new residential uses. Improve Wailuku's image and level of service as a commercial center for the region's population. A combination of redevelopment and rehabilitation actions is necessary to meet the needs of a growing center.	**NA**
3. Allow opportunities for hotel accommodations within the region at Kahului and Wailuku--at the existing hotel district by Kahului Harbor; near the Kahului Airport; and within the Wailuku Town core.	**NA**
4. Provide industrial growth opportunities through the expansion of existing industrial centers associated with the airport and harbor, and in Wailuku and Kahului. Encourage the fee simple ownership of lots provided by private developers.	**NA**
5. Recognize the importance of small businesses to the region's economy.	**S**
6. Encourage the development of affordable business incubator spaces with public subsidies or incentives, as necessary, similar in concept to that of the Maui Research and Technology Park.	**S**
7. Provide for the establishment of centralized business districts within the region, in order to minimize the extensive migration of commercial projects into light industrial	**S**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
developments.	
8. Accommodate mixed use residential/commercial development as a "transition" between residential districts and the civic center and business/commercial districts compatible with a residential scale and character and subject to a new zoning classification. Lands intended for this use shall be designated Service Business/Residential (SBR) on the Community Plan land use map.	**S**
9. Support the establishment of agricultural parks for truck farming, piggery operations, bee keeping and other diversified agricultural operations within larger unsubdivided agricultural parcels and in locations that are compatible with residential uses.	**S**
Implementing Actions:	
a. Prepare a prioritized island-wide directed and managed growth strategy to ensure that the location, rate and timing of development is consistent with the provision of infrastructure and public facilities and services.	**S**
b. Include conditions of approval for new residential developments requiring that adequate school facilities shall be in place before a certificate of occupancy is issued.	**NA**

ANALYSIS: The MIP designates the project area as a "Planned Growth Area". However, the bulk of the subject property proposed for urbanization, 485 acres, is designated Agriculture in the Wailuku-Kahului Community Plan. Thus, implementation of the project will require a Community Plan Amendment. If a community plan amendment is granted from Agriculture to a Project District, the WCT will be developed in accordance with the goals, objectives and policies of the Wailuku-Kahului Community Plan that provide guidance for development of urban and rural areas.

The WCT Master Plan is intended to support a diverse range of socio-economic backgrounds by providing a host of housing types for all age and income categories. A diversity of commercial space configurations are also anticipated and these configurations may include live-work, small-business incubator spaces, retail, restaurant, light manufacturing, service and office space. It is expected that from 20- to 25-percent of the Project's residential units will sold as "workforce" housing in accordance with MCC Chapter 2.96. These units will be subject to price controls and resale restrictions. Based

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	

upon the Project's Central Maui location and the types and configurations of units to be sold, it is reasonably expected that up to 80 percent of the Project's residential units could be sold at prices deemed affordable to families earning 140-percent or less of the County's median income, as determined by the United States Department of Housing and Urban Development.

The project also includes a 12-acre elementary school and nearly 83 acres of active and passive park space. The WCT incorporates a network of separated pedestrian and bicycle paths that link the Project's residential neighborhoods with the elementary school, neighborhood and community parks, the "Village Center" and "Main Street". Through a combination of separated pedestrian and bicycle facilities and complete streets, the Project will safely accommodate pedestrians, bicyclists and vehicular traffic throughout the development. From the Project's mauka "Village Center" and from the makai "Main Street", all residential neighborhoods are within a five-minute walk and/or bicycle ride of commercial services and park facilities.

In order to create a true "Country Town", while supporting the County's agricultural development, the WCT Master Plan keeps 1,077 acres within the State and County Agricultural Districts. About 800-acres of this area will be preserved in perpetuity through an agricultural conservation easement. A public and/or private agricultural park will be established within the 800-acre preserve and the existing WCT farmers – Bobby Pā'ia, <u>owner of Hoaloa Farms</u>, and Kumu Farms are expected to serve as the Park's anchor tenants. The agricultural preserve will also create a permanent open space buffer that separates Waikapū Town from Mā'alaea and preserves open space views towards the Pacific Ocean, Haleakalā and the West Maui Mountains.

When fully developed, it is envisioned that the WCT will be bound by actively farmed agricultural lands and the West Maui Mountains. Urban residents may be able to experience an agricultural lifestyle through a network of hiking trails, bike paths and equestrian trails that would course around the perimeter of the rural and agricultural areas. It is environed that a farmers market will become a feature of the mauka "Village Center" and/or at an appropriate location along the makai "Main Street". Community gardening opportunities may also be provided within suitable areas of the WCTs

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
park network and agricultural lands, should a demand exist for such facilities.	
Environment	
Goal: A clean and attractive physical and natural environment in which man-made developments or alterations to the natural environment relate to sound environmental and ecological practices, and important scenic and open space resources are maintained for public use and enjoyment.	
Objectives and Policies:	
1. Preserve agricultural lands as a major element of the open space setting that which borders the various communities within the planning region. The close relationship between open space and developed areas is an important characteristic of community form.	**S**
2. Protect nearshore waters by ensuring that discharges from waste disposal meet water quality standards. Continuous monitoring of existing and future waste disposal systems is necessary to ensure their efficient operation.	**S**
3. Protect shoreline wetland resources and flood plain areas as valuable natural systems and open space resources. These natural systems are important for flood control, as habitat area for wildlife, and for various forms of recreation. Future development actions should emphasize flood prevention and protection of the natural landscape.	**S**
4. Preserve the shoreline sand dune formations throughout the planning region. These topographic features are a significant element of the natural setting and should be protected from any actions which would detract from their scenic, environmental, and cultural value.	**NA**
5. Require that new shoreline development respect shoreline resources and maintain public access. a. Existing dune formations are important elements of the natural setting and should remain intact. b. Indigenous or endemic strand vegetation should remain undisturbed; new development and landscaping should treat such vegetation as given conditions.	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
c. Planning for new shoreline development, as well as redevelopment, shall consider the cyclic nature of beach processes. Setbacks shall be used to provide a sufficient buffer between the ocean and structures to allow for periodic and long-term accretion and erosion of the shoreline. A Coastal Erosion Rate Analysis shall be developed. The planning commissions are encouraged to incorporate data from the analysis into planning decisions for shoreline areas, especially with respect to shoreline building setbacks. In the interim period prior to the completion of the analysis, the planning commissions are further encouraged to utilize minimum setbacks for multi-family and hotel uses, and any undeveloped property, of 150 feet from any shoreline, or 25 percent of the average lot depth, whichever is greater. For other uses, including single family residences and subdivisions along shoreline property, the Department of Planning staff and the Land Use and Codes Division Plans Examiners are encouraged to consult existing data on shoreline trends when discussing minimum shoreline setbacks with developers. Both episodic and long-term erosion rates should be disclosed to current or prospective purchasers of property to assist with the selection of an adequate shoreline setback. Where shoreline erosion threatens existing structures or facilities, beach replenishment shall be the preferred means of controlling erosion, as opposed to sole reliance on seawalls or other permanent shoreline hardening structures.	
6. Encourage the use of siltation basins and other erosion control features in the design of drainage systems.	**S**
7. Mitigate potential hazards associated with oil storage tanks and the bulk containment of other toxic, corrosive or combustible substances.	**NA**
8. Minimize noise, water and air pollution from industrial uses, electric power generating facilities and wastewater treatment plants.	**NA**
9. Maintain coastal open space along the region's shoreline as a scenic amenity and public recreational area.	**NA**
10. Monitor air quality in the planning district and enforce applicable standards with regular public reporting.	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
11. Encourage joint government action in the investigation of seaweed build-up in Kahului Harbor and other affected areas and the implementation of coordinated clean-up and other mitigate actions.	**NA**
12. Promote recycling programs to reduce solid waste disposal in landfills, including convenient drop-off points for recycled material.	**S**
13. Support energy conservation measures, including the use of solar heating and photovoltaic systems, in conjunction with urban uses.	**S**
14. Promote the planting and maintenance of trees and other landscape planting to enhance the streetscapes and the built-environment.	**S**
Implementing Actions:	
1. Formulate and adopt a regional landscape planting master plan, including standards, for implementation in conjunction with public and private projects.	**NA**
2. Establish and maintain a monitoring program for nearshore water quality.	**NA**
3. Develop a master plan for a recreational coastline access.	**NA**
4. Develop and implement a strategy for sand dune protection.	**NA**
5. New studies should be commissioned that seek to better understand site-specific causes of coastal erosion.	**NA**

ANALYSIS: In accordance with the County's *"Rules for the Design of Storm Water Treatment Best Management Practices",* the design of the stormwater system will include water quality treatment to reduce the discharge of pollutants to the maximum extent practicable.

A maintenance plan will be developed for the stormwater BMPs. The plan will include the requirements for removal of the accumulated debris and sediment, maintaining vegetation, and performing inspections to insure that the BMPs are functioning properly. Moreover, stormwater runoff during site preparation will be controlled in compliance with the County Code Chapter 20.08 "Soil Erosion and Sediment Control Minimum BMPs". During the construction period, temporary

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	

erosion control measures will be incorporated to minimize dust and soil erosion. Additional controls will be implemented to protect Waikapū Stream. Temporary BMPs include the construction of diversion berms and swales, dust fences, silt fences, stabilized construction entrances, truck wash down areas, inlet protection, temporary grassing of graded areas, and slope protection.

As discussed in Section V.D.2 "Electric, Telephone and Cable TV" the WCT will include energy-efficient design and conservation measures. Specifically, WCTs design guidelines will encourage the use of energy efficient technology throughout the project, specifically in lighting, air-conditioning, and building materials. Solar hot water heaters will be utilized throughout the residential portion of the development and installation of Photovoltaic Energy Systems will be encouraged, where appropriate, on residential and commercial buildings within the WCT. Additionally, the WCT proposes to develop, in appropriate locations within the agricultural district, solar farms to help off-set the Project's demand for carbon emitting electrical energy.

A major component of the project is the 1,077 acres of agricultural lands that will extend out from the western and southern perimeters of the project. These lands will be used primarily for diversified agricultural development, but may also be used in appropriate ways for open land recreation and renewable energy generation. The agricultural lands will also serve the purpose of creating a permanent open space separation between the town of Waikapū and Mā'alaea and will help to preserve the existing mauka and makai views along Honoapi'ilani Highway.

Cultural Resources

Goal: Identification, protection, preservation, enhancement, and where appropriate, use of cultural practices and sites, historic sites and structures, and cultural landscapes and view planes that:

1. **Provide a sense of history and define a sense of place for the Wailuku-Kahului region; and**
2. **Preserve and protect native Hawaiian rights and practices customarily and traditionally exercised for subsistence, cultural and religious purposes in accordance with Article XII, Section 7, of the Hawai'i State Constitution, and the Hawai'i Supreme Court's PASH opinion, 79 HAW. 425 (1995).**

Objectives and Policies:	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
1. Preserve the character and integrity of historic sites in the Wailuku-Kahului region.	**S**
2. Recognize the importance of historically and archaeologically sensitive sites and encourage their preservation through development project review.	**S**
3. Protect and preserve historic, cultural and archaeological sites and resources through on-going programs to identify and register important sites, and encourage their restoration. This shall include structures and elements that are a significant and functional part of Hawai'i's ethnic and cultural heritage.	**S**
4. Ensure that the proposed projects are compatible with neighboring historic, cultural, and archaeological sites or districts. Such projects should be reviewed by the Cultural Resources Commission, where appropriate.	**S**
5. Require development projects to identify all cultural resources located within the project area as part of initial project studies. Further, require that all proposed activity include recommendations to mitigate potential adverse impacts on cultural resources.	**S**
6. Support programs for the protection and preservation of historic and archaeological resources and foster an awareness of the diversity and importance of the region's ethnic, cultural, historic, and archaeological resources.	**NA**
7. Encourage community stewardship of historic buildings and cultural resources and educate private property owners about financial benefits of historic preservation in Maui County.	**NA**
Preserve and restore historic roads, paths, and water systems as cultural resources, and support public access.	**S & NS**
8. Recognize and respect family ancestral ties to certain sites including burial sites, and establish cultural and educational programs to perpetuate Hawaiian and other ethnic heritages.	**S**
Implementing Actions:	
1. The Cultural Resources Commission shall update, and the Council shall adopt, the County Cultural Resources Management Plan to further identify specific and significant cultural resources in the region and provide strategies for preservation and enhancement.	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
2. Require development projects to identify all cultural resources located within or adjacent to the project area and consult with individuals knowledgeable about such cultural resources prior to application as part of the County development reviewprocess. Further, require that all proposed activity include recommendations to mitigate potential adverse impacts on cultural resources including site avoidance, adequate buffer areas, and interpretation. Particular attention should be directed toward dune areas, known and probable pre- contact habitation areas, and other sites and areas listed in No. 5 below, with review by the Cultural Resources Commission, where appropriate.	**S**
3. Implement a historic and cultural overlay ordinance to provide protection for areas with significant archaeological, historical, and cultural resources.	**NA**
4. Establish recognition of culturally sensitive areas such as Naniloa Bridge, Wai`ale Bridge, and burial and habitation sites along Lower Main Street and Kahului Beach Road.	**NA**
5. Significant Wailuku-Kahului region sites and areas include the following: Wahi Pana (Significant Traditional Places) a. Nā Wai ʻEhā (Waiheʻe, Waiehu, Wailuku, Waikapū). b. Waiheʻe Dunes Archaeological Complex. c. Waiheʻe Church. d. Waiheʻe Sugar Mill site. e. Halekiʻi-Pihanakalani heiau. f. Waiheʻe Dune complex. g. Taro loʻi in ʻĪao Valley. h. Traditional surfing sites. i. Kanahā Pond. j. Habitation and burial sites along Lower Main Street corridor. k. Wai`ale Bridge. l. Wailuku Civic Center Historic District. m. Kama Ditch, Spreckels Ditch, and Waiheʻe Ditch. n. Kaʻahumanu Church. o. Hale Hoʻikeʻike (Bailey House Museum). p. Alexander House (next to Kaʻahumanu Church). q. Waikapū Stone Church Site. r. Wailuku School. s. Puʻunene School. t. Puʻu One Sand Dune Formation from Kahului Harbor to Waikapū.	**S**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
u. Coastal sand dunes from Kahului Airport to Baldwin Park. v. Kahului Railroad System sites (i.e., Roundhouse, Makaweli Crusher Mill Foundation, etc.). w. Chee Kung Tong Society Hall site. x. Maui Jinsha Mission. y. Naval Air Station Kahului Airport (NASKA). z. Pu'unene Mill/Village. aa. Kahului Railroad Building and Old Kahului Store. bb. Buildings designed by C. W. Dickey-Wailuku Library, the Territorial cc. Building in Wailuku, and the Baldwin Bank (Bank of Hawai'i in Kahului). dd. Wailuku Union Church. ee. Church of the Good Shepherd. ff. ʻĪao Theatre. gg. Plantation Manager's Residence in Wailuku. gg. St. Anthony's School. hh. Market Street from Main Street through Happy Valley. ii. Vineyard Street from Market Street to end. jj. ʻĪao Stream. The above list is not comprehensive. It represents some of the well-known sites currently listed in the State inventory of Historic Places and on file with the State and National Registers of Historic Places. Many more sites have not yet been surveyed for historic, archaeological, and cultural significance. The Department of Planning has (or will obtain from the State Historic Preservation Division) maps indicating the general location of these sites. Planning Department staff will obtain, maintain, and update all pertinent maps, which will be consulted prior to development proposals affecting the above-mentioned areas.	Rock
ANALYSIS: As discussed in Section V.A.4 (Historical and Archaeological Resources) the Project's AIS documented no evidence of traditional Hawaiian activities, with the possible exception of a remnant retaining wall or terrace (Site 7882) on the property. It was noted that the negative results are primarily due to the compounded disturbances from sugarcane cultivation, historic habitation and	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	

modern land use. Other historic features documented in the AIS primarily relate to plantation-era agricultural irrigation features, including a section of the Waihe`e Ditch that traverses north to south across the subject property mauka of Honoapi'ilani Highway.

The Waihe`e Ditch may by covered as part of the development for the purpose of reducing water loss through seepage, preventing potential liability once the project area is developed, making it easier and less costly to develop the project site, and to create a north-south pedestrian and bicycle corridor within the ditch right-of-way. The AIS concludes that the Waihe`e Ditch has been adequately recorded and that covering it will not significantly impact the State's archaeological resources. The AIS also recorded a World War II era bunker on the site. The AIS recommends that if this bunker is to be removed during development, that a commemorative plaque be erected at the site to document the structures historical significance.

The AIS recommends Archaeological Monitoring during the construction phase. Prior to the commencement of construction, an Archaeological Monitoring Plan (AMP) detailing the localities to undergo monitoring procedures will be prepared and submitted to SHPD for review and approval. With the preparation of an AIS prior to ground alteration, and conducting State approved archaeological monitoring during construction, the State's objectives for the identification and protection of historic properties should be accomplished.

The WCT intends to create a sense of place within the community that reflects the cultural values, traditions and history of Hawai'i, and more specifically Waikapū. In preparing the ~~DEIS~~ FEIS, a Cultural Impact Assessment (CIA) was prepared to thoroughly document any potential impacts that the project could have upon traditional and customary rights. The CIA recommends that the Applicant work with the Waikapū community to ensure that the Waikapū stream isn't impacted by the Development, that traditional access rights are maintained into the Waikapū Valley, and that existing kuleana land owner rights are protected. The Applicant is committed to protecting the Waikapū Stream by establishing a wide riparian buffer and greenway along the stream where development will not be permitted. ~~The WCT will also have negligible impact upon existing stream flows as no requests for additional stream water will be made for the development.~~ The Applicant has filed a Surface Water Use Permit with the CWRM in order to ensure the Project's agricultural lands are served by a sufficient supply of non-potable irrigation water. Any water drawn from the Nā Wai 'Ehā will be used

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
in strict compliance with CWRM directives. The Applicant also intents to use non-potable well water and recycled water from the Project's wastewater reclamation facility to reduce the Project's use potable water resources. As noted in the ~~DEIS~~ FEIS, the WCT will be served by new wells that will be managed in strict compliance with County and State requirements. The Applicant also intends to work with the Waikapū community to develop a cultural resources plan to ensure that local cultural values are incorporated into the fabric of the project. The Cultural Resources Plan may include recommendations such as the naming of streets and places within the WCT, identifying a site for a small museum depicting the history and culture of Waikapū, incorporating various features and artifacts reflecting Waikapū's past – such as remnants from the sugar industry – into the design of key buildings and sites, and maintaining and protecting access into the Waikapū Valley for the purpose of hunting, gathering, the replanting of native trees and vegetation. See Appendix F, A of the FEIS (Ka Pa`akai Cultural Analsyis) for a discussion of on-going traditional and customary Native Hawaiian cultural practices that are occurring within the Project area and measures that may be taken to ensure these activities are protected. The Applicant also intends to facilitate the expansion of diversified agricultural activities, including the growing of traditional Hawaiian food staples such as wet and dryland kalo, banana, sweet potato, etc. within the Project's agricultural lands. Moreover, small community gardens may be dispersed throughout the project site, depending upon demand by residents, so that residents can connect with the land and grow their own foods, including traditional Hawaiian staples, for their daily needs.	
Indigenous Architecture	
Goal: Reserve for future implementation provisions for indigenous architecture as may be adopted from time to time by the County Council and/or the County Cultural Resources Commission.	
Objectives and Policies:	
1. To legitimize and amend County Building Codes to allow indigenous architecture as viable spaces for living, work, and recreation.	**NA**
Implementing Actions:	
1. Develop a County ordinance for indigenous architecture.	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
2. Adopt standards for indigenous architecture.	**NA**
Housing	
Goal: A sufficient supply and choice of attractive, sanitary and affordable housing accommodations for the broad cross section of residents, including the elderly.	
1. Utilize a project district planning approach for major housing expansion areas which will allow flexibility in project planning. This will provide for flexible development standards and a mix of housing types which can result in more efficient site utilization and potential reductions in housing development costs.	**S**
2. Provide sufficient land areas for new residential growth which relax constraints on the housing market and afford variety in type, price, and location of units. Opportunities for the provision of housing are presently constrained by a lack of expansion areas. This condition should be relieved by a choice of housing in a variety of locations, both rural and urban in character.	**S**
3. Seek alternative residential growth areas within the planning region, with high priority given to the Wailuku and Kahului areas. This action should recognize that crucial issues of maintaining important agricultural lands, achieving efficient patterns of growth, and providing adequate housing supply and choice of price and location must be addressed and resolved.	**S**
Encourage the creation of elderly housing communities in various parts of the region that address the range of specialized needs for this population group.	**S**
Encourage the formulation of an elderly needs assessment study for Maui County by the State Department of Health, including recommendations for elderly housing projects, facilities and programs.	**NA**
Coordinate the planning, design and construction of public infrastructure improvements with major residential projects that have an affordable housing component.	**S**
Plan, design and construct off-site public infrastructure improvements (i.e. water, roads, sewer, drainage, police and fire protection, and solid waste) in anticipation of residential, commercial and industrial developments defined in the Community Plan.	**S**
Promote efficient housing designs in order to reduce residential home energy and water	**S**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
consumption.	
Implementing Actions:	
Develop a comprehensive housing strategy for low and moderate income groups involving government and private industry cooperation that provides an adequate supply of housing for the various strata of income. This approach would combine the resources of Federal, State, County, and private enterprise to improve the availability of rental and ownership housing targeted to various need groups. Anti-speculation and specification of a percentage of low and moderate income units in major projects are tools which should be considered as part of an overall housing program.	**S**
Develop procedures and regulations to streamline government review and approval for housing projects. This should result in cost reductions by expediting the time required for implementation.	**NA**
Develop programs to encourage housing rehabilitation in older residential areas. This would designate target areas where low interest loans, grants and flexible code regulations not related to public health, safety and welfare would be available to homeowners.	**NA**
Revise zoning, building and housing codes to allow for specialized elderly housing projects.	**NA**
ANALYSIS: The WCT will offer a mix of single and multi-family housing types to address the diverse housing needs of Maui residents. Due to the Project's Central Maui location and the expected lot and unit size configurations that will be developed using the MCC's Project District zoning ordinance, the Applicant expects that the majority of the Project's market priced housing will be sold at prices considered affordable to Maui County residents earning between 100 and 140 percent of the County's median income as determined by the United States Department of Housing and Urban Development. The WCT will also include workforce housing units pursuant to Chapter 2.96, MCC, "Residential Workforce Housing Policy". These homes will be subject to price controls and resale restrictions to ensure that affordable homes remain available for full-time Maui residents. Housing types within the WCT may include multi-family condominiums, small cottage homes on small lots with common open spaces, traditional single-family lots within a variety of home and lot size configurations, rental apartments, townhomes and larger estate rural lots. The goal is to serve the demands of all Maui residents.	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
As discussed in Section V.D.2 "Electric, Telephone and Cable TV" the WCT will include energy-efficient design and conservation measures. Specifically, WCTs design guidelines will encourage the use of energy efficient technology throughout the project, specifically in lighting, air-conditioning, and building materials. Solar hot water heaters will be utilized throughout the residential portion of the development and installation of Photovoltaic Energy Systems will be encouraged, where appropriate, on residential and commercial buildings within the WCT. A dual water system is also proposed. A dual system would use non-potable irrigation well water for irrigating the WCTs open space, park lands, and residential and commercial landscape planting. A dual system could reduce potable water demand by one-third.	
Social Infrastructure	
Goal: Develop and maintain an efficient and responsive system of public services which promotes a safe, healthy and enjoyable lifestyle, accommodates the needs of young, elderly, disabled and disadvantaged persons, and offers opportunities for self- improvement and community well-being.	
Recreation	
Objectives and Policies:	
Provide park and recreation areas as an integral part of project district specifications which will accommodate the needs of population growth.	**S**
Ensure adequate public access to shoreline recreation resources by pursuing access ways identified by the County.	**NA**
Provide access for persons with disabilities at all park facilities.	**S**
Provide for a major regional multi-purpose center for the planning district to accommodate resident needs for banquet and meeting facilities with adequate parking.	**NA**
Investigate the need for an additional community center facility in Kahului.	**NA**
Place high priority on utilizing the ʻĪao Theatre as a multi-purpose community facility and develop the adjoining property in a manner that retains the integrity of the town core.	**NA**
Place high priority on implementation of Keopuolani Park, including enhancement of the Kahului Harbor shoreline.	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Expand shoreline recreation opportunities by extending Kanahā Beach Park and establishing park areas along Spreckelsville, Waiehu and Waiheʻe shorelines.	**NA**
Enhance existing parks by improving maintenance and expanding the range of facilities provided.	**NA**
Maintain lands acquired or designated for recreational purposes exclusively for those uses.	**NA**
Provide for additional municipal golf courses.	**NA**
Maintain existing recreational uses at the Kahului harbor for canoe club activities. When development occurs, provide alternate sites for canoe club activities at the Kahului Bay area.	**NA**
Establish a linear park with bikeways and pedestrian routes along the shoreline between Waiheʻe and Paʻia.	**NA**
Establish a permanent fairground site that encourages year-round use as an inter-regional community center and meeting facility.	**NA**
Establish a linear park, with bicycle and pedestrian facilities where practical, from the Paukukalo oceanfront along ʻĪao Stream to Kepaniwai Park.	**NA**
Ensure that adequate regional/community park facilities are provided to service new residential developments.	**NA**
Ensure that the development of the North Shore greenway project is done in a manner that respects the dune system and cultural sensitivity of the area. Specifically, the project should: a. minimize the excavating, grading, and grubbing for the project, and instead use minimal fill (as necessary to meet engineering standards), especially in the area near Baldwin Beach Park; b. provide appropriate protection to prevent unnecessary traversing of the dune system mauka-makai; c. use the greenway as an opportunity to interpret the significant cultural and historic sites in the area; and	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
d. have the archaeological inventory survey and the design plans for the project reviewed by the Cultural Resources Commission prior to the issuance of the necessary development permits.	
Implementing Actions:	
1. Undertake a site selection study for a permanent fairgrounds site that encourages year-round use.	**NA**
2. Undertake a regional park master plan study to identify the needs and potential sites for expanded passive and active recreational uses in the planning region.	**NA**
3. Prepare and implement, as soon as possible, a plan for a major regional multi- purpose center to service the entire planning district. Also, investigate the need for an additional community center in Kahului and/or the upgrading and expansion of the existing Kahului Community Center.	**NA**
4. Continue to implement the plan for Keopuolani Park.	**NA**
ANALYSIS: The WCT provides an extensive network of neighborhood and community parks, open spaces and separated pedestrian and bicycle facilities throughout the Project. The Project's park facilities will provide diverse opportunities for community and family gatherings, passive recreation and active recreation. The park system may include shaded areas for picnics and barbeques, developed tot lot facilities for families with young children, areas for community gardening, and areas for active recreation such as soccer, football, baseball and basketball. The WCT's approximate 8-mile network of trails, walkways and bikeways will provide additional open land recreational opportunities while connecting the Project's residential areas, neighborhood parks and employment areas together. The Project's agricultural lands may also offer opportunities for horseback riding, hiking, and mountain bike riding.	
Social Services/Health	
Objectives and Policies:	
1. Support the expansion of services and facilities at the Maui Memorial Medical Center, the major primary care facility on the island, including the construction of a multi-level parking facility and a second roadway access.	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
2. Plan for the expansion of community services facilities, such as the Cameron Center.	**NA**
3. Expand social services for young and elderly persons.	**NA**
4. Continue to assess the social needs in the community and facilitate a coordinated response in the delivery of social services and programs for young, elderly, disabled and disadvantaged persons.	**NA**
5. Support the formulation of an elderly needs assessment study for Maui County by the State Department of Health and lobby for the implementation of needed programs and projects.	**NA**
6. Coordinate the provision of long-term care facilities and programs with other providers, such as Hale Makua and Hale Mahaolu.	**NA**
Implementing Actions:	
1. Acquire a minimum of 10 acres of land for expansion of Maui Memorial Medical Center as soon as possible.	**NA**
2. Provide a second roadway access to Maui Memorial Medical Center. As noted in the section on transportation, this access should precede or be concurrent with the extension of Mahalani Street.	**NA**
Public Safety	
Objectives and Policies:	
1. Maintain adequate police and fire protection services in the region.	**S**
2. Encourage communities to establish Neighborhood Crime Watch Programs.	**NA**
Implementing Actions:	
1. Study the feasibility of establishing fire and police protection facilities in the proposed Project Districts within the region.	**NA**
Objectives and Policies:	
1. Allocate sufficient land areas as part of residential project district specifications to meet future school site needs.	**S**
2. Encourage the Department of Education to provide recreation facilities for schools, thus expanding opportunities for public use of presently shared facilities.	**S**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
3. Coordinate the development of school facilities with the State Department of Education in conjunction with planned residential projects.	**S**
4. Support the establishment of a four-year university on Maui.	**NA**
5. Encourage apprenticeship or work study programs, in conjunction with higher educational or technical/vocational studies.	**NA**
6. Support efforts to expand the Maui Community College facilities and incorporate desired elements of Hawaiian architectural design.	**NA**
7. Support the improvement and maintenance of existing school facilities.	**NA**
8. Encourage the development of child care and pre-school facilities, in conjunction with major centers of employment.	**NA**
Implementing Actions:	
1. Where possible during the zoning process, ensure that applicants contribute to the development, funding, and/or construction of school facilities on a fair-share basis as determined by and to the satisfaction of the State Department of Education. Terms of the contribution shall be agreed upon by the applicant and the State Department of Education prior to the applicant applying for building permits.	**S**
ANALYSIS: The project site is being designed to accommodate a public elementary school campus on 12-acres adjacent to the proposed 18.5-acre community park. In addition, in 2007, the Hawai'i Legislature enacted Act 245 as Section 302A, HRS, "School Impact Fees". Based upon this legislation, the Department of Education has enacted impact fees for residential developments that occur within identified school impact districts. The Project is within the boundaries of the Central Maui Impact Fee District and is within the Wailuku Cost Area of that district. Projects within the district and cost area pay a construction fee and either a fee-in-lieu of land or a land donation, at the DOE's discretion. At the appropriate time, the applicant will contact the DOE to enter into an impact fee agreement. In order to reduce response times for both fire and medical emergencies, construction of a new fire station is planned in Waikapū. According to the Mayor's proposed 2013 capital	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
improvement program, the fire station will be situated on approximately 5 acres of the 100 acres recently acquired in Waikapū to accommodate a County campus for various departments. The CIP states that the 5-acre fire station will be located along the proposed Waiko Road Extension. The development of a fire station within Waikapū will bring the proposed project well within the County's desired response time standard.	
Government	
Goal: Government that demonstrates the highest standards of fairness; responsiveness to the needs of the community; fiscal integrity; effectiveness in planning and implementation of programs and projects; a fair and equitable approach to taxation and regulation; and efficient, results-oriented management.	
Objectives and Policies:	
1. Utilize the County's budgeting process as a means of carrying out the policies and priorities of the Community Plan.	**NA**
2. Utilize the County's real property tax assessment function as both a means to carry out the policies and priorities of the Community Plan and a mechanism for monitoring and updating the Community Plan.	**NA**
3. Streamline the land use, building permit and subdivision approval processes.	**NA**
4. Monitor the implementation of and compliance with the Community Plan.	**NA**
5. Ensure that adequate infrastructure is or will be available to accommodate planned development.	**S**
6. Support public and private partnerships to fund the planning and construction of infrastructure.	**S**
7. Encourage students within Maui County to participate in Maui County governmental affairs through such means as the submittal of testimony and resolutions on issues and concerns related to community affairs.	**NA**
8. Encourage cooperation and coordination between agencies, boards and commissions charged with land use planning and urban design and development within Wailuku Town.	**NA**
Implementing Actions:	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
1. Streamline the land use, building permit and subdivision processes through means such as consolidated public hearings and concurrent processing of applications.	**NA**
2. Adopt a beach-mountain access dedication ordinance pursuant to Chapter 46, Hawai'i Revised Statutes. This should be done as part of an island-wide comprehensive mountain and beach access study.	**NA**
3. Evaluate and modify present zoning and subdivision ordinances to incorporate the land use and design guidelines as well as other recommendations incorporated herein.	**NA**
4. Establish an additional government complex with adequate public parking in a central location.	**NA**
5. Maintain the War Memorial Complex for public parking and recreational uses only.	**NA**
6. Facilitate public access to information through the use of computers, microfiche/microfilm readers, and other tutorial services in County agencies.	**NA**
7. Re-evaluate the composition, role and boundaries of the Wailuku Redevelopment Agency to support its mission for the revitalization and enhancement of this district and explore ways to coordinate planning for Wailuku Town.	**NA**
8. Formulate special plans and studies to implement recommendations of the Community Plan. These would include water development and distribution, housing, local and regional circulation, drainage, solid waste and recycling, sewage disposal and treatment, human services, recreation, public safety and other special plans and studies as required.	**NA**
9. Prepare a progress report five years after the adoption of this plan for review by the public and Maui County Council describing the status of General and Community Plan implementation and actions taken to comply with same.	**NA**
ANALYSIS: Development of the WCT will require the provision of on- and off-site infrastructure to support the development. The Applicant will work with State and County agencies to define and coordinate the scope of these improvements, their location and timing. It is expected that the on- and off-site improvements will be phased over a ten year period as described in Section III.B.7 of the ~~DEIS~~ FEIS.	
Land Use	
Goal: Government that demonstrates the highest standards of fairness; responsiveness to the	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
needs of the community; fiscal integrity; effectiveness in planning and implementation of programs and projects; a fair and equitable approach to taxation and regulation; and efficient, results-oriented management.	
Objectives and Policies:	
1. Ensure that adequate lands are available to support the region's present and future agricultural activities	**S**
2. Identify prime or productive agricultural lands, and develop appropriate regulations for their protection.	**NA**
3. The direct and cumulative impacts of agricultural subdivisions and the impacts on the community shall be assessed and considered.	**NA**
4. Establish administrative procedures and standards within both the Department of Public Works and Waste Management and the Department of Planning, to ensure that agricultural subdivisions shall not be approved unless their uses are expressly permitted by Chapter 205, Hawai'i Revised Statutes.	**NA**
5. Encourage traditional Hawaiian agriculture, such as taro cultivation, within the agricultural district, in areas which have been historically associated with this cultural practice.	**S**
6. Establish an adequate supply of urban land use designations to meet the needs of the community over the next 20 years.	**S**
7. The Community Plan map shall define the urban growth limits for the region.	**NA**
8. Maintain a project district approach for the major residential growth areas adjacent to Wailuku, Kahului, and Waiehu to allow flexibility in master planning. These project districts may contain a variety of residential unit types as well as supporting community services, including business, public, recreational and educational facilities.	**S**
9. Maintain the existing Kahului Airport district boundaries, as defined in the Community Plan Land Use Map and continue to evaluate the air transportation needs of the County to determine future air transportation facility requirements. Create a direct control overlay district in and around Kahului Airport due to the public investment and the economic importance of the facility. The boundaries of this district shall be generally	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
defined by the 60 Ldn isoline (60 decibels, day- night average) of the FAA approved noise contour map for the airport. The intent of this district shall be to establish specific guidelines for development within the area which would define uses compatible with the airport and appropriate design standards, particularly with respect to noise attenuation to reduce interior noise levels to the 45 Ldn level or less. Total closure of structures, as well as air-conditioning, are generally required for this purpose. Residential uses should be discouraged within the 60 Ldn isoline.	
10. All zoning applications and/or proposed land uses and developments shall conform with the planned use designations, as specified in the adopted Community Plan Land Use Map, and be consistent with the Community Plan policies.	**S**
11. The subdivision ordinance should be revised to provide for public review of projects with significant impacts. Subdivision approval should consider environmental, economic, and social impacts of the project, including impacts on archaeological, historical and cultural resources.	**NA**
12. Establish a Wailuku Town Design District.	**NA**
13. Within the Wailuku Town core, formulate and implement flexible land use guidance policies that enhance the various activity centers and maintain the traditional character of the town. a. Civic Center District: This district defines the government office center and adjacent blocks of commercial use which are functionally related to the government center. This district is generally bounded by Main, South High, Kaohu, Napua, Uluwehi, South Church, Pakahi, South Market and Wells Streets. b. Wailuku Historic District: Protection of this complex of historic structures in a park setting will continue under the provisions of the current Community Plan. c. Commercial and Residential: The following comprise the commercial core, commercial areas, and surrounding residential uses:	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
1) Commercial Core. This area is generally situated along Central, Wells, Main, High, and Vineyard Streets. It should emphasize commercial uses oriented to serve the business and residential community. Ground floor activities should emphasize commercial retail with expansion of the variety and scope of offerings to serve residents. 2) Mixed Use Areas. These occur in several blocks adjacent to the commercial core and act as a transition between the core and single family residential areas. The business residential mix should be retained with intensification to accommodate multi- family and business uses. Patterns of mixed use could allow vertical mixture (residences over ground floor business) or horizontal mixture (business frontage and residences behind), or residential and business uses on adjacent lots. 3) Maintenance and rehabilitation of existing structures should be encouraged in a manner that respects the residential scale that now exists. Intensification of uses through new development would require consolidation of substandard lots. Performance criteria for rehabilitation and upgrading should be developed to permit more flexibility than present zoning and building code standards allow. 4) Single Family Residential. These areas surround the commercial and mixed use areas. The emphasis should be on preserving and rehabilitating existing housing, providing adequate circulation, and encouraging home maintenance and rebuilding of deteriorating structures. 5) Service Business/Single Family Residential. These uses occur primarily along the Waiheʻe side of Kaohu Street, and along the mauka side of South Market	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Street to permit a mixture of single family and duplex dwellings, with small-scale service and neighborhood oriented businesses which are established in previously utilized residential dwellings or other existing structures. The business use should be compatible with the physical character of the residential neighborhood.	
14. Maintain physical separation between traditional towns and villages in the region. Where possible, provide specific design or landscape elements, such as open space buffers or changes in streetscape, to clearly delineate the boundary between Kahului and Wailuku. Maintain open space around traditional rural areas, such as Waikapū and Waihe'e, to provide a sense of community and to prevent envelopment of these areas by urban expansion.	**S**
15. Provide a substantial greenway or greenbelt to serve as a buffer zone, line of demarcation, or definition between Wailuku and Waikapū, and between Waikapū and Ma'alaea, in order to prevent the continuation of urban sprawl. Changes in streetscapes could include landscaping and agricultural planting materials that reflect the character of each community, and are utilized to delineate a substantial boundary between Kahului and Wailuku.	**S**
16. Upon adoption of this plan, allow no further development unless infrastructure, public facilities, and services needed to service new development are available prior to or concurrent with the impacts of new development.	**S**
Implementing Actions:	
1. Establish zoning regulations to implement the land use recommendations in the Community Plan, including but not limited to Service Business/Single Family Residential (SBR), Business/Multi-Family (BMF), and Business/Industrial (BI).	**NA**
ANALYSIS: The Project will result in the urbanization of approximately 485 acres. However, as documented in the Agricultural Impact Assessment (See Appendix G) and in Section V.A.7 of the ~~DEIS~~ FEIS, the land proposed for urbanization represents a very small percentage of the agricultural lands available. There are approximately 2 million acres in the State Agricultural District. The subject development represents just .024% of this area. On Maui, there are approximately 82,582 acres of agricultural lands rated by the LSB as A,	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
B, or C. The subject development represents just 0.59% of these lands. Within Maui County, approximately 64,150 acres has been released from crop production since 1987. The subject development represents just 0.76% of these lands.[38] Moreover, in January 2016 HC&S announced that its sugar plantation on Maui would be closed after a final harvest. This event will release approximately 33,000 acres from production, which will dramatically increase the supply of land available for diversified agriculture. Thus, the urbanization of the subject 485 acres should have minimal long-term impact on the availability of agricultural land within the County and/or State since an abundance of other land, of a similar or higher quality, is currently fallow and available for production elsewhere. The WCTs agricultural component includes nearly 1,077 acres of land that will remain in agricultural use. Of these lands, approximately 800 acres will be permanently dedicated to agricultural use with no residential structures to be permitted. The remaining 277 acres may be subdivided into as many as five agricultural lots where a farm dwelling may be permitted. These lands will be used primarily for diversified agricultural development, but may also be used in appropriate ways for open land recreation and renewable energy generation. It is also expected that some of these lands may be used for community gardening and to support traditional Hawaiian agricultural practices. Kalo is currently being grown along the Waikapū Stream, within existing Kuleana lots. It may be possible for some of these activities to be expanded to suitable locations within the WCT. The WCTs agricultural lands will also serve the purpose of creating a permanent open space separation between the town of Waikapū and Mā‘alaea and will help to preserve mauka and makai views along Honoapi’ilani Highway. A Project District ordinance and design guidelines will guide the location, type and character of future urban and rural development within the WCT. As noted, the provision	

[38] Does not account for the release of an additional 33,000 acres from sugarcane resulting from the closure of HC&S. If these lands are added to the 64,150 acres released since 1987, then the subject development accounts for just 0.50 percent since 1987.

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
of on- and off-site infrastructure will be required to support the development. The Applicant will work with State and County agencies to define and coordinate the scope of these improvements, their location and timing. It is expected that the on- and off-site improvements will be phased in over a ten year period as described in Section III.B.7 of the ~~DEIS~~ FEIS.	
Infrastructure	
Goal: Timely and environmentally sound planning, development and maintenance of infrastructure systems which serve to protect and preserve the safety and health of the region's residents, commuters and visitors through the provision of clean water, effective waste disposal and drainage systems, and efficient transportation systems which meet the needs of the community.	
Water and Utilities	
Objectives and Policies:	
1. Coordinate water system improvement plans with growth areas to ensure adequate supply and a program to replace deteriorating portions of the distribution system. Future growth should be phased to be in concert with the service capacity of the water system.	**S**
2. Improve the quality of domestic water.	**NA**
3. Promote water conservation and education programs.	**S**
4. Protect water resources in the region from contamination, including protecting ground water recharge areas, and wellhead protection areas within a 1.25-mile radius from the wells.	**S**
5. Coordinate the construction of all water and public roadway and utility improvements to minimize construction impacts and inconveniences to the public.	**S**
6. Coordinate expansion of and improvements to the water system to coincide with the development of residential expansion areas.	**S**
7. Promote conservation of potable water through the use of treated waste water effluent for irrigation.	**S**
8. Encourage reasonable rates for water and public utility services.	**S**
9. Ensure that proliferation of telecommunication towers does not negatively impact the natural beauty of Maui County and the comfort and health of its residents.	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Implementing Actions:	
1. Update the County's Water Use and Development Plan and estimated water use for the Wailuku-Kahului region.	**NA**
2. Prepare or update a water improvement master plan for the Wailuku-Kahului region to be incorporated as a functional component of the Community Plan.	**NA**
3. Plan and construct water system improvements, including additional source, transmission, and storage capabilities.	**S**
4. Provide incentives for water and energy conservation practices.	**NA**
5. Coordinate the development of telecommunication towers by developing an ordinance governing telecommunication facilities.	**NA**
6. Relocate the Kahului Power Generating Facility out of the tsunami zone.	**NA**
7. Adopt a water allocation plan for the region and require that the use of water from the Central Maui Water System for future development shall be subject to the provisions of this water allocation plan.	**NA**
Promote and implement programs for ground water and wellhead protection.	**NA**

ANALYSIS: As discussed in Section V.D.4 (Water), the WCT has developed three on-site potable wells and two on-site non-potable wells to meet the Project's potable and non-potable water demand. Development of these wells is being done with input from the County's Department of Water Supply and the State Commission on Water Resources Management (CWRM). It is expected that the WCT water system will have sufficient capacity to accommodate the project and other potable water needs within the area.

The Applicant is proposing to develop a dual water system for potable and irrigation water demand. The non-potable system will service the WCTs park lands, open space and landscape planting of individual residential and commercial lots. It is expected that the dual system will reduce potable water demand by at least one-third. Moreover, the WCT will incorporate other water conservation measures into the project, such as low flow toilets and shower heads. Water conserving irrigation practices including using draught tolerant plants and drip irrigation will also be utilized to conserve non-potable water resources. In the future, when reclaimed water becomes available, it will also be

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
used within the Project in appropriate areas.	
Liquid and Solid Waste	
Objectives and Policies:	
1. Coordinate sewer system improvement plans with future growth requirements, as defined in the Community Plan.	**S**
2. As part of a county-wide solid waste management study, address the needs of the planning region for disposal and transfer sites with more convenience to residential areas. The collection system and location of disposal sites need to be improved to better serve residential areas.	**NA**
3. Reduce the disposal of solid waste in landfills through reducing the amount of material for disposal at the source (i.e. home composting of lawn or tree trimmings), reuse and recycling programs, bioconversion (i.e. composting) and the provision of convenient drop-off facilities.	**S**
4. Reuse the treated effluent from the County's waste water treatment system for irrigation and other suitable purposes in a manner that is environmentally sound.	**S**
Implementing Actions:	
1. Develop and implement a comprehensive waste management and recycling plan for the region.	**NA**
2. Explore feasibility of extending sewer service to unserviced areas as part of comprehensive sewer system planning.	**S**
3. Investigate the feasibility of constructing a wastewater treatment facility for the Central Maui area to service the future needs of population growth. Locations to be investigated include the airport area, the Puʻunene sugar mill area, and other areas east of Kūihelani Highway. Site conditions to be evaluated shall include, but not be limited to, potential odor problems with surrounding neighborhoods, corrosive environments, effluent disposal, groundwater contamination and project costs.	**S**
Relocate the Kahului Wastewater Treatment Plant out of the tsunami zone.	**NA**
ANALYSIS: As described in Section V.D.5 of the ~~DEIS~~ FEIS, the Applicant proposes to develop an on-	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
site wastewater reclamation facility to treat the Project's wastewater. The recycled water produced by the facility will be used for irrigation of the Project agricultural lands and may also be used for irrigation of urban parks, open spaces and landscape planting of commercial and residential lots. ~~As discussed in Section V.D.5 (Wastewater), the WCT will coordinate with the County of Maui, Department of Environmental Management, and if capacity is available at the KWRF, request treatment of up to 650 units within the first phase of the development. Based on pre-consultation conducted with the DEM, necessary upgrades to the off-site transmission system will be required in order to service WCT units at the KWRF. The WCT will also be developing its own private wastewater treatment facility, or developing a facility in association with the County and other neighboring landowners, to treat wastewater generated by the Project. If a joint facility is developed, it would accommodate wastewater generated by several other large projects in Central Maui including Wai`ale and the County's proposed regional park and governmental complex. Wastewater treated at the plant would be treated to R-1 quality and the treated water may be used for landscape irrigation at the County's 310-acre regional park and on other open space lands within the WCT and neighboring developments.~~ As discussed in Section V.C.6 (Solid Waste) the WCT will develop strategies for reducing solid waste delivered to the land fill by providing options for recycling and promoting recycling practices among residents and businesses.	
Drainage	
Objectives and Policies:	
1. Establish a storm drain improvement program to alleviate existing problems; implement a continuing maintenance program, and ensure that improvements to the system will meet growth requirements. This addresses safety and property loss concerns as well as the need for comprehensive flood control planning. a. Design drainage systems that protect coastal water quality by incorporating best management practices to remove pollutants from runoff. Construct and maintain,	**S**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
as needed, sediment retention basins and other best management practices to remove sediments and other pollutants from runoff. b. Construct necessary drainage improvements in flood-prone areas. Where replacement drainage is required for flood protection, these systems shall be designed, constructed, and maintained using structural controls and best management practices to preserve the functions of the natural system that are beneficial to water quality. These functions include infiltration, moderation of flow velocity, reduced erosion, uptake of nutrients and pollutants by plants, filtering, and settlement of sediment particles. The use of landscaped swales and unlined channels shall be urged.	
2. Respect natural drainageways as part of good land development.	**S**
3. Construct and maintain, as needed, desilting basins along major drainage channels.	**S**
4. Ensure that storm water run-off and siltation from proposed development will not adversely affect the marine environment and nearshore and offshore water quality. Minimize the increase in discharge of storm water runoff to coastal waters by preserving flood storage capacity in low-lying areas, and encouraging infiltration of runoff.	**S**
5. Encourage the incorporation of drainageways, setbacks, and flood protection areas into greenways consisting of open space, pedestrian way and bikeway networks.	**S**
Implementing Actions:	
1. Update and implement a drainage master plan for the planning region that considers the cumulative impacts of existing and planned development. The master plan shall guide future development while preventing flooding and providing guidance to reduce the degradation of coastal waters.	**NA**
2. Establish a comprehensive program of improvements to the storm drainage system; implement a maintenance program; and ensure that safety, property loss, pollutant removal, and the need for comprehensive planning, are considered. Maintain current drainage ways, swales and spillways.	**NA**
3. Revise the County drainage rules to require that drainage system design shall not	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
adversely affect downstream and coastal water quality.	

ANALYSIS: In accordance with the County's *"Rules for the Design of Storm Water Treatment Best Management Practices",* the design of the stormwater system will include water quality treatment to reduce the discharge of pollutants to the maximum extent practicable. Some examples of stormwater BMPs are:

- ***Grassed Swales.*** Grassed swales will be implemented within the landscaped areas where practical. Grass and groundcover provides natural filtration and allows for percolation into the underlying soils.
- ***Open Space and Parks.*** Open space and parks will be maintained with grass or other landscape materials, thereby reducing the amount of impervious surfaces and promoting infiltration.
- **Stormwater detention** collects stormwater allowing some of the suspended solids to settle out. The stored runoff infiltrates into the underlying soils and recharges groundwater. In accordance with the County's *"Rules for the Design of Storm Drainage Facilities",* the design of the drainage systems with retention basins shall be based on the following design conditions:

> *"In areas where the existing drainage systems are inadequate, the existing system shall be upgraded to handle runoff from the new project area or a new system shall be provided to connect to an adequate outlet. When there is no existing drainage system or adequate outlet to connect to, the additional runoff generated by the development may be retained on-site in a temporary retention basin with the following design conditions:*
>
> > *A. Storage volume of an infiltration basin, infiltration trench piping, or retention basin shall equal at least the total additional runoff volume for the appropriate storm intensity.*
> >
> > *B. Soil percolation shall not be used in satisfying required storage volumes.*
> >
> > *C. Fifty percent (50%) of voids within the rock*

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	

envelope for subsurface drains may be used in satisfying required storage volume provided that filter fabric is installed around the pipe and at the interface of the rock envelope and soil.

D. Sumps, detention and retention facilities will remain private.

E. Detention or retention ponds with embankment heights equal to or in excess of 50 acre-feet shall conform to all state and federal requirements relative to dams".

- ***Runoff from Agricultural Lands into the Waikapū Stream.*** The Applicant is working with Waikapū community stakeholders to address concerns regarding stormwater runoff from the agricultural lands that may be contributing to sedimentation of the Waikapū Stream. The implementation of on-site low impact development techniques (LID's) may help to mitigate these concerns. LID's that may be feasible along the upper reaches of the Waikapū Stream include: 1) a landscaped buffer and or riparian zone adjacent to the stream that is planted with vegetation to promote filtration and infiltration; 2) grass swales; and 3) bio-retention systems. All of these techniques are proven to promote infiltration and filtration of groundwater.

- ***Post-Construction Water Quality Goals and Standards.*** The Project's drainage system will be designed to meet the County's drainage and water quality standards. The project will also be required to comply with Ordinance 3902, which requires subdivisions to comply with Section 18.20.130 Post Construction Storm Water Quality Best Management Practices of the Maui County Code. The criteria for sizing of storm water quality facilities are:

  "(a) The criteria can be met by:

  (1) Either detaining storm water for a length of time that

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	

allows storm water pollutants to settle (detention treatment from such methods as extended detention wet and dry ponds, created wetlands, vaults/tanks, etc.);

(2) By use of filtration or infiltration methods (flow-through based treatment from such methods as sand filters, grass swales, other media filters, and infiltration);

(3) Short-term detention can be utilized with a flow-through based treatment system (e.g., a detention pond designed to meter flows through a swale of filter) to meet the criteria; or

(4) Upstream flow-through treatment and detention treatment can be utilized.

(b) Other proposals to satisfy the water quality criteria may be approved by the director if the proposal is accompanied by a certification and appropriate supporting material from a civil engineer, licensed in the State of Hawai'i, that verifies compliance with one of the following (by performance or design):

(1) After construction has been completed and the site is permanently stabilized, reduce the average annual total suspended solid ("TSS") loadings by eighty percent. For the purposes of this measure, an eighty percent TSS is to be determined on an average annual basis for the two-year/twenty-four hour storm.

(2) Reduce the post development loadings of TSS so that the average annual TSS loadings are no greater than predevelopment loadings."

BMPs will consist of grassed swales and retention basins sized adequately to promote infiltration and filter pollutants to meet water quality standards. Other Low Impact Development Techniques (LID's) will also be explored to help reduce runoff volumes, promote infiltration and filtration of groundwater. Some of these measures may include

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
promoting rain gardens, the use of rain barrels, developing green roofs, and use of permeable paving surfaces, where appropriate, within residential, commercial, and institutional developments. The Applicant will also explore the opportunity of utilizing bio-retention swales with native plantings at appropriate locations within the street network to reduce and filter stormwater runoff and to take advantage of natural drainage for irrigation. A maintenance plan will be developed for the stormwater BMPs. The plan will include the requirements for removal of the accumulated debris and sediment, maintaining vegetation, and performing inspections to insure that the BMPs are functioning properly. Moreover, stormwater runoff during site preparation will be controlled in compliance with the County Code Chapter 20.08 "Soil Erosion and Sediment Control Minimum BMPs". During the construction period, temporary erosion control measures will be incorporated to minimize dust and soil erosion. ~~Additional controls will be implemented to protect Waikapū Stream.~~ Temporary BMPs include the construction of diversion berms and swales, dust fences, silt fences, stabilized construction entrances, truck wash down areas, inlet protection, temporary grassing of graded areas, and slope protection. Water trucks and temporary sprinkler systems will be used to minimize dust generated from the graded areas. A National Pollution Discharge Elimination System (NPDES) permit will be required by the Department of Health prior to approval of the grading permit. The drainage design criteria will be to minimize any alterations to the drainage pattern of the existing onsite surface runoff. No additional runoff will be allowed to sheet flow toward Keālia Pond.	
Energy	
Objectives and Policies:	
1. Promote the use of alternative energy sources, such as biomass, wind and solar.	**S**
2. Develop efficient circulation systems, public transportation and promote bicycle and pedestrian travel to reduce energy expenditures for travel.	**S**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
3. Promote energy conservation and awareness programs.	**S**
4. Reduce domestic energy consumption.	**S**
5. Expand efforts to utilize environmentally and cost effective renewable resources for energy production, such as solar, biomass, and wind energy.	**S**
6. Encourage energy efficient building design and site development practices.	**S**
7. Support energy conservation measures, including the use of solar heating and photovoltaic systems, in conjunction with urban uses.	**S**
8. Promote recycling programs to reduce solid waste disposal in landfills.	**S**
9. Promote competition among energy providers to increase options and decrease costs to Maui County residents and government facilities.	**NA**
Implementing Actions:	
1. Adopt standards and regulations for the use of solar heating, low flush toilets and other conservation fixtures in new building construction.	**NA**
2. Develop and adopt an integrated energy functional plan for the County of Maui, including but not limited to, strategies for energy conservation, reuse of treated waste water, recycling, reduction in the use of fossil fuels, public education and awareness, and other strategies and actions related to transportation and utilities, housing, environment, urban design and economic activity.	**NA**
3. Develop incentives and requirements for energy efficient building design and site development practices through various approaches, including modifications to building codes and zoning and subdivision ordinances.	**NA**
4. Provide incentives to promote the use of alternative energy sources.	**NA**
5. Develop, compile and disseminate information on new energy technologies, policies, and programs relevant to the community's economy and environment.	**NA**
6. Identify energy-saving measures for all community buildings and facilities.	**NA**
7. As part of a County-wide waste management study, pursue the feasibility of utilizing resource recovery systems.	**NA**
8. Support reduction of entry barriers to distributed generation and other forms of alternative energy.	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
ANALYSIS: As discussed in Section V.D.2 "Electric, Telephone and Cable TV" the WCT will include energy-efficient design and conservation measures. Specifically, WCTs design guidelines will encourage the use of energy efficient technology throughout the project, specifically in lighting, air-conditioning, and building materials. Solar hot water heaters will be utilized throughout the residential portion of the development and installation of Photovoltaic Energy Systems will be encouraged, where appropriate, on residential and commercial buildings within the WCT. Additionally, the WCT proposes to develop, in appropriate locations within the agricultural district, solar farms to help off-set the Project's demand for carbon emitting electrical energy. Moreover, the WCT is utilizing New Urbanism best planning practices to help reduce automobile trips. Smart Growth helps to minimize automobile trips by providing employment, goods, services and housing all within walking or biking distance of each other. The WCT will have a unified pedestrian and bicycle system throughout the project that links the project site to its existing and future surroundings. The pedestrian and bicycle system will provide future residents an alternative to driving for traveling within the WCT and to neighboring developments.	
Transportation	
Objectives and Policies:	
1. Enhance circulation by improving road maintenance; improving or providing traffic signals and turning lanes at congested intersections; and by providing street and destination signs. Important intersections include Lono and Papa Avenues, and intersections along Papa Avenue, Wakea Avenue, and North Market Street. Additional turning lanes, traffic signals and roadway improvements in the Wailuku Town core should be designed to facilitate safe traffic movement and be compatible with the traditional character of the area.	**NA**
2. Provide bikeway and walkway systems in the Wailuku-Kahului area which offer safe and pleasant means of access, particularly along routes accessing residential districts, major community facilities and activity centers, school sites, and the shoreline between Kahului Harbor and Pa'ia.	**S**
3. Expand parking facilities serving the civic and commercial centers of Wailuku. Parking	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
improvements should include expanding the existing public parking facilities off Market Street and around the civic center, and improving controls over existing civic center parking to reserve it for short-term use. Explore the feasibility of a shuttle service for County employees to remote parking facilities.	
4. Support private efforts to expand public transit service, with an emphasis on service to the Kahului Airport and Wailuku Civic Center. Future growth in population will warrant an expanded public transportation system.	**S**
5. For future residential development, prohibit direct lot access from primary roads.	**NA**
6. Accommodate bicycle and pedestrian ways within planned roadway improvements.	**S**
7. Support the extension of the Kahului Airport runway, access road improvements, and other related facility improvements, including expansion of the adjacent shoreline area for public park uses.	**NA**
8. Support the expansion of Kahului Harbor, the island's primary commercial harbor, to accommodate long-term needs. The State Department of Transportation should be encouraged to allow recreational uses by canoe clubs or provide an alternative site for such uses in its long range master plan. The harbor master plan should also incorporate safe bicycle and pedestrian access. Support the investigation of alternative sites for a second commercial harbor facility on the island of Maui. Further, the State Department of Transportation should be strongly encouraged to mitigate its traffic impacts prior to or in conjunction with the Harbor expansion, including, but not limited to, the following: a. Improve the intersections between Ka'ahumanu Avenue and Wharf Street and Hobron Avenue; b. Provide alternative and bypass routes for vehicular traffic, possibly including a direct route to Kahului Airport; c. Provide safe (possibly underpass) routes for pedestrian traffic; d. Acquire pockets of land for more efficient facility location within Kahului	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Harbor; and e. Work with the community to plan a second commercial harbor.	
9. Support the extension of Wai`ale Drive to a new intersection with Honoapi'ilani Highway south of Waikapū Village.	**S**
10. Preserve the Wai`ale Bridge and the significant subsurface archaeological sites in the Wai`ale Drive corridor, from the Mahalani Street intersection to Lower Main Street, by maintaining the existing roadway width.	**NA**
11. Preserve the character of Honoapi'ilani Highway between Waikapū and Wailuku by maintaining two travel lanes and the existing trees.	**NA**
Implementing Actions:	
1. Establish ordinances to designate truck or other heavy vehicle weight commercial traffic routes to relieve traffic impacts on residential neighborhoods and the traditional town center.	**NA**
2. Re-establish school bus routes and stops to minimize impacts on residential neighborhoods and provide sheltered stops where appropriate.	**NA**
3. Study traffic patterns and circulation at intersections adjacent to school sites prior to road construction, to ensure safe access.	**S**
4. Study circulation patterns at school sites.	**S**
5. Implement the State Department of Transportation Bikeway Master Plan and the County Bikeway Plan.	**S**
6. Update and implement the Department of Transportation's Maui Long Range Planning Study: Islandwide Plan and other traffic master plans to implement the Community Plan. The improvements to the regional roadway network should include but not be limited to the following: a. <u>Maui Lani</u> 1) Extend Lono Avenue, Kamehameha Avenue, and Onehee Street into the Maui Lani Project District.	**S**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
2) Provide interconnections with the Maui Lani roadway network to Kūihelani Highway, Honoapi'ilani Highway, and Wai`ale Drive in order to provide maximum flexibility for the additional traffic to be generated by Maui Lani and to reduce its impact on adjoining existing neighborhoods. 3) The extension of Lono Avenue to Kūihelani Highway should precede the Kamehameha Avenue and Onehee Street extensions. If the Maui Lani project does not proceed in a timely manner, the County should move forward with the Lono Avenue extension. 4) Upgrade Mahalani Street, Kamehameha Avenue, Onehee Avenue and Lono Avenue to County collector road standards. 5) Plan the Maui Lani Parkway as an arterial road. b. <u>Kahului</u> 1) Improve Dairy Road between Kūihelani Highway and Keolani Place. 2) Improve major intersections to accommodate increased traffic volumes, including turning lanes, signals, and other improvements, including but not limited to the corridors of Kamehameha, Pu'unene and Wakea Avenues. 3) Construct the planned Airport Access Road. 4) Improve existing roadway systems within the Kahului Light Industrial area and accessing Kahului Airport to facilitate egress/ingress and to provide for the safe and convenient flow of traffic.	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
5) Improve Kahului Beach Road between Ka‘ahumanu Avenue and Waiehu Beach Road/Lower Main Street. 6) Improve Lower Main Street. c. <u>Wailuku</u> 1) Establish additional major routes between Kahului and Wailuku by utilizing the major road systems of the Maui Lani and C. Brewer Project Districts with connections to Honoapi’ilani and Kūihelani Highways and Wai`ale Road.  2) Extend Mahalani Street as a through connection between Ka‘ahumanu Avenue and Wai`ale Road. The Mahalani extension should be preceded by, or constructed concurrently with, a second roadway access to Maui Memorial Hospital. 3) Establish a new Wailuku through road connecting Honoapi’ilani and Kahekili Highways, utilizing the existing Wai`ale Road right-of- way, the old cane haul road, as well as the major roads in the Piihana Project District. 4) Establish a new access road to serve the existing and proposed golf courses to alleviate through traffic in Waihe‘e town. 5) Provide left turn lanes on Lower Main Street between Mill Street and Wai`ale Drive.  6) Facilitate or expedite the connection of Wai`ale Drive to Kuikahi Drive.	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
7) Improve Wai`ale Drive and plan for a future connection to the Honoapi'ilani Highway south of Waikapū. d. <u>Other</u> 1) Improve Honoapi'ilani Highway south of Kūihelani Highway. 2) Improve Kūihelani Highway from Pu'unene Avenue to the future Maui Lani Parkway and plan for the continuation of such improvements to Honoapi'ilani Highway. 3) Plan and construct a Pu'unene Bypass that would connect the Mokulele Highway and Kūihelani Highway and continue to Ka'ahumanu Avenue, via the future Maui Lani Parkway. 4) Plan and implement improvements to Ka'ahumanu Avenue as soon as possible. 5) Acquire and maintain Waiko Road as a public vehicular right-of-way. 6) In addition to other roadway improvements, implement other alternatives for improving traffic circulation in the region through signalization, one-way streets, prohibiting on-street parking and heavy-weight vehicles, and establishing time controls. 7) Provide a second roadway access connecting to the Maui Memorial Medical Center. This access should precede, or be developed concurrently with, the extension of Mahalani Street.	
<u>ANALYSIS:</u> As discussed in Section V.D (Infrastructure) the WCT will provide a variety of traffic related improvements that will address the traffic impacts specifically related to the Project. In addition, the Applicant will coordinate with neighboring land owners and the State and County to address the need	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
for regional improvements that will be warranted by development of the WCT, together with neighboring projects. Regional traffic improvements may include planning for the Wai`ale Bypass road and traffic signalization to enhance the inter-regional mobility in Central Maui. The WCT's non-vehicular transportation strategy includes: 1) compact and mixed-use development patterns, 2) pedestrian oriented streets integrating street trees, sidewalks, and traffic calming, 3) both striped and separated bike lanes in appropriate locations, 4) a network of greenways and parkways to facilitate mobility, and 5) providing connectivity to adjacent developments, such as the Wai`ale development and the State and County's proposed regional parks. In addition, transportation demand management measures include: 1) encouraging alternate work schedules and off peak hours for employment generators, and 2) supporting park and ride, ridesharing, carpooling and van pooling, regional and sub-regional shuttles.	
Urban Design	
Goal: An attractive and functionally integrated urban environment that enhances neighborhood character, promotes quality design, defines a unified landscape planting and beautification theme along major public roads and highways, watercourses and at major public facilities, and recognizes the historic importance and traditions of the region.	
Objectives and Policies of the Wailuku-Kahului Region in General:	
1. Enhance the appearance of major public roads and highways in the region.	**S**
2. Maintain a design quality for commercial and public projects and large-scale master planned developments.	**S**
3. Improve pedestrian and bicycle access within the region.	**S**
4. Establish, expand and maintain parks, public facilities and public shoreline areas.	**NA**
5. Integrate stream channels and gulches into the region's open space system for purposes of safety, open space relief, greenways for public use and visual separation. Drainage channels and siltation basins should not be used for building sites, but rather for public open space. Drainage channel rights-of-way and easements may also be used for	**S**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
pedestrian and bikeway facilities.	
6. Promote a unified street tree planting program along major highways and streets.	**S**
7. Buffer public and quasi-public facilities and light-heavy industrial/commercial type facilities from adjacent residential uses with appropriate landscape planting.	**NA**
8. Maintain shrubs and trees at street intersections for adequate sight distance.	**S**
9. Save and incorporate healthy mature trees in the landscape planting plans of subdivisions, roads and other developments.	**S**
10. Incorporate drought tolerant plant species and xeriscaping in future landscape planting.	**S**
11. Use native Hawaiian plants for landscape planting in public projects to the extent practicable.	**S**
12. Existing and future public rights-of-way along roads and parks shall be planted with appropriate trees, turfgrass and ground covers.	**S**
13. Encourage neighborhoods and community organizations to upgrade and maintain streets and parks in accordance with the Maui County Planting Plan of the Arborist Committee.	**NA**
14. Require all future subdivisions, construction projects and developments to comply with the adopted Maui County Planting Plan.	**S**
15. Emphasize contrasting earth-tone color schemes for buildings and avoid bright or garish colors. Within Wailuku Town, require buildings that have bright or garish colors to comply with earth-tone color schemes.	**S**
16. Encourage the review of architectural and landscape architectural plans for major government projects by the County's Urban Design Review Board.	**NA**
ANALYSIS: The Applicant is establishing wide setbacks along Honoapi'ilani Highway to allow for pedestrian and bicycle facilities and the establishment of landscape planting. As is common throughout Hawai'i, and especially on Maui, the planting of large canopy Monkey Pod trees, tropical shrubs and bushes and grass will be maintained to create a sense of separation and definition between the urban development and the highway. Separated from the highway, an approximate 10-foot wide shared pedestrian and bicycle	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
track will meander along the roadway's frontage. The overall effect will be to create a sense of enclosure, with a variety of tropical colors, and the presence of intermittent views of Haleakalā and the West Maui Mountains along the frontage of the development. Within the Project, roadways will also be aligned, where feasible, to capture mauka and makai view corridors. This opportunity exists at each entrance into the project site and along internal roadways that travel from east to west. Within the project site, the WCT Master Plan will transform the current character of the MTP from a visitor oriented attraction to a park-like town center, with its existing lagoon, gardens, open spaces, shops, and restaurants coming together to create a unique sense of place. While the existing agricultural and open space ambiance of the lands abutting the MTP will be transformed to an urban settlement pattern, the WCT will maintain a rural and agricultural ambiance at its boundaries because of the preservation of the agricultural lands comprising the agricultural preserve. The WCT Master Plan Design Guidelines will limit building heights, where necessary, in order to maintain views towards the summits of Haleakalā and the West Maui Mountains. Moreover, open space will be integrated throughout the Project and, together with the proposed street layout, will create and frame view corridors throughout the WCT to the Pacific Ocean, Haleakalā, and the West Maui Mountains. From an urban design perspective, the proposed project will complement the unique country-town architectural character that exists in Waikapū, Wailuku, Pāʻia, and Makawao. The WCT design guidelines are being developed to control the density, architectural design, and variation of all buildings in the WCT without sacrificing views or the aesthetic character of the development. The goals of the design guidelines will be to preserve views and maintain the aesthetic character of the community. A defining quality of the urban design character of the development will be to create architecturally pleasing streets with landscape planting that frames the travel ways and provides scale around architectural	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
elements.	
Objectives and Policies for Wailuku Town:	
1. Maintain the existing character of historic Wailuku Town.	**NA**
2. Support the creation of a Wailuku Town Design District and the adoption of design guidelines for the town core, excluding properties designated for single family residential use. The objective is to integrate the design elements of multi- family, commercial and public properties in Wailuku Town and to retain the traditional town character. The design district boundaries should include the following areas, as depicted on the attached map: a. The area bounded by High, Vineyard, Central and Main Streets, including the Wailuku Redevelopment District; b. The area bounded by High, Main, North Market and Kaohu Streets, including the Civic District; c. Both sides of Main Street from Central Avenue to the Wailuku Bridge; and d. Both sides of Market Street from Vineyard Street to Piihana Road in Happy Valley.	**NA**
3. Circulation and Parking. a. Provide for the Wai`ale Drive bypass to Honoapi'ilani Highway and road connection from Lower Main Street across ʻĪao Stream to Kahekili Highway. b. Maintain the existing character of streets in the commercial core along Vineyard, Market, Central and Main Streets. c. Expand public parking facilities at the Wailuku Municipal Parking Lot and provide for safe and convenient bicycle parking in Wailuku town. d. Provide a continuous and pleasant pedestrian pathway connecting the Historic District, Civic Center, commercial office areas and park and public facilities.	**NA**
3. Building Form and Character. The following design policies shall express the Council's	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
intent as it relates to urban design for properties designated for commercial and business multi-family use along and bounded by Spreckels Ditch and Wells, High, and Vineyard Streets--Wailuku Town's commercial district. They shall serve as a supporting rationale during the development and adoption of design guidelines for the above area. They shall also serve as a reminder of the Council's intent as the guidelines are amended. (See Exhibit "D".) a. Maintain the area's small-town profile and character to allow present land uses, and to allow mixed use zoning with residential uses above and in back of commercial properties. The identifying core and focus is the County seat with its present government building heights, with decreasing heights through the concepts of "Step Zoning" and "Stepping a Building" as one moves away from the streetscape. A mixture of one, two, three and four story heights is desirable because it will support the type of land use intensity that is needed to encourage investment and economic viability; yet it is compatible with the area's small-town profile and character. b. Where commercial areas abut residential blocks, a transition in height should be required to achieve compatibility with the residential scale. c. Utilize architectural treatments such as facade and roof modulation to break up the mass and reduce the apparent size of the buildings. d. Protect mauka (mountain) and makai (ocean) view planes. e. Foster an interesting and active street scene by developing a community gathering place, providing historically sensitive street furniture and making streetscape enhancements.	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
f. Emphasize the continuity of commercial frontages along the main shopping streets, primarily on Market, Main and Vineyard Streets, by maintaining uniform building setbacks along the street frontages. Commercial displays should continue to emphasize and enhance the pedestrian experience. Interruptions, such as blank facades, should be avoided. g. Emphasize continuity in architectural details and materials through the following facade treatments: 1) Second story balconies and recesses to create interest. 2) Ground floor display windows to heighten visual interest. 3) Compatibility in color by emphasizing earth tones and avoidance of bright or garish building colors which greatly contrast with their surroundings. 4) A variety of signs which do not compete for attention or distract from the overall street appearance. 5) Awnings or canopies that provide shelter over sidewalk areas and protect store entrances.	
5. Landscape Character: pending adoption of design guidelines for Wailuku Town, utilize the following interim guidelines in the review of projects. a. Maintain the landscape character and open space of the Wailuku entry along South High Street by preserving mature vegetation. b. Establish a unified street tree planting theme for streets within the commercial core which are to be pedestrian oriented. c. Foster the development of mini-parks where appropriate and a community beautification program.	**NA**
6. The Maui Redevelopment Agency (MRA) shall be encouraged to consult with the Cultural Resources Commission in the formulation of and/or amendments to the Wailuku	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Town Design Guidelines.	
Objectives and Policies for Kahului:	
1. Within industrial subdivisions, encourage the establishment of design standards for individual projects, including a unified streetscape planting theme and program, in order to enhance the visual quality of industrial developments.	**NA**
2. Circulation: provide and maintain sidewalks and bikeways for convenient and pleasant connections between activity centers, such as shopping centers, schools, Maui Community College and public parks. These pathways should have adequate separation from vehicular traffic for safety purposes.	**NA**
3. Building Form and Character: maintain compatible scale relationships between the existing low-scale character of the area, adjacent public uses and higher buildings. a. Building heights for the hotel-designated district fronting the ocean side of Ka‘ahumanu Avenue shall not exceed ten stories in order to provide a dynamic skyline and identifiable hotel district. b. The low-rise character of the central business area should be maintained. Higher building forms up to six stories should be sited in the central portion of commercial blocks. c. Building heights along the perimeter of commercial blocks should provide a transition in scale to adjacent public and quasi-public uses. d. Commercial uses along the perimeter of central business area blocks should be low-rise and provide sufficient setbacks to allow landscaped buffers along street frontages.	**NA**
1. .Landscape Character a. A coordinated landscape theme should be established from the airport to Kahului, with landscape buffers established along Keolani Place, Hana Highway, and Ka‘ahumanu Avenue.	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
b. Landscaping along Dairy Road between Keolani Place and Pu‘unene Avenue should be established and coordinated with the landscaping of the airport-Kahului roadway approach routes. c. Parkway character should be established along Ka‘ahumanu Avenue, from Kahului to Wailuku. Keopuolani Park plans should be updated and made an integral part of the area’s landscaping. d. Open parking areas should be landscaped to provide visual screening and shade. e. The perimeters of the central business area blocks should provide landscape buffers as part of a coordinated landscape theme to enhance their visual image. f. The mature landscape character of Kahului’s commercial areas should be preserved and incorporated into future development plans, subject to review by the County’s Arborist Committee. g. The landscape treatment along streets within the central business area should be extended along major collector roads serving adjacent residential neighborhoods, including Pu‘unene, Kamehameha and Lono Avenues.	
Implementing Actions:	
1. Implement a unified landscape planting theme along Ka‘ahumanu Avenue from Kahului to Wailuku and along other major public roadways.	**NA**
2. Establish a Wailuku Town Design District with adopted design guidelines.	**NA**
3. Implement related actions specified in the Transportation section of the Community Plan related to roadways, pedestrian and bikeway improvements.	**NA**
4. Provide pedestrian and bicyclist amenities within Wailuku Town, including shaded rest stops, bicycle parking, trash receptacles and public restroom facilities.	**NA**
5. Incorporate a landscape planting master plan in the update and implementation of the	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
Keopuolani Park plan.	
6. Amend the Public/Quasi-Public zoning standards to enable greater heights for Public/Quasi-Public uses such as Maui Community College and the Maui Memorial Medical Center to permit facility expansion consistent with the architectural parameters of existing facilities.	**NA**
Planning Standards	
Goal: The following planning standards are guides for development and design. These standards are essential in clarifying the intent of the land use and town design objectives and policies and the Land Use Map.	
Objectives and Policies:	
1. <u>Land Use</u> a. All zoning applications and/or proposed land uses and developments shall conform with the planned use designations, as specified in the adopted Community Plan Map, and be consistent with the Community Plan policies. b. Any proposed development of the Pestana property (TMK: 3-4-30:09), the Ige property (TMK: 3-4-30:10), and the Schenk property (TMK: 3-4-30:11), shall be reviewed and approved by the Maui-Lana`i Burial Council, Historic Preservation Division, State Department of Land and Natural Resources. Existing sand dune features shall be maintained. c. Development of the vacant properties in the Dairy Road Light Industrial Expansion (Matrix 33), identified as TMK: 3-8-1: portion of 2 and 3-8-6: portion of 4; and the Airport Triangle (Matrix 34), identified as TMK: 3-8-79:13, shall provide a landscaped aesthetic visual corridor along all adjacent highways. Additionally, a landscaped berm utilizing trees and shrubbery shall be constructed along the entire proposed collector road (Ho‘okele Street Extension) to soften the visual impact of the buildings along the road. Ingress/egress or other improvements	**S**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
mandated by engineering safety standards shall be exempt. Additionally, alternative energy shall be utilized, including, but not limited to, the use of solar energy to heat water. Underground utilities and low impact lighting to preserve the visual appearance of the area shall also be utilized. Signalized intersections shall be minimized on the Ho'okele Street Extension, and shall be installed only when warranted by standard traffic engineering requirements. In addition, the said Dairy Road Light Industrial Expansion (Matrix 33), shall be constructed in increments of not greater than seventy (70) acres. Building permits shall not be authorized for each increment until completion of the infrastructure construction for the prior increment. The Ho'okele Street Extension, or similar thoroughfare connecting Dairy Road to Hana Highway, shall be constructed concurrently with development of the first increment. The exact location of the Ho'okele Street Extension shall be determined as a part of the property's zoning approval, with an emphasis on maintaining a "view corridor" toward Haleakalā.	
2. <u>Cultural Resources</u> a. Require development projects to identify significant cultural resources located within the project area as part of initial project studies. Further require that all proposed activity include recommendations to mitigate potential adverse impacts on cultural resources.	**S**
3. <u>Urban Design</u> a. <u>General</u> 1) Buffer public and quasi-public facilities and light-heavy industrial/commercial type facilities from adjacent residential uses with appropriate landscape	**S**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
planting and setbacks. 2) Save and incorporate healthy mature trees in the landscape planting plans of subdivisions, roads and other developments. 3) Incorporate drought tolerant plant species and xeriscaping in future landscape planting. 4) Use native plants for landscape planting in public projects to the extent practicable. 5) Emphasize contrasting earth-tone color schemes for buildings. 6) Allow for greater building heights for public and quasi-public facilities such as educational facilities, medical facilities, and fire stations.	
b. Wailuku Town Building Form and Character. The following design policies shall express the Council's intent as it relates to urban design for properties designated for commercial and business multi-family use along and bounded by Spreckels Ditch and Wells, High, and Vineyard Streets--Wailuku Town's commercial district. They shall serve as a supporting rationale during the development and adoption of design guidelines for the above area. They shall also serve as a reminder of the Council's intent as the guidelines are amended. 1) Maintain the area's small-town profile and character to allow present land uses, and to allow mixed use zoning with residential uses above and in back of commercial properties. The identifying core and focus is the County seat with its present government building heights, with decreasing heights through the concepts of "Step Zoning" and "Stepping a Building" as one moves away from the streetscape. A mixture of one, two, three and four story heights is desirable because it will support the type of land use intensity that is needed	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
to encourage investment and economic viability; yet it is compatible with the area's small-town profile and character. 2) Where commercial areas abut residential blocks, a transition in height should be required to achieve compatibility with the residential scale. 3) Utilize architectural treatments such as facade and roof modulation to break up the mass and reduce the apparent size of the buildings. 4) Protect mauka (mountain) and makai (ocean) view planes. 5) Foster an interesting and active street scene by developing a community gathering place, providing historically sensitive street furniture and making streetscape enhancements. 6) Emphasize the continuity of commercial frontages along the main shopping streets, primarily on Market, Main and Vineyard Streets, by maintaining uniform building setbacks along the street frontages. Commercial displays should continue to emphasize and enhance the pedestrian experience. Interruptions, such as blank facades, should be avoided. 7) Emphasize continuity in architectural details and materials through the following facade treatments. a) Second story balconies and recesses to create interest. b) Ground floor display windows to heighten visual interest. c) Compatibility in color by emphasizing earth tones and avoidance of bright or garish building colors which greatly contrast with their surroundings. d) A variety of signs which do not compete for attention or distract from the	

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
overall street appearance. e) Awnings or canopies which provide shelter over sidewalk areas and protect store entrances.	
c. <u>Kahului</u> 1) Within industrial subdivisions, encourage the establishment of design standards for individual projects, including a unified streetscape planting program and appropriate setbacks, in order to enhance the visual quality of industrial developments. 2) Building Form and Character: maintain compatible scale relationships between the existing low-scale character of the area, adjacent public uses and higher buildings. a) Building heights for the hotel-designated district fronting the ocean side of Ka‘ahumanu Avenue shall not exceed ten stories in order to provide a dynamic skyline and identifiable hotel district. b) The low-rise character of the central business area should be maintained. Higher building forms up to six stories should be sited in the central portion of commercial blocks. c) Building heights along the perimeter of commercial blocks should provide a transition in scale to adjacent uses. d) Commercial uses along the perimeter of central business area blocks should be low-rise and provide sufficient setbacks to allow landscaped buffers along street frontages.	**NA**

WAILUKU-KAHULUI COMMUNITY PLAN	RATING
Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable	
4. <u>Environmental</u> a. Protect shoreline wetland resources and flood plain areas as valuable natural ecosystems and open space resources. b. Encourage the use of siltation basins and other erosion control features in the design of drainage systems.	**S**
***<u>ANALYSIS</u>*:** The WCT will be developed in a manner that is consistent with the Wailuku-Kahului Community Plan. A Cultural Impact Assessment was prepared as part of the ~~DEIS~~ <u>FEIS</u> (See Appendix F) and its recommendation will be implemented to mitigate potential impacts to cultural resources. As described in Section V.D.3 of the ~~DEIS~~ <u>FEIS</u>, construction and operation phase BMPs will be implemented to mitigate drainage related impacts to downslope properties and nearshore waters.	
5. <u>Project Districts</u> The implementation strategy for large-scale planned developments within the planning region is to utilize the project district development approach. This provides for flexibility in master planning rather than specifying detailed land use patterns. The project district is implemented in accordance with Maui County Code Chapter 19.45. Because of the variety of conditions and constraints related to the different project districts, each will be implemented through a separate zoning ordinance. Each project district ordinance will specify the permitted uses, densities, design guidelines and other requirements, consistent with the project district description and related policies specified in the Community Plan.	**S**
<u>ANALYSIS:</u> The WCT will be developed pursuant to MCC Chapter 19.45, "Project District Processing Regulations". The project district ordinance will specify permitted uses, densities, design guidelines and other development standards to effectuate implementation of the WCT Master Plan.	

I. COUNTY ZONING

Title 19 of the Maui County Code provides comprehensive zoning for the County. The purpose and intent of this comprehensive zoning is to regulate the utilization of land in a manner that encourages orderly development that protects the health, safety and welfare of the people of the County.

The WCT will require a Change in County Zoning in order to bring the entire area proposed for urban and rural development into a Project District, pursuant to the requirements of MCC 19.45. As stated in MCC 19.45.010, the intent of the project district ordinance is as follows:

> "…to provide for a flexible and creative planning approach rather than specific land use designations, for quality developments. The planning approach would establish a continuity in land uses and designs while providing for a comprehensive network of infrastructural facilities and systems. A variety of uses as well as open space, parks, and other project uses are intended in accord with each individual project district objective."

Pursuant to Chapter 19.510.040 Change in Zoning, of the Maui County Code a Change in Zoning may be granted by the County Council provided that all of the following criteria are met:

1. The proposed request meets the intent of the General Plan and the objectives and policies of the community plan of the County.

Analysis. As discussed in Section VII.H the WCT meets the intent of the General Plan, which comprises the goals, objectives and policies of the County-wide Policy Plan, Maui Island Plan and Wailuku-Kahului Community Plan. The Project site is located entirely within the MIPs Small Town Growth Boundary and the Project is being developed in accordance with the MIPs Planned Growth Area planning guidelines for the Project.

2. The proposed request is consistent with the applicable community plan land use map of the County.

Analysis. Community Plan Amendments are required for the approximate 499 acres of land that are proposed for development. The existing MTP properties, TMK Nos. (2) 3-6-005:007 and (2) 3-6-004:006, will require a change from the existing Wailuku-Kahului Project District No. 5 (Maui Tropical Plantation) to a new Project District. The new Project District Community Plan designation will reflect the character and uses described in the ~~DEIS~~ FEIS. The Project District designation will serve to implement the WCT Master Plan vision and the goals, objectives and policies of the MIP and the Wailuku-Kahului Community Plan. The Project District designation will also provide the policy direction for the preparation of the WCTs Project District Ordinance.

3. The proposed request meets the intent and purpose of the district being requested.

Analysis. Concurrently with the filing of the community plan amendment, a project district ordinance will be filed in accordance with MCC Chapter 19.45 to allow for development of the project site, in accordance with the WCT Master Plan vision and the MIP and Wailuku-Kahului Community Plan goals, objectives and policies.

4. The application, if granted, would not adversely affect or interfere with public or private schools, parks, playgrounds, water systems, sewage and solid waste disposal, drainage, roadway and transportation systems, or other public requirements, conveniences and improvements.

Analysis. As discussed in Sections V.C and D, the development of the WCT will not adversely affect public or private schools, parks, playgrounds, or infrastructure such as drainage or transportation systems. Mitigation measures such as on-site schools and parks and the payment of applicable impact fees will help to off-set the increase in demand for these facilities created by the Project. The development will include walking and biking pathways, and on- and off-site roadway improvements to increase mobility. Other infrastructure improvements include a drainage system that will contain on-site any increase in run-off created by the Project.

5. The application, if granted would not adversely impact the social, cultural, economic, environmental and ecological character and quality of the surrounding area.

Analysis. As discussed in Section V.A.4-5 and Section V.B.3-4 of the ~~DEIS~~ FEIS, with the implementation of the described mitigation measures the WCT will not impact historic, archaeological or cultural resources. However, the project will improve Maui's economy by creating short-term construction related employment and longer-term operation phase employment. The WCT is expected to indirectly support Maui's existing economic base activities by providing much needed housing to serve the island's workforce. The WCT will provide housing along with supporting commercial, employment and institutional uses that will allow for the growth and diversification of Maui's economic base industries, while also allowing for them to become more sustainable - including the island's agricultural industry.

As discussed in Section V.B.3-4 (Economy), the WCT will bring in ~~$609.1~~ $ 644.1 million of new capital investment into the Maui economy. The construction of the WCT components will directly create an estimated ~~2,320~~ 2,476 "worker-years" of employment (the equivalent of 52 work weeks at 40 hours per week) in the trades and associated businesses during build-out, averaging about 165 Full Time Equivalent (FTE) per year for the 15 years of building. Most of these positions will not be new jobs for new businesses, but work flowing to existing contractors and suppliers. ~~positions 193 worker years annually, with an estimated $188.3 million in wages (averaging about $15.7 million per year).~~

The 169,000 square feet of new commercial operation will generate some 4,251 FTE worker years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions. These jobs will be new positions in the Maui economy. This total does not include the employment, wages or business activity contributions of the existing 29,250 square feet of commercial space in the Maui Tropical Plantation which will be retained.

The Project will require an estimated 66 worker years of maintenance and common area element employment on a continual basis, and will generate some 1,750 1,789 worker years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions. In aggregate, during the development of the WCT 8,750 8,946 worker years of employment will be created during construction and operations, on-site/direct and off-site/indirect, with stabilized employment after completion of 746 jobs. During the 15 years projection period, WCT will have

a base economic impact on Maui of some $817.1 million in new monies with a stabilized annual benefit of $32.1 million thereafter.

Regarding historical and archaeological resources, an Archeological Inventory Survey (AIS) was conducted on the property. During the investigation, no evidence of traditional Hawaiian activities, with the possible exception of Site 7882 (remnant retaining wall or terrace) was recorded. These negative results are primarily due to the compounded disturbances from sugarcane cultivation, historic habitation and modern land use. Archaeological monitoring is recommended for those areas that contain former LCA's and Grants. Prior to the commencement of construction, an Archaeological Monitoring Plan (AMP) detailing the localities to undergo monitoring procedures will be prepared and submitted to SHPD for review and approval. The project is not expected to have an adverse impact upon archaeological or historical resources.

The WCT intends to create a sense of place within the community that reflects the cultural values, traditions and history of Hawai'i, and more specifically Waikapū. In preparing the ~~DEIS~~ FEIS, a Cultural Impact Assessment (CIA) was prepared to thoroughly document any potential impacts that the project could have upon traditional and customary rights. The CIA recommends that the Applicant work with the Waikapū community to ensure that the Waikapū stream isn't impacted by the Development, that traditional access rights are maintained into the Waikapū Valley, and that existing kuleana land owner rights are protected. The Applicant is committed to protecting the Waikapū Stream by establishing a wide riparian buffer and greenway along the stream where development will not be permitted. The WCT will also have negligible impact upon existing stream flows and no requests for additional stream water will be made for the development. As noted in the ~~DEIS~~ FEIS, the WCT will be served by new wells that will be managed in strict compliance with County and State requirements.

Moreover, the WCT is not located within the State's Special Management Area and no listed or endangered species of flora and fauna were identified on the property that will constrain development of the site. During build-out and during the operation phase BMPs will be implemented to mitigate non-point source pollution to Maui's coastal resources as well as to mitigate fugitive dust impacts.

6. If the Change in Zoning application involves the establishment of an agricultural district with a minimum lot size of two acres, an agricultural feasibility study shall be required and reviewed by the Department of Agriculture and the U.S. Soil Conservation Service.

Analysis. This application does not involve the establishment of an agricultural district. The 1,077 acres that comprise the agricultural component of the WCT are already in the County's Agricultural District.

J. WATER AVAILABILITY POLICY

In December 2007, the County Council passed Ordinance 3502, modifying the County Code to include:

14.12.040 - Written verification of long-term, reliable supply of water.

A. No applicable subdivision shall be approved, unless prior to approval of subdivision construction plans pursuant to section 18.20.180 of this code, the director has provided written verification of either: (1) a County water meter or water meter reservation; or (2) the receipt of an approved engineering report for a long-term, reliable supply of water for the subdivision.

B. Written verification of a long-term, reliable supply of water shall not constitute an assurance, covenant, or warranty by the County of water source from a private, non-County system.

As noted in Section V.D.4 of the ~~DEIS~~ FEIS, water and fire protection for the project will be provided from a private onsite water system. ~~Five~~ (~~5~~) Six (6) wells have been drilled on the site. One of these wells is a monitoring well. Three (3) wells have been designated for potable use and two (2) for non-potable purposes. All of the wells are located within the Waikapū Aquifer. The three potable water wells have been approved by the State of Hawai'i, Commission on Water Resource Management for a total pumping capacity of 2,300 gallons per minute (gpm).

A 10-day pump test was conducted from April 26, 2016 to May 6, 2016 for Potable Wells 1, 2 and 3 by Water Resource Associates (WRA). The results of the pump test at each well were:

Well 1 was pumped at a constant rate of 972 gpm (1.39 mgd) for 10 days for a total pumpage of 13,600,000 gallons. The chloride content varied from 41 mg/L to 47 mg/L (potable water limit is 250 mg/l). WRA suggested that Well 1 is capable of yielding 1.4 mgd with a static water level of 8.5 feet above mean sea level.

Well 2 was pumped at a constant rate of 720 gpm (1.03 mgd) for 10 days for a total pumpage of 10,238,400 gallons. The chloride content decreased from 132 mg/L to 100 mg/L. WRA suggested that Well 2 is capable of yielding 1.0 mgd with a static water level of 15.0 feet above mean sea level.

Well 3 was pumped at a constant rate of 747 gpm (1.07 mgd) for 10 days for a total pumpage of 10,487,8800 gallons. The chloride content varied from 25 mg/L to 109 mg/L. WRA suggested that the sustainable capacity of Well 3 is less than 700 gpd, despite a static water level of 8.5 feet abovemean sea level. They recommended further testing at lower pumping rates and drawdowns to assess Well 3's sustainable pumping capacity with regard to chlorides.

The Water Resources Associates (WRA) report stated the following regarding water quality:

> *"The water quality parameter which is of most concern during a pumping test is chloride because it is an easily determined indicator of salt water intrusion. The potable water limit for chloride content is 250 mg/L, which indicates that Well 1 produces the freshest water at approximately 40 mg/L, followed close behind by basalt Well 2 at approximately 100 mg/L and alluvial Well 3 varying between 25 and 109 gm/L. In addition to the frequent tests for chlorides, representative water samples were carefully collected from Wells 1, 2 and 3 for testing by Eurofins Analytical, an approved lab, in accordance with the requirements of the Hawai'i Department of Health for new potable water sources. The results indicate that all three wells are capable of producing potable water of excellent quality. The chlorides are low and the tested inorganic constituents are well within the Federal maximum contaminant levels (MCL) of public water systems.*

Further, all volatile and non-volatile organic contaminants and pesticides analyzed were non-detectable."

Water pumped from the non-potable wells will be discharged into the Waiheʻe Ditch or lined onsite reservoirs and used for irrigation purposes for the residential lots, agricultural farming, parks and open areas.

CHAPTER VIII

Alternatives Analysis

VIII. ALTERNATIVES ANALYSIS

Under HAR Title 11, DOH, Chapter 200, EIS Rules, Section 11-200-17(F), a Draft EIS must contain a section discussing alternatives that could attain the project objectives, regardless of cost, in sufficient detail to explain why the specific alternative was rejected. Alternatives to the WCT, along with reasons why each alternative was rejected, are described below.

WCT Project Objectives

The primary mission of the WCT Master Plan is to create a new mixed-use residential community that embodies the principles and policies of the MIP and that respects and implements the Statement of Values of the Waikapū Community Association. Key guiding principles in the MIP that have guided the development of the WCT Master Plan include:

1. Respect and encourage island lifestyles, cultures, and Hawaiian traditions;
2. Promote sustainable land use planning and livable communities;
3. Keep "urban-urban" and keep "country-country;
4. Protect traditional small towns;
5. Protect open space and working agricultural landscapes;
6. Protect environmentally sensitive lands and natural resources;
7. Promote equitable development that meets the needs of each community;
8. Plan for and provide efficient and effective public facilities and infrastructure;
9. Support sustainable economic development and the needs of small business; and
10. Promote community responsibility, empowerment, and uniqueness

The WCT Master Plan also seeks to embody the values of the existing residents of Waikapū. The Waikapū Community Association's Statement of Values and Supplemental Statements have helped

to shape the WCT Master Plan. These values and supplemental statements are listed in Section III.A of the ~~DEIS~~ FEIS.

In addition to the above-referenced guiding principles from the MIP and Waikapū Community Association Statement of Values, project specific objectives include the following:

- Be a profitable development for the project's entrepreneurial developers, the County and State;
- Provide a diverse range of market and affordably priced housing in order to help address the projected housing demand through 2030;
- Develop a "complete community" with a diversity of housing, retail, and civic uses to support residents daily needs;
- Protect the environment by directing development away from sensitive lands and by incorporating sustainability practices into the design, development and operation of the project;
- Reduce automobile dependence;
- Provide a jobs and housing balance within the development;
- Create the opportunity for more active and healthy lifestyles;
- Reduce the project's energy demand through conservation, energy efficient design and development of on-site renewables;
- Respect traditional Hawaiian lifestyles and existing cultural practices;
- Facilitate agricultural development within the project's protected agricultural lands;
- Maintain a sense of community where Maui residents feel comfortable visiting, living, working and playing.

The alternatives considered prior to selecting the preferred alternative included the following:

- No Action Alternative;
- Develop fewer units;
- Develop more units by producing more workforce housing than required;
- Develop at a lower density; and

- Develop at an alternative location.

Five (5) alternatives to the proposed WCT Master Plan were considered. These alternatives are described below.

1. No Action Alternative

Under the no action alternative, existing entitlements would remain. The approximate 485 acres of agricultural lands proposed for urban and rural development would remain in agricultural use pursuant to the permitted uses allowed by the State Land Use Law and the Maui County Code. Under this scenario farming of sugar cane by HC&S would likely continue into the foreseeable future on the WCT lands they currently lease. It would be expected that the existing diversified agricultural operations of Kumu Farms, Bobby Pā'ia and others would also continue their production activities.

The existing MTP would also likely continue functioning much as it currently does, in accordance with the provision of Maui County Code, Chapter 19.86 Wailuku-Kahului Project District 5 (Maui Tropical Plantation). The No Action Alternative assumes that the housing and commercial development proposed by the WCT would not be developed elsewhere within Central Maui. Therefore, should the No Action Alternative be implemented both the benefits and costs associated with the development would not be incurred at an alternative location.

Potential benefits of the No Action Alternative might include: 1) the existing "sense of place" and open space ambiance and integrity of existing views across agricultural lands to Haleakalā and the West Maui Mountains would remain unchanged by development; 2) approximately 485 acres of highly productive agricultural lands would remain undeveloped and available as a resource for agricultural production; 3) the existing MTP would continue to generate employment and serve as a visitor attraction for the benefit of the tourism industry; 4) there would be no short-term construction-related impacts (such as construction noise, construction equipment exhaust emissions and fugitive dust); 5) avoidance of additional infrastructure demands (water, wastewater

flows, and solid waste disposal); 6) no increased WCT traffic impacts and associated infrastructure costs; and 7) less demand upon the region's coastal and inland parks and recreation facilities generated by the project population. The No Action Alternative would not add to regional population increases, or require any public services, such as parks and schools, to accommodate an increase in population within the area.

Pursuing the No Action Alternative would also impose negative impacts upon the community. Under the No Action Alternative the project would not be built. This would be in direct contradiction to the recently adopted MIP (December 2012), which sets forth a managed and directed growth strategy for the island of Maui. The MIPs Directed Growth Plan states:

> *The Directed Growth Plan is the backbone of the Maui Island Plan (MIP). Taking into account population projections, it prescribes and outlines how Maui will grow over the next two decades, including the location and general character of new development. The Directed Growth Plan accommodates growth in a manner that provides for economic development, yet protects environmental, agricultural, scenic and cultural resources; economizes on infrastructure and public services; meets the needs of residents; and protects community character.*

The No Action Alternative would negatively impact the community in the following ways:

- ***Housing Supply.*** The principal purpose of the WCT is to create additional housing supply to help address future demand. If the additional housing is not built, but demand remains strong and continues to outpace supply then home prices will remain prohibitively high for many island residents. High home costs place a significant burden on working families who also face high transportation costs, food costs, energy costs, medical costs and educational costs. The MIP states the following in the introduction to the Plan's housing element:

> *Housing is one of our most basic human needs. It is one of the fundamental building blocks in our communities and it is where our families gather and find shelter. All segments of our island have particular needs, whether it is the first home or apartment for young adults, or to accommodate the specified needs that come with age. Housing is not always treated as a human right. When adequate or appropriate housing is unattainable to a large portion of the population, it negatively impacts the entire community and decreases overall quality of life. We can do many things to promote an adequate and permanent supply of affordable for-sale and rental housing to meet resident needs. To meet our island's housing needs, we must rethink Maui's paradigm. Due to numerous factors, Maui's housing prices have escalated dramatically in the last decade. With some of the highest housing prices in the nation, many Maui residents are struggling to afford housing on the island.*

The MIP projects the total demand for new housing units on Maui through 2030 to be approximately 29,589 units of which about 10,845 units will need to be built on currently unentitled lands. The MIP designates four new planned growth areas for the Wailuku-Kahului region. These four areas are to accommodate about 4,437 units plus an undetermined number of rural lots, or about 41 percent of the projected demand island-wide. The WCTs percentage of the planned supply to be derived from newly entitled lands within Wailuku-Kahului is 32%. The No Action Alternative would therefore significantly reduce this planned supply, which would limit the diversity of housing supply available to prospective home buyers and renters and would likely lead to higher housing costs for Maui residents.

- ***Economic Development***. The WCT is expected to indirectly support Maui's existing economic base activities by providing much needed housing to serve the island's workforce. The WCT is intended to provide housing along with supporting commercial, employment and institutional uses that will allow for the growth and diversification of Maui's economic base, while also allowing for the economy to become more sustainable - including the island's agricultural industry. By providing much needed housing in a format that will create a high quality of life for Maui's working families, and by generating both short- and long-term employment in the construction, trade and agricultural industries, the Project is directly supportive of the State and County's economic development. More specifically, the No Action Alternative would deprive the State, County and general public of the significant economic benefits associated with the WCT, including an estimated:
    - The WCT development will bring in $609.1 million of new capital investment into the Maui economy.
    - The construction of the WCT components will directly create an estimated 2,320 "worker-years" of employment (the equivalent of 52 work weeks at 40 hours per week) in the trades and associated businesses during build-out, averaging about 193 worker years annually, with an estimated $188.3 million in wages (averaging about $15.7 million per year).
    - The on-going operations and maintenance of the business commercial and residential components will directly provide an estimated 4,251 FTE worker-years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions.
    - The Project will require an estimated 66 worker years of maintenance and common area element employment on a continual basis, and will generate some 1,750 worker years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions.

- In aggregate, during the development of the WCT 8,750 worker years of employment will be created during construction and operations, on-site/direct and off-site/indirect, with stabilized employment after completion of 746 jobs.

- During the 15 years projection period, WCT will have a base economic impact of $1.3 billion with a stabilized annual benefit of $137.3 million thereafter.

- ***Master Plan Benefits***. The WCT is a master planned community that arose from the General Plan update process and which has had a tremendous amount of community input that has helped to shape and define the community design. Under the No Action Alternative, there would be no master-planned community utilizing "smart growth" and "neo-traditional" town planning principles, such as locating growth close to infrastructure, employment and facilities; creating diverse residential opportunities for all income categories; designing mixed use neighborhoods incorporating commercial and civic uses to satisfy daily needs, incorporating abundant on-site recreational amenities and integrated bicycle and pedestrian networks. Moreover, under the No Action Alternative the opportunity to establish a permanent agricultural preserve comprising approximately 800 acres, with an additional 277 acres of agricultural lands with limited subdivision potential would be lost. The WCTs agricultural lands are an important component of the overall project and will serve to create on-site agricultural employment, greater self-sufficiency in food production and a permanent open space separation between Waikapū and Māʻalaea.

For the following reasons, the No Action Alternative was rejected:

- Is not consistent with the MIPs Directed Growth Plan;
- Would exacerbate the County's current housing deficit and would worsen the island's affordable housing crisis;
- Would deny Maui residents of the many substantive benefits that would be implemented under the WCT Master Plan; and

- Would not provide the State, County and general public the significant economic benefits associated with the implementation of the WCT.

In summary, the benefits associated with the No Action Alternative are outweighed by the benefits to the community that the Project would bring.

2. Develop Fewer Units

Under this scenario, fewer units would be developed. For planning purposes, it was assumed that just the mauka lands encompassing the current MTP and surrounding agricultural lands would be developed. The site plan for the mauka lands would be updated to accommodate approximately half of the proposed development, or about 717 residential units and 100,000 square feet of commercial space. Developing the mauka lands, rather than the makai lands, is preferable because access to the project can be provided directly from Honoapi'ilani Highway. The full development of the mauka lands would not be dependent upon having the Wai`ale Bypass constructed whereas it is expected that this infrastructure is required for full development of the makai lands.

Under this scenario, there would be benefits and costs to the community. Potential benefits of this scenario include: 1) the integrity of existing views from Honoapi'ilani Highway across agricultural lands towards Haleakalā would remain unchanged by development; 2) approximately 236 acres of highly productive agricultural lands would remain undeveloped and available as a resource for agricultural production; 3) there would be no short-term construction-related impacts (such as construction noise, construction equipment exhaust emissions and fugitive dust) associated with development of the makai lands; 4) avoidance of additional infrastructure demands (water, wastewater flows, and solid waste disposal) associated with the development of about 716 residential units and 100,000 square feet of commercial on the makai lands; 6) no increased traffic and associated impacts from the development of the makai lands; and 7) less demand upon the region's coastal and inland parks and recreation facilities generated by the additional project population. Assuming that the makai units would not be built elsewhere by other projects within the region, the regional population increase may be less and the types of impacts associated with

population growth, such as increased demand upon infrastructure and public services, would be less than the preferred alternative.

The Develop Fewer Units Alternative would negatively impact the community in many of the same ways that the No Action Alternative. However, the magnitude of the negative impacts would be proportionally less. The following summarizes the principal costs to the community associated with this alternative.

- ***Housing Supply.*** The principal purpose of the WCT is to create additional housing supply to help address future demand. If the additional housing is not built, but demand remains strong and continues to outpace supply, then home prices will remain prohibitively high for many island residents. In a market with constrained supply but strong demand, those with the greatest purchasing power will bid up the price until supply approaches equilibrium with demand. Those that cannot compete in such a market are forced out, which is the current situation for many Maui residents. High home costs place a significant burden on working families who also face high transportation costs, food costs, energy costs, medical costs and educational costs.

As noted, the MIP projects total demand for new housing units on Maui through 2030 to be approximately 29,589 units of which about 10,845 units will need to be built on currently unentitled lands. The WCTs percentage of the planned supply from newly entitled lands within Wailuku-Kahului is 32%. The Develop Fewer Units Alternative would significantly reduce this planned supply, which would limit the diversity of housing supply available to prospective home buyers and renters and would likely lead to higher housing costs for Maui residents.

- ***Economic Development***. The WCT is expected to indirectly support Maui's existing economic base activities by providing much needed housing to serve the island's workforce. The WCT is intended to provide housing along with supporting commercial, employment and institutional uses that will allow for the growth and diversification of

Maui's economic base industries, while also allowing for the economy to become more sustainable - including the island's agricultural industry. By providing much needed housing in a format that will create a high quality of life for Maui's working families, and by generating both short- and long-term employment in the construction, trade and agricultural industries, the project is directly supportive of the State and County's economic development. As noted in the No Action Alternative, the full buildout of the WCT will produce significantly positive economic impacts to the community in the form of wages and employment. While the development of a smaller project will also generate positive economic impacts, these impacts will be significantly less by just developing the mauka lands.

- ***Master Plan Benefits***. The WCT is a master planned community that arose from the General Plan update process and which has had a tremendous amount of community input that has helped to shape and define the community design. In describing the WCT Planned Growth Area, the MIP states in part:

> *Providing the urban character of a traditional small town, this area will have a mix of single-family and multifamily rural residences, park land, open space, commercial uses, and an elementary or intermediate school developed in coordination with the Wai'ale project. The area is located south of Waikapū along Honoapi'ilani Highway, and it will incorporate the integrated agricultural and commercial uses of the existing tropical plantation complex. This area is proximate to the Wai'ale planned growth area, providing additional housing in central Maui within the Wailuku-Kahului Community plan region. As part of this project, parcels to the south of the project (identified as Agricultural Preserve on Figure 8-1) shall be protected in perpetuity for agricultural use through a conservation easement.*

Planned Growth Area Rationale:

Keeping the Waikapū Tropical Plantation as its town core, this area will become a self-sufficient small town with a mix of single-family and multifamily housing units in a walkable community that includes affordable housing in close proximity to Wailuku's employment centers. Schools, parks, police and fire facilities, transit infrastructure, wastewater, water supply resources, and other infrastructure should be developed efficiently, in coordination with neighboring developments including Maui Lani, Kehalani, Pu'unani and Wai'ale.

Under the Develop Fewer Units Alternative, it would be challenging to create a "complete community" where a diversity of housing could be provided at a scale that would make it economically feasible to make investments into infrastructure and public facilities – such as schools, water and wastewater systems. Moreover, it would be difficult to justify the dedication of agricultural lands for preservation, since future development pressure would likely warrant the urbanization of those lands.

For the following reasons, the no action alternative was rejected:

- Is not consistent with the MIPs Directed Growth Plan;
- Would exacerbate the County's current housing deficit and would worsen the island's affordable housing crisis;
- Would deny Maui residents of the many substantive benefits that would be implemented under the WCT Master Plan; and
- Would not provide the State, County and general public the significant economic benefits associated with the implementation of the Master Plan Update.

In summary, the benefits associated with the Develop Fewer Units Alternative are outweighed by the benefits to the community that full build-out of the Project would bring.

3. Develop More Units by Building More Workforce Housing

Under the "Develop More Units by Building More Workforce Housing" Alternative, the total number of units within the WCT would be increased by 300, or about 21 percent to 1,733 units. This alternative would be in conformance with the MIPs policy of allowing for additional units if provided as affordable housing in excess of what is required by law. The MIP states: *"Additional units may be permitted through a transfer of development rights program or to provide affordable housing in excess of what is required by law."*

In consideration of the current undersupply of affordably priced housing within Central Maui, this alternative may offer significant benefits to the community. However, by building additional units the project would also produce increased marginal impacts upon infrastructure and public facility systems. Developing additional affordable residential units would have to be conducted within the existing growth boundary designated by the MIP. Therefore, in order to accommodate additional units, the net residential density of the project would have to increase, specifically in the area currently planned for multi-family residences.

If this alternative were to be pursued, an approximate 300-unit workforce housing project would be proposed on the makai lands abutting the proposed elementary school and within close proximity to the Community Park, Main Street and the Main Street commercial districts. The WCT Master Plan designates this area for multi-family and country town mixed-use development (**See**: Figure No. 48, Preferred Location to Develop Additional Affordable Housing).

If developed, the 100 percent affordable 201H project would likely be built as a two- and 3-story multi-family project with about one-half of the units offered for sale and the other half for rent. By developing 300 additional units within the areas of the WCT Master Plan designated for Multi-Family, the net residential density of the WCTs multi-family development would increase from about 10.61 units per acre to about 21.34 units per acre. The overall net residential density for the urban lands (excluding rural units) within the WCT would increase from about 8.29 units per acre to about 10.12 units per acre. The MIPs net residential density guideline for the WCTs Planned

Figure 48: Preferred Location for Additional Affordable Housing

Area is 9 to 12 dwelling units per acre. Thus, even with the development of a 100 percent affordable 300 unit workforce housing project, the WCT would still be well within the MIPs net residential density guideline. Under this scenario, the proportion of multi-family units to single-family units would increase from about 27 percent of the project to about 39 percent, which is consistent with the MIPs Planned Growth Area guideline of having a "balance of single-family to multi-family residences".

This scenario presents benefits and costs to the community. Potential costs associated with this scenario relate mostly to the additional population generated by the development. If 300 additional workforce multi-family units are developed, is should be expected that the project population would increase by about 735 persons. The increase in the project population would increase demand for infrastructure and public facilities including parks, schools, water, police, fire and wastewater systems. The project would also generate additional traffic, which would impact roadways within the project area.

However, the additional workforce housing units would also produce significant benefits to the County. As noted, high home costs place a significant burden on working families who also face high transportation costs, food costs, energy costs, medical costs and educational costs. Many Maui families have been forced to leave Hawai'i, live in overcrowded housing conditions, or have fallen into homelessness due to the limited availability and high cost of housing on Maui. The additional affordable units would increase the supply of affordable rentals and for sale housing units in an area within walking distance of an elementary school, an intermediate school (at the proposed Wai`ale community), parks, shopping and employment. The project site is also within a short vehicular commute by transit, or personal automobile, to the employment, commercial and governmental centers within Wailuku, Kahului and Kīhei.

This scenario would also likely produce greater positive short- and longer-term operation phase employment and wage impacts relative to the preferred alternative. Another potential benefit of developing additional workforce housing, is the more efficient use of the urban lands that the MIP

has placed within a designated growth boundary. By developing at higher densities, less land in the future may be required for urbanization and the marginal cost per unit for infrastructure and land typically decreases.

Developing additional workforce housing units will require further analysis of the associated impacts to infrastructure and public facility systems. It will also require further consultation with agency and community stakeholders to gauge community support for the workforce housing units. While, development of additional affordable housing units is not the Preferred Alternative, if such housing is pursued at a future date additional impact assessment studies would be required before the development could be pursued.

4. Develop at a Lower Density

As an alternative to the preferred alternative, the project could also be developed at a lower density. For example, rather than developing the urban area of the project site at a net residential density of 8.29 units per acre the urban areas could be developed at 4 units per acre. In addition, rather than developing the rural lots at an average of about 1.5 acres per lot, these lots could be developed at an average net density of 1 unit per 4 acres.

Under such a scenario the urban land area would need to increase by about 214 acres to about 377 acres and the rural land area would increase from about 150 acres to about 345 acres. Thus, the MIPs small town and rural growth boundaries would need to increase in area by about 409 acres to accommodate the 1,433 units at a lower density.

Under this scenario, there are benefits and costs to the community. One benefit of this scenario might be an overall increase in the value of the residential and rural lots, which might generate greater property tax revenues to the County relative to fiscal costs. As such, the net fiscal impact to the County might be higher for a less dense, and assumably less affordable, project relative to a higher density project with the same number of units.

Some home buyers may also prefer this scenario because the project would offer considerably larger lots, with more privately owned open space, for their use and enjoyment. Regarding development impacts, this scenario would likely produce similar impacts to public infrastructure and facility systems since the population of the project is assumed to be the same. However, by spreading development out over a larger area more land would need to be developed with impervious surfaces, such as roadways, and the need for larger and more expensive on-site detention basins to retain the a larger volume of runoff from the project site should be expected.

The negative impacts to the community are primarily four-fold:

- ***Higher Home Prices***. It should be expected that with less density infrastructure and land costs will be higher, increasing the cost of each lot. Less density requires proportionally more roadways and longer utility runs for the same number of units. These costs are passed on to consumers, especially in an environment where there is a shortage of supply relative to demand. Developers will also often pass on the cost of the additional land, plus a profit, to buyers of larger lots. Moreover, many home buyers typically pay more for the perceived benefit of having larger lawns and greater separation between neighboring properties, which can make such communities more exclusive resulting in a crowding out of lower income working families. Larger lots are also often more expensive to maintain. Large lots require more time for maintenance and more water for irrigation. The cost of water is high on Maui and watering a lawn can add a considerable cost to home ownership.
- ***Greater Dependence upon the Automobile***. Lower density communities generally require greater communing distances between residential neighborhoods, parks, schools and commercial services. Since the scenario described doubles the distance required for most residents to walk or bike to civic and commercial services, it should be expected that many residents will choose to drive rather than walk or bicycle. Automobile dependence places significant burdens upon society. These burdens include: increased air pollution and greenhouse gas emissions, decrease in physical activity, increase in the cost of living, congestion and the need for more land dedicated to parking and roadways.

- ***Impact on Prime Agricultural Lands.*** Lower density would also require the urbanization of an additional 409 acres of prime agricultural land. This would reduce the WCTs agricultural lands from 1,077 to about 668 acres. While the loss of the additional agricultural lands to urbanization would likely not produce a significantly negative impact upon Maui County's agricultural economy, it would reduce the availability of this resource for future generations. Best planning practice generally prescribes that development should be directed away from prime resources lands in favor of lands without these values. Policy 7.1.1.f of the MIP states: "Strongly discourage the conversion of productive and important agricultural lands (such as sugar, pineapple and other produce lands) to rural or urban use, unless justified during the General Plan Update, or when other overriding factors are present." Developing additional prime agricultural lands in favor of a lower density development directly contradicts this MIP policy, and does not offer "overriding factors" that would justify such a proposal.

For the following reasons, the Develop at a Lower Density Alternative was rejected:

- Is not consistent with the MIPs Land Use Element or Directed Growth Plan;
- Would likely result in higher development costs and home prices for Maui consumers;
- Would reduce the area of the WCTs holdings of prime agricultural lands, which are intended to be leased to farmers for agricultural development.

In summary, the benefits associated with the Develop at a Lower Density Alternative are outweighed by the benefits to the community that the preferred alternative would bring.

5. Develop at an Alternative Location

Under the "Alternative Location" Alternative, the 1,433 residential units and associated commercial and civic spaces could be relocated to an alternative location within Central or South Maui. For example, the development could be relocated to one of the MIPs other Planned Growth Areas designated to receive residential development in Central or South Maui. Or, the development

could be directed to other unentitled lands beyond the designated Urban and Rural Growth Boundaries. The MIP notes in its Directed Growth Chapter that Maui's future urban development will occur through infill and redevelopment, urban expansion, new towns and settlements, and infill and expansion of existing towns and villages.

Finding appropriate locations for urban development depends upon many factors including topography and soil conditions on the site, presence of natural and environmental resource constraints, proximity and availability of infrastructure and supporting public facilities, and proximity to employment. Other key factors include underlying land entitlements, community support and/or opposition to development, land ownership and amenity values.

The proposed project site scores favorably on most of these criteria. Its principal drawback is the underlying lands value for agricultural production. However, as documented in Section V.A.7 of the ~~DEIS~~ FEIS, an abundance of other highly suitable agricultural land is available on Maui. Moreover, the WCT is dedicating approximately 800 acres of prime agricultural lands, with access to affordable irrigation water, to create an agricultural preserve for long-term diversified agricultural production at the WCT.

Relocating the subject project would create similar demands upon infrastructure and public facilities regardless of location. Likewise, developing raw lands produces a set of similar impacts – such as construction phase dust, noise and drainage that must be mitigated regardless of location. Most urban expansion in Central Maui will produce some level of impact upon agricultural lands since the majority of the Central Maui isthmus is comprised of high quality agricultural lands. This is especially true on the urban fringe of Wailuku-Kahului, which also happens to be the area that is most proximate to employment and urban levels of infrastructure and services. Placing development mauka of Piilani Highway, within North and Central Kīhei, would displace less productive agricultural land, but this area has less favorable topography and soils, is significantly further from the Central Maui employment center, and would significantly burden the Piilani Highway.

The MIP considered many of these factors in selecting its Central Maui Planned Growth Areas, and through a highly transparent and thoroughly vetted public planning process, determined that the WCT location was a desirable location for future urban expansion – when considering the various factors described above.

For the following reasons, the Develop at an Alternative Location Alternative was rejected:

- Is not consistent with the MIPs Land Use Element or Directed Growth Plan;
- Would likely result in higher development costs and home prices for Maui consumers;
- Would likely produce a less desirable location for future Maui residents to live.

In summary, the benefits associated with developing at the proposed location outweigh relocating the development to an alternative location.

6. Wastewater Treatment Alternatives

The Applicant has evaluated several alternatives for the treatment of the Project's wastewater. The alternatives analyzed included following:

1. Connect to the KWWRF to treat the entire Project;
2. Temporarily connect to the KWWRF for the first 650 residential units and then construct a private on-site and/or regional Waikapū wastewater reclamation facility;
3. Construct a regional Waikapū wastewater reclamation treatment facility in association with the County of Maui and adjoining property owners;
4. Construct a private wastewater reclamation facility on property owned by the Applicant;
5. Construct a conventional wastewater treatment plant within the subject property;
6. Construct an Organica Food Chain Reactor (FCR) facility within the subject property; and

7. No action, which is to not proceed with the Project.

The following summarizes each of the subject alternatives:

1. ***Connect the WCT to the KWWRF to treat the entire Project***. In a letter dated July 16, 2013, the Department of Environmental Management, Wastewater Reclamation Division, stated that the preferred method of treatment for future projects within the Waikapū area is for a Waikapū wastewater reclamation facility to be constructed. The Division noted that such a facility would eliminate energy costs for pumping, reduce the volume of wastewater being disposed of through shoreline injection wells and would allow for reuse of the treated wastewater for non-potable irrigation. However, the Department also suggested in their letter that a temporary connection to the KWWRF for the Project might be possible. The Division noted that a temporary connection would allow the Project to proceed with sales while designing and constructing a wastewater reclamation facility for the area. The Division's letter further states: *"An agreement would need to be completed between the County and the developer(s) with defined milestones in regards to required upgrades, building permits allowed, possible reimbursements (if any) for improvement work on the existing collection system, provisions for the treatment facility etc."*

   The Division's July 16, 2013 letter also provided an overview of the capacity of the KWWRF's gravity sewer, pump station and treatment facility. Key findings of the Division's analysis included:

   - After build-out of the following entitled projects: Kehalani, Waiolani Mauka, Waikapū Gardens Multi-family and Maui Lani (approx. 2,100 units) the KWWRF would have additional capacity for approximately 1.11 mgd (3,000 dwelling units) and 0.54 mgd for other supportive uses permits. This was as of June 30, 2013.
   - *"The Wailuku Wastewater Pump Station would have adequate capacity to accommodate about 2,000 homes above the currently expected for the area,*

however; additional studies would be needed to determine if any modifications at the Kahului WWRF headworks would be required."

- *"In order for the collection system to accept any flows from the Tropical Plantation/Wai'ale area of Waikapū an upgrade of the existing gravity sewer in Lower Main Street from 12 inch to 15 inch would be required. This segment stretches from Ainahou Place to Hala Place (Manholes KA20GE0100 to KA20GB0510) and is approximately 1950 linear feet."*
- *"A second upgrade would be required prior to the number of equivalent housing units exceeding two hundred (200). This would require upsizing current lines at two locations: (a) the 8 inch main trunk line from the force main daylight manhold in Waiko Road through Waikapū Gardens would need to be upgraded to 12 inch (approximately 2,750 linear feet); (b) upsize the final two pipe segments prior to the Wailuku Pump station from 24 inch to 36 inch (approximately 150 linear feet with a major bypass operation.) Upgrade 4 (a) would accommodate approximately 450 additional homes."*
- *"Further analysis is required to determine the exact extent of Lower Main Street improvements required for additional units over 650."*

Based upon the Division's July 2013 capacity analysis it can be concluded that capacity currently exists within the KWWRF to accommodate the Project. However, significant improvements to transmission capacity would be required to accommodate the Project's wastewater. While the June 2013 letter documents required improvements to accommodate up to 650 of the Project's residential units, additional analysis would be required to determine needed transmission improvements to accommodate the entire Project. In order for the Applicant to invest into expanding the transmission infrastructure to connect the Project to the KWWRF, the Applicant would require a guarantee from the County that the Project's wastewater could be conveyed to the facility for treatment.

However, In response to the Project's January 2016 DEIS, the Wastewater Reclamation Division notified the Applicant in its April 13, 2016 comment letter that the KWWRF *does not have the capacity to accept flows from outside the current service area and* that the collection system is unable to accept flows from the Project without significant upgrades. The Division also stated that the Applicant shall work with the County and area developers to complete a master plan for a regional treatment solution and that the Project shall contribute its fair share towards the implementation of this regional improvement (**See**: Appendix S, DEIS Agency and Community Comment and Response Letters).

Assuming that the KWWRF has capacity to accept the Project's wastewater, and that transmission infrastructure can be upgraded to accommodate the Project, there are benefits and costs associated with connecting the Project to the KWWRF. Potential benefits to the Applicant and County by connecting the Project to the KWWRF may include the following:

- ***More Cost Effective Infrastructure Development***. Based upon the capacity analysis conducted by the County, Department of Environmental Management's, Wastewater Reclamation Division it appears that capacity exists at the KWWRF to accept existing entitled development within the service area and additional flows from the Maui Island Plan's (MIP's) Planned Grown Areas in Waikapū. Directing wastewater flows to existing developed centralized facilities is typically more cost effective that constructing new facilities. Assuming that it is less expensive to invest in the expansion of transmission infrastructure to connect the Project to the KWWRF then it would be more cost effective to utilize existing infrastructure than to build new more expensive infrastructure. Preliminary cost estimates to construct a private wastewater treatment facility using Organica's FCR technology is approximately $25.85 million. Preliminary cost estimates to expand the transmission infrastructure to accommodate approximately 650 of the Project's

residential units is about $2.0 million. Further study is required to determine the expansion costs required for the entire project.

- ***More Affordable Housing***. The Project is located within a Planned Growth Area identified in the Maui Island Plan. The purpose of a Planned Growth Area is to provide new housing to accommodate future demand. A project's infrastructure costs will impact the cost of development and ultimately the price of housing charged to consumers. Connecting to the KWWRF, in lieu of developing a new wastewater reclamation facility in Waikapū, would likely result in lower cost housing to consumers. Developing affordably priced housing is consistent with the MIP Goal 5.1 and Objective 5.1.4. MIP Goal 5.1 states: "*Maui will have safe, decent, appropriate, and affordable housing for all residents developed in a way that contributes to strong neighborhoods and a thriving island community*". MIP Objective 5.1.4 states: "*Provide infrastructure in a more timely manner to support the development of affordable housing*."
- ***Lower Project Risk***. Connecting to the existing KWWRF may require considerably less capital investment than the capital required to construct a Waikapū wastewater treatment facility. High upfront capital costs generally makes a project more difficult to finance and therefore requires greater returns for the investor to justify the investment. Therefore, assuming the cost to connect to the KWWRF is lower than constructing a new Waikapū wastewater treatment plant, the project would be less risky to implement if it could connect to the existing KWWRF.

Potential costs to the Applicant and County by connecting the Project to the KWWRF may include the following:

- ***Increased Tsunami Risk.*** According to the United States Federal Emergency Management Agency, the KWWRF is located within Flood Zone VE. Flood Zone VE represents areas of coastal flood zone with velocity hazard and base flood elevations (BFE) determined. The BFE ranges from approximatey 15 feet to 19 feet

in this area. Although the County of Maui is investing in the KWWRF to armor it against tsunami inundation, the facility's location is within a tsunami hazard area, which places it in risk of being inundated. By constructing a standalone treatment facility in Waikapū, the Project's wastewater treatment would not be directly threatened by tsunami inundation.

- ***Less Opportunity for Wastewater Reuse.*** The KWWRF relies upon injection wells to dispose of its approximate 4.7 mgd of treated wastewater. The KWWRF has not been improved to treat wastewater to R-1 quality, where it could be broadly applied for non-potable irrigation. The facility is also located along the shoreline and the pumping of recycled water may be more cost prohibitive than for a facility located within the subject property in Waikapū. The MIP's Objective 6.2.3 states that the County should increase its reuse of wastewater.
- ***Greater Reliance upon Injection Wells.*** The KWWRF relies upon injection wells to dispose of the approximate 4.7 mgd of effluent that is treated by the facility. After treatment to State and County standards, this effluent flows by gravity to the injection wells where it enters the nearshore groundwater and then it leaches into the ocean's nearshore coastal waters. There have been concerns expressed and recent studies that document that injection wells have an impact upon nearshore water quality.
- ***MIP Policy 6.2.1.c.*** MIP Policy 6.2.1.c states the following: "*establish new wastewater treatment plant(s) outside the tsunami zone*". Although the existing treatment plant is already within the tsunami zone, placing greater reliance upon this facility may be inconsistent with this County policy.

During pre-consultation with the County regarding the Project's wastewater treatment, it was represented by the County in its July 13, 2016 letter, that a temporary connection to the KWWRF might be possible provided that the Project upgrade the transmission system. Thereafter, in its April 13, 2016 letter, the County informed the Applicant that the KWWRF does not have sufficient capacity to accept flows from outside of the current service area

and that the Project should develop wastewater treatment in Waikapū. In consideration of the County's April 13, 2016 letter regarding the capacity of the KWWRF to accept Project flows, the "***Connect the WCT to the KKWRF to treat the entire Project"*** alternative is not viable and is therefore not being considered.

2. Connect to the KWWRF for the first phase of the Project and then transition the Project to a Waikapū facility once it is developed.

In a letter dated July 16, 2013 (See Appendix S), the Department of Environmental Management (DEM), Division of Wastewater Reclamation, stated that it was possible that the KWWRF could accept the wastewater flow of approximately 650 of the Project's residential units on a temporary basis, but that significant upgrades to the transmission system would be required. In its letter, the Division further stated the following (**See**: Appendix S, DEIS Agency and Community Comment and Response Letters):

> *"Thus there exists a possibility of allowing a temporary connection for these out of service area projects so that they can proceed with development and sales while designing and constructing a wastewater reclamation facility for the area. An agreement would need to be completed between the County and the Developer(s) with defined milestones in regards to required upgrades, building permits allowed, possible requirements, if any, for improvement work on the existing collection system, provisions for the treatment facility etc."*

The Department further noted that in order for the existing collection system to accept flows from the WCT, the following transmission system improvements would be required:

Table 62 ~~56~~: Required Off-site Wastewater Transmission System Improvements

Required off-site Wastewater Transmission System Improvements		
Location	**Description**	**No. Units Accommodated**
Lower Main Street	Upgrade existing gravity sewer line in Lower Main Street from 12-inch to 15-inch. This segment stretches from ʻĀinahou Place to Hala Place (Manholes KA2OGE0100 to KA20GB0510) and is approximately 1,950 linear feet.	200
Waiko Road;	Upgrade approximately 2,750 linear feet of the 8-inch main trunk line from the force main daylight manhole in Waiko Road through Waikapū Gardens to 12-inch;	450
Wailuku Pump Station	Upsize the final two pipe segments prior to the Wailuku Pump station from 24-inch to 36-inch, which is approximately 150 linear feet with a major bypass operation.	
TOTAL UNITS		**650**

The DEM further stated that adding additional WCT residential units beyond 650 would require further analysis to determine the extent of Lower Main Street improvements.

The policy of the DEM is that wastewater capacity cannot be reserved until the project is ready to receive building permits. If capacity at the KWRF is available at the time building permits are ready to be issued for the project, it may be possible for the Project to temporarily connect to the County's sewer system and complete the upgrades to connect up to 650 units in the phase I development.

The DEM's long-term desire is for a wastewater treatment plant to be constructed in the Waikapū Area to accommodate future flows generated by development within the Waikapū region. In the Project's DEIS, the Applicant indicated a desire to connect temporarily to the KWWRF for the initial 650 units and then to transition the Project to either a standalone private wastewater reclamation facility within the WCT project area or to work with the County and nearby landowners to construct a regional Waikapū wastewater reclamation facility. In was estimated by Otomo Engineering in November 2014 that the cost of the upgrades identified in Table 62 ~~43~~ would be approximately $2.27 million. It was the Applicant's desire to invest in the temporary capacity upgrades, and then once the Waikapū facility was constructed, request a reimbursement from the County since the capacity improvements could then be utilized to service infill development.

As described in Alternative 1, "***Connect the WCT to the KWWRF to treat the entire Project"***, there are benefits and costs associated with connecting the Project to the KWWRF. While the benefits of Alternative 2 would be similar to Alternative 1, there are also important differences. Benefits to the Applicant, and to the County, for allowing a temporary connection to the KWWRF may include.

- ***Reduces Up-front Capital Costs***. The Project is allowed to proceed with a portion of the development prior to the construction of a costly wastewater reclamation facility. By deferring this up-front capital cost, the Applicant is able to build-up a reserve of funding from Phase I home-buyers to pay for a significant first increment of the facility.
- ***Provides Additional Time for the Design and Permitting of a Treatment System***. The planning, design, permitting and construction of a wastewater treatment facility may take many years to complete. There is a risk to the Applicant that delays caused by permitting and/or financing of the facility could produce a delay in the Project's groundbreaking. The opportunity to have a temporary connection to the KWWRF mitigates these risks to the Applicant.

- **Provides Additional Time to Coordinate the Development of a Regional System**. Development of a regional Waikapū wastewater treatment facility will require a considerable investment in time to formalize a plan with the pertinent stakeholders to determine the following: 1) location of the facility; 2) type of facility to be constructed; 3) size of the facility; 4) phasing of the facility; 5) cost sharing; and 6) project financing. Finalizing the details of an agreement with all of the relevant stakeholders and then securing financing for planning, design and construction will likely require considerable time to conclude. The additional time provided by having temporary access to the KWWRF would create the space needed to achieve a greater likelihood of developing a regional facility.

Alternative 2, "Connect to the KWWRF for the first phase of the Project and then transition the Project to a Waikapū Facility" presents the following costs:

- ***Continued Reliance upon the KWWRF***. Although Alternative 2 is intended to provide a temporary wastewater treatment option for the Project, it nonetheless places greater reliance upon the KWWRF for servicing the region's wastewater treatment demand. The KWWRF is an aging facility that was designed in 1972 and constructed in 1976. Concerns regarding the existing facility include: 1) its location within a flood hazard area that makes it subject to tsunami inundation; and 2) the facility relies upon injection wells.
- ***Risk to the County that the Applicant may not develop a Private and/or Regional Facility once Connected to the KWWRF.*** Should the cost of developing a regional facility be determined to be cost prohibitive, it is possible that the facility would not be developed and the 650 units would thereby be permanently connected to the Kahului treatment plant.

As noted, the DEM notified the Applicant it its April 13, 2016 comment letter (See Appendix S, Agency and Community Comment and Response Letters) that the KWRF does not have

the capacity to accept flows from outside the current service area and that the existing collection system is inadequate and unable to accept flows from the development without significant upgrades. As such, this alternative is not being considered further by the Applicant.

3. Construct a regional Waikapū wastewater reclamation treatment facility in association with the County of Maui and adjoining property owners.

In its April 13, 2016 comment letter, the DEM stated the following: "*the Applicant shall work with the County and area developers to complete a master plan for a regional treatment solution and shall contribute its fair share towards its implementation*" (See Appendix S, Agency and Community Comment and Response Letters). The construction of a regional Waikapū wastewater reclamation facility was studied in 2015. In April 2015 Brown and Caldwell Consultants were retained by the Department of Environmental Management to prepare the *"Central Maui Recycled Water Study".* The report states the following:

> *"A conceptual Central Maui service area wastewater system was developed. The major elements required for the Central Maui service area include:*
>
> - *Three new WWPSs.*
> - *A wastewater conveyance system that includes gravity sewers and forcemains.*
> - *A new Central Maui WWRF to produce R-1 recycled water.*
> - *A soil aquifer treatment system for excess recycled water disposal.*
> - *A brackish groundwater well to provide supplemental water to the recycled water system.*
> - *A recycled water pump station and storage tank.*

- *Recycled water transmission pipelines to the Tier 1 areas.*

The total cost for the system is estimated to be $91.4 million, or $20,300 per market-rate EDU. The County may consider increasing the size of the service area to include areas outside the defined Central Maui growth area. Future MIP updates could include projects that have been proposed but were excluded from the current Urban Growth Boundaries. Examples include the Department of Hawaiian Homelands project in Puunene, and Maalaea Mauka subdivision. The County could also consider providing capacity for the existing Maalaea development area to eliminate the use of near-shore injection wells there. These additional areas would contribute to wastewater flows, and would have to be considered in the conveyance, treatment, reuse, supplemental water, and disposal systems. Capital costs, O&M costs, and WWRF land area requirements would increase to accommodate projects that are outside of the defined service area boundaries. Assessment of the additional costs and land area requirements was outside the scope of this study. Approximately 80 percent of the recycled water that is produced by the WWRF throughout a typical year would be beneficially used for irrigation purposes. Supplemental groundwater would be needed to meet the irrigation needs of the recycled water users during the hot season. The system will have no injection wells for effluent disposal. Excess recycled water during the wet season would be disposed in a soil aquifer treatment system. The soil aquifer treatment system will provide additional natural treatment as the applied water percolates through the soil to groundwater. The soil aquifer treatment system will provide an additional layer of environmental

protection compared to the status-quo injection well systems used for effluent disposal at the County's existing WWRF's. If the County decides to proceed with a public wastewater system for the Central Maui growth area it should consider preparing a master plan for the wastewater and recycled water systems."

Alternative 3, "Construct a Regional Waikapū Wastewater Reclamation Facility in Association with the County of Maui and Adjoining Property Owners" provides both benefits and costs to the Applicant and to the County. Benefits to the Applicant, and to the County, from Alternative 3, may include the following:

- ***Reduced Tsunami Risk.*** A regional *Waikapū Wastewater Reclamation facility* would be located outside of a flood hazard area. However, according to the United States Federal Emergency Management Agency, the KWWRF is located within Flood Zone VE. Flood Zone VE represents areas of coastal flood zone with velocity hazard and base flood elevations (BFE) determined. The BFE within the area of the treatment plant ranges from 15 feet to 19 feet. Although the County of Maui is investing in the KWWRF to armor it against tsunami inundation, the facility is located within a tsunami hazard area, which places it in risk of being inundated. By constructing a standalone treatment facility in Waikapū, the facility would not be directly threatened by tsunami inundation.
- ***Greater Opportunity for Wastewater Reuse.*** The KWWRF relies upon injection wells to dispose of its approximate 4.7 mgd of wastewater. The KWWRF has not been improved to treat wastewater to R-1 recycled quality, which is the level of treatment required to use it broadly for non-potable irrigation. The facility is also located along the shoreline, which makes the pumping of recycled wastewater to users more expensive due to pumping costs. The MIP's Objective 6.2.3 states that the County should increase its reuse of wastewater. Constructing a regional wastewater treatment facility in Waikapū would be consistent with that objective.

- ***Reduced Reliance upon Injection Wells.*** The KWWRF relies upon injection wells to dispose of the approximate 4.7 mgd of effluent that is treated by the facility. After treatment to State and County standards, this effluent in pumped by the injection wells into the nearshore groundwater and then it leaches into the ocean's nearshore waters. There have been concerns expressed, and studies have recently confirmed, that injection wells produce negative impacts upon nearshore water quality. Constructing a regional wastewater treatment facility in Waikapū would reduce the reliance of the County upon injection wells.
- ***Consistency with MIP Policy 6.2.1.c.*** MIP Policy 6.2.1.c states the following: "*establish new wastewater treatment plant(s) outside the tsunami zone*". Constructing a regional wastewater treatment facility in Waikapū would be consistent with this policy.
- ***Greater Economy of Scale.*** Relative to Alternative 2 and Alternative 4, which are limited to treatment plants designed to treat just the Project's wastewater, participating with other area developers and the County to build a regional wastewater treatment facility could offer greater "economy-of-scale". Generally, building facilities at a larger economy-of-scale spreads fixed costs over a development, which can result in construction and operating cost savings. Such savings may be passed along to home buyers in the form of more affordable housing.

Costs to the Applicant, and to the County, from Alternative 3, may include the following:

- ***Greater Complexity and Risk of Delay***. Development of a regional Waikapū wastewater treatment facility will require a considerable investment in time to formalize a plan with the pertinent stakeholders that would require agreement on the following: 1) location of the facility; 2) type of facility to be constructed; 3) size of the facility; 4) phasing of the facility; 5) cost sharing; and 6) project financing. Finalizing the details of an agreement with all of the relevance stakeholders; and

then securing financing for planning, design and construction would likely have a significantly negative impact upon the Project's development schedule.

- ***Larger Investment of Time and Funding by the County***. In order to develop a regional wastewater treatment facility, the County would likely be required to take a more active role in planning and financing the facility. Greater participation required of the County would place additional demand upon County resources.

4. Construct a stand-alone private wastewater reclamation facility to service the Project.

The WCT could construct a standalone private wastewater treatment plant within the subject property. A private wastewater treatment plant would be owned and operated by the Applicant and subject to State Department of Health regulations. Alternative 4, "*Construct a standalone wastewater reclamation facility to service the project*" may offer benefits and costs to the Applicant and County. Benefits to the Applicant, and to the County, from Alternative 4 may include the following:

- ***Reduced Tsunami Risk; Greater Opportunity for Wastewater Reuse; Reduced Reliance upon Injection Wells; Consistency with MIP Policy 6.2.1.c.*** These are the same benefits that are associated with Alternatives 2 and 3 and that have been described previously.
- ***More Control and Flexibility for the Applicant.*** Alternative 4 provides the Applicant with the opportunity to have exclusive control over the location, design, timing and financing of the wastewater treatement facility. For the Applicant, having the opportunity to control the location, timing and design of the facility will help to ensure that the Project's schedule is not delayed by having multiple decision-making parties. In addition, bringing multiple parties together to formulate an agreement for the execution of a large regional capital project would require a considerable investment of time and resources, which would likely delay the Project. Finally, developing a regional wastewater treatment plant would require a separate HRS Chapter 343 Environmental Assessment (EA) because it

would likely be located off-site, have differing neighboring lands uses, and potentially other types of impacts. Preparing and processing a separate EA would take considerable time and likely significantly impact the Project's schedule.

In addition to Benefits, there may be costs associated with Alternative 4. Potential costs to the Applicant and County may include the following:

- ***Less Economy of Scale***. Participating with other area developers and the County to build a regional wastewater treatment facility could offer greater "economy-of-scale". Generally, building facilities at a larger economy-of-scale reduces fixed costs over a larger development, which can result in construction and operating cost savings. Such savings may be passed along to home buyers in the form of more affordable housing.
- ***Risk / Cost Sharing***. Since constructing a wastewater reclamation facility requires a considerable up-front capital cost, sharing these costs amongst multiple parties may mitigate risk to the Applicant. Increased risk taking generally warrants higher returns to investors, which could impact the cost of the housing.
- ***Reduced Risk of Insolvency.*** Private utilities may also pose unique risks to the County. While the construction and operation of a private utility is typically privately financed, saving the government money, there is the potential that private parties may become insolvent, requiring intervention by the government to continue providing needed services to residents.

5. ***Alternative Designs; a Stand-alone Conventional Private Wastewater Reclamation Facility versus a Facility using Organica Food Chain Reactor (FCR) Technology.*** The Applicant contracted with Enviniti LLC to perform an analysis of a conventional wastewater reclamation plant. The Applicant also contracted with Mana Water LLC, in association with Kennedy/Jenks Consultants, to perform an analysis of the Organica FCR wastewater reclamation technology.

The Enviniti study identifies regulatory and design requirements for the planning, design, construction, operation, and maintenance of such a facility. Conventional wastewater treatment technology generally involves liquids treatment consisting of preliminary treatment, flow equalization, primary sedimentation treatment, secondary biological treatment, secondary sedimentation treatment, disinfection, and disposal. The treatment of solids includes stabilization, dewatering, and disposal.

The Mana Water and Kennedy Jenks report describes the FCR technology and its advantages over more conventional treatment systems. A FCR configuration consists of biological treatment in successive reactor zones utilizing fixed biomass on a combination of natural plant roots and engineered biofiber media, along with a limited amount of suspended biomass. This alternative generally involves pretreatment, secondary biological treatment through a FCR zone, process aeration, chemical phosphorus removal/coagulation, flocculation, disinfection and disposal. The reactors are made of concrete, have fine bubble aeration at the bottom (just as in any traditional technology) and have suspended "activated sludge" (hungry bacteria that feeds off of the wastewater organic material and nutrients) as in traditional solutions. What is new to a FCR system is that a few centimeters under the water surface there is a grid on which plants are placed. The root systems of these plants are submerged into the water at a depth of 3- to 5-feet. This allows for several thousand species to naturally develop in the reactor, which produces a much larger variety of species than in traditional systems.

While the plants are one of the most visible parts of and FCR system, it is not the plants that treat the water, but their extensive root systems that provide the habitat for a complex ecosystem that treats the wastewater both more robustly and efficiently than other biological systems.

The primary advantage of utilizing conventional wastewater reclamation facility technology is its long history of use throughout the United State and in Hawai'i. In addition, State and

County regulators are likely to be more familiar with conventional technologies and these facilities have a track record of compliance with governmental requirements.

However, facilities using biological treatment trains have been used for many decades and Organica's FCR technology is well established in Europe, the Middle-East and Asia. Factors considered in determining whether one facility was preferred over the other included:

1. ***Reliability***. Organica FCR systems are more reliable than conventional activated sludge systems because the bulk of secondary treatment is performed by attached growth organisms. Attached growth systems are less likely to become upset than suspended growth systems such as activated sludge. For example, if there is a big rain or flood event that washes through the system, the facility will be much more resilient than a traditional facility where the bulk of the bacteria are washed out, because in the Organica system the biology is fixed to the plant roots and artificial media.

2. ***Feasibility of being permitted by the State***. While State and County regulators are likely to be more familiar with conventional technologies, the feasibility of State Department of Health permitting should be similar for both the Organica FCR system and conventional wastewater treatment systems. They both are considered biological wastewater treatment systems and are subject to the same regulatory and permit requirements.

3. ***Capital cost***. The capital cost will be somewhat less in the Organica FCR system than in conventional wastewater treatment systems because the size of the Organica FCR system is less than conventional activated sludge systems. Other factors that will reduce capital cost are a smaller aeration system, no Return Activated Sludge (RAS) required and less site preparation/site work required.

4. ***Operating cost***. The overall operating cost of an Organica FCR is significantly less than other activated sludge-based systems (conventional systems), primarily due to reductions in both energy demand and sludge production. Because the solution relies on fixed-film cultures, and less on cultures suspended in the water, the water in the reactor has lower solids concentration and is "clearer". Oxygen transfer in clearer water is more efficient, thus less air is required to be pumped into the reactor to meet oxygen demand. This results in lower power consumption; typically 20 to 50 percent lower than competitive designs. Further, due to the multi-level food chains that are present in complex ecosystems, the bacteria that process waste material are consumed by other organisms, which are in turn prey for higher predators within the food chain. This food chain effect results in lower excess sludge (commonly 20 to 30 percent less) at the end of the treatment process.

5. ***Land area requirements***. Organica FCR systems use less than one-half the land area of conventional activated sludge systems due to the high density of microorganisms in the FCRs.

6. ***Aesthetics.*** Organica FCR systems are more aesthetically pleasing than conventional wastewater treatment systems. The plants used in the Organica FCR system give the facility a park like atmosphere created by the facility's fresh vegetation rather than the typical industrial like atmosphere associated with conventional systems.

7. ***Odors.*** Odors are similar for each type of facility. A properly designed wastewater treatment plant will have odor control systems in place to minimize odors. Most of the odors emanate from the plant headworks where raw wastewater enters the facility. A well designed system ensures that the headworks (where the sewage enters the facility) are enclosed and equipped with a state-of-the-art air filter and odor control mechanisms.

8. ***Noise***. Noise levels are similar for conventional wastewater treatment and FCR systems. Most of the noise will emanate from the air blowers than run continuously. The blowers are required to provide an aerobic environment for the microorganisms. There will be less noise from sludge removal operations since Organica FCR systems generate less sludge than conventional activated sludge systems. Because the system is fixed film the blower requirements are generally lower because only fine bubble aeration is required as opposed to traditional coarse aeration.

9. ***Water use / demand***. Water use/demand will be similar for each type of system.

10. ***Other environmental impacts.*** Organica FCR systems have a lower carbon footprint than conventional wastewater systems. This is due to 1) lower energy requirements and 2) the plants utilized in the FCR system help absorb carbon dioxide from the atmosphere.

11. ***Energy demand***. Organica FCR systems typically utilize 30% less energy than conventional activated sludge systems.

While both a conventional and FCR system would be suitable for treatment of the Project's wastewater, the FCR system has several advantages that make it the preferred wastewater treatment option. These advantages include: 1) greater reliability; 2) lower capital costs; 3) lower operating costs; 4) smaller facility footprint; 5) better aesthetics; 6) better for the environment; and 7) less energy demand.

6. ***Alternative Locations***. The Applicant considered multiple locations within the property for the wastewater reclamation facility. The following site selection criteria were considered to determine the preferred location for the facility:

- ***Land area requirements*.** The facility requires a site of 12 acres. Of this area, approximately 5.6 acres is required for a Soil Aquifer Treatment (SAT) Basin.
- ***Drainage patterns.*** The optimal site should allow for the WCT's wastewater to gravity flow to the treatment facility in order to minimize pumping costs.
- ***Pumping costs and network optimization.*** Pumping costs can be a significant component of the operating costs of a wastewater treatment facility. Therefore, the ideal location should utilize natural topography/drainage patterns wherever feasible to maximize gravity flow. Likewise, once the wastewater is treated, gravity flow should be utilized to direct the non-potable irrigation water to users. Such users may include agricultural fields and landscaped open space areas such as parks and roadway right-of-way.
- ***Proximity to recycled water users.*** A location proximate to potential recycled water users, which may reduce pumping costs to these users, is preferable to more distant locations where costly pumping may be required.
- ***Proximity to planned wastewater collection system network.*** In order to minimize sub-surface transmission system infrastructure costs, the ideal location would be proximate to the wastewater collection system network.
- ***Impact upon WCT Master Plan uses.*** The facility could be placed within the WCT's Small Town Growth Boundary. However, this would displace approximately 12 acres of land that is planned for residential use. Moreover, this would place the reclamation facility within close proximity of residences, which could cause concern over odor, aesthetic and noise impacts and decrease property values in the immediate area.
- ***Land Ownership.*** A treatment facility may be able to be located on or off-site, depending upon the users being serviced by the plant. However, if the treatment plant is to be developed by the Applicant for the purpose of supporting the Project, then it is preferable to locate the facility within the Applicant's property.

- ***Prevailing winds and possible odor impacts.*** Locating wastewater treatment facilities downwind of developed urban areas may help to mitigate possible odor and or dust impacts generated by the facility.
- ***Impact upon neighboring land users.*** Although noise and air quality impacts can largely be mitigated through proper design, neighboring property owners may have concerns regarding the aesthetics of the facility as well as air quality and noise impacts. Such concerns may make neighboring properties less marketable and therefore decrease property values.
- ***Environmental impacts.*** A wastewater reclamation facility may generate environmental impacts if not properly designed and located in appropriate areas. For the purpose of disposing of the wastewater through injection wells or SAT basins, it is preferable to locate the plant outside of the State of Hawai'i's Underground Injection Control (UIC) Line. The purpose of the UIC Line is to protect potable ground water resources from contamination.
- ***Flood Hazards.*** The facility should be located outside of areas that are prone to flooding.
- ***Expansion and interconnection potential for offsite users.*** A location that allows for off-site users to tie into the system in a manner that minimizes pumping costs for treatment and recycled water use is preferable to a location that does not provide for such opportunities.
- ***Accessibility.*** The project site should be easily accessible to passenger vehicles and large trucks.

Based upon the site selection criteria, it was determined that the location for the wastewater reclamation facility should be located east of the Wai'ale Bypass Road. Placing the facility east of the Wai'ale Bypass places the facility outside of the UIC Line and minimizes pumping costs since the wastewater will be able to gravity flow to the facility. In addition, locating the plant east of the Bypass also places it within close proximity to future agricultural and open space recycled water users. It was also decided that the facility

should not be located within the Small Town Growth Boundary, since this would displace considerable land that could be used for residential, commercial, or park use. Morover, placing the facility within the urban project boundary may produce concerns by neighboring property owners about odors, noise and aesthetic impacts. As such, two sites east (makai) of the Bypass, within the Applicant's property, were evaluated.

Site Location A, located at the northeast corner of the development (**See**: Figure No. 49, "Alternative Site A for WWRF) did not provide sufficient acreage to accommodate the facility. Furthermore, a portion of this site is located with a flood hazard area. Site Location B, located near the southeast edge of the development, performs well across all of the site selection criteria. It is located adjacent to the agricultural site of reuse and leverages the project areas natural drainage patters, thereby reducing pumping and energy consumption which further reduces the carbon footprint of the WCT. Moreover, this location takes advantage of the prevailing northeast winds, is within the Applicant's property and is easily accessible by all types of vehicles (**See**: Figure No. 50, Alternative Site B for WWRF).

Location A | Site Plan - scale 1:7500

Water Reclamation Facility

Figure 49: Alternative Site "A" For WWRF

Location B | Site Plan - scale 1:7500

Water Reclamation Facility

Water Reclamation Facility (Location "B")

N

Figure 50: Alternative Site "B" For WWRF

Table 66 ranks the site selction criteria on a score of -3 as the worst and +3 as the best. Based upon this analysis, Location "B" is superior to Location "A" across most of the site selection parameters.

Table 66: WWRF Site Selection Criteria

Considerations	**Location B**	**Location A**
Land area requirements	3	1
Drainage patterns	3	2
Pumping costs and network optimization	3	1
Proximity to recycled water users	3	1
Proximity to planned wastewater collection system network	3	3
Impact upon WCT Master Plan uses	3	3
Land ownership	3	3
Prevailing winds and possible odor impacts	3	2
Impact upon neighboring land users	3	2
Environmental impacts	3	3
Flood hazards	3	1
Expansion and interconnection potential for offsite users	2	3
Accessibility	2	1
Total	**37**	**26**

6. ***No Action***. The "No Action" alternative would leave the property in its existing condition so that a wastewater treatment plant would not be warranted. This would not be consistent with the MIP's directed growth strategy and/or goals, objectives and policies in the MIP that promote economic development and the delivery of a diversity of residential housing types to accommodate population grown. This alternative is also not consistent with the Applicant's desire to develop the Project. Therefore, Alternative 6 was not considered further.

CHAPTER IX

EISPN Distribution List and Comment Letters

IX. EISPN DISTRIBUTION LIST AND COMMENT LETTERS

The EISPN was sent to the following agencies, organizations, and individuals indicated below in Table 67 ~~60~~. The EISPN was also available on the LUC and OEQC websites. The public comment period on the EISPN was from May 23, 2015 through June 22, 2015. The EISPN agency comment and response letters are included in Appendix Q ~~L~~.

Table 67 ~~60~~: EISPN Distribution List and Comment Letters

EISPN Distribution List and Comment Letters	Comment Date
State of Hawai'i Department of Agriculture	June 22, 2015
State of Hawai'i Department of Accounting and General Services	May 28, 2015
State of Hawai'i Department of Accounting and General Services, Archives Division	-----
State of Hawai'i Department of Business. Economic Development and Tourism	-----
State of Hawai'i Department of Business. Economic Development and Tourism. Research Division Library	-----
State of Hawai'i Department of Business. Economic Development and Tourism. Strategic Industries Division	-----
State of Hawai'i Department of Business. Economic Development and Tourism. Office of Planning	June 24, 2015
State of Hawai'i Department of Defense	June 25, 2015
State of Hawai'i Department of Education	June 5, 2015
State of Hawai'i. Department of Education. Hawai'i State Library, Hawai'i Documents Center	-----
State of Hawai'i. Department of Education. Hawai'i State Library. Kahului	-----
State of Hawai'i Department of Hawaiian Home Lands	-----

EISPN Distribution List and Comment Letters	Comment Date
State of Hawai'i Office of Hawaiian Affairs	June 22, 2015
State of Hawai'i. Department of Health. Environmental Health Administration	June 19, 2015
State of Hawai'i. Department of Health. Safe Drinking Water Branch	June 1, 2015
State of Hawai'i. Department of Health. Clean Air Branch	June 3, 2015
State of Hawai'i. Department of Health. Clean Water Branch	June 9, 2015
State of Hawai'i. Department of Health. Maui District Office	June 23, 2015
State of Hawai'i. Department of Health. Wastewater Branch	June 25, 2015
State of Hawai'i. Department of Land and Natural Resources	-----
State of Hawai'i Department of Land and Natural Resources State Historic Preservation Division	-----
State of Hawai'i Department of Transportation	June 17, 2015
University of Hawai'i Water Resources Research Center	-----
University of Hawai'i Environmental Center	------
University of Hawai'i Maui College Library	------
Legislative Reference Bureau Library	-----
County of Maui Department of Fire and Public Safety	-----
County of Maui Department of Environmental Management	June 17, 2015
County of Maui Department of Housing and Human Concerns	June 1, 2015
County of Maui Department of Parks and Recreation	May 27, 2015
County of Maui Department of Planning	June 9, 2015
County of Maui Department of Transportation	-----
County of Maui Department of Water Supply	-----
County of Maui	June 2, 2015

EISPN Distribution List and Comment Letters	Comment Date
Police Department	
Department of the Interior Fish and Wildlife Service	June 18, 2015
Department of Agriculture National Resources Conservation Service	June 2, 2015
Department of the Army Army Corps of Engineers	-----
Department of Transportation Federal Highways Administration	-----
Maui News	-----
County Council Representative	-----
Neighborhood Board Representative	-----
Wailuku Public Library	-----

CHAPTER X

DEIS Distribution List and Comment Letters

X. DEIS DISTRIBUTION LIST AND COMMENT LETTERS

The DEIS was sent to the following agencies, organizations, and individuals indicated below in Table 68. The DEIS was also available on the LUC and OEQC websites. The public comment period on the DEIS was from February 8, 2016 through March 28, 2016. The DEIS agency comment and response letters are included in Appendix S.

Table 68: DEIS Distribution List and Comment Letters

FEIS DISTRIBUTION LIST AND COMMENT LETTERS	COMMENT LETTER DATE
STATE OF HAWAI'I	
State of Hawai'i Department of Agriculture	March 30, 2016
State of Hawai'i Department of Accounting and General Services	February 9, 2016
State of Hawai**'i** Department of Accounting and General Services Archives Division	-----
State of Hawai'i Department of Business, Economic Development and Tourism	-----
State of Hawai'i Department of Business, Economic Development and Tourism, Research Division Library	-----
State of Hawai'i Department of Business, Economic Development and Tourism, Strategic Industries Division	-----
State of Hawai**'i** Department of Business, Economic Development and Tourism, Office of Planning	March 28, 2016
State of Hawai**'i** Department of Defense	March 24, 2016

FEIS DISTRIBUTION LIST AND COMMENT LETTERS	COMMENT LETTER DATE
State of Hawai'i Department of Education	March 23, 2016
State of Hawai'i, Department of Education, Hawai'i State Library, Hawai'i, Documents Center	-----
State of Hawai'i, Department of Education, Hawai'i State Library, Kaimuki Regional Library	-----
State of Hawai'i Department of Education Hawai'i State Library, Kane'ohe Regional Library	-----
State of Hawai'i Department of Education Hawai'i State Library, Pearl City Regional Library	-----
State of Hawai'i, Department of Education, Hawai'i State Library, Hawai'i Kai Regional Library	-----
State of Hawai'i Department of Education Hawai'i State Library, Hilo Regional Library	-----
State of Hawai'i, Department of Education, Hawai'i State Library, Kahului Regional Library	-----
State of Hawai'i Department of Education Hawai'i State Library, Lihu'e Regional Library	-----
State of Hawai'i Department of Hawaiian Home Lands	-----
State of Hawai'i, Department of Health Environmental Health Administration	February 10, 2016
State of Hawai`i, Department of Health Maui District Office	March 8, 2016
State of Hawai`i, Department of Health Office of Environmental Quality Control	March 24, 2016
State of Hawai`i, Department of Health Wastewater Branch	February 12, 2016

FEIS DISTRIBUTION LIST AND COMMENT LETTERS	COMMENT LETTER DATE
State of Hawai`I, Department of Land and Natural Resources, Land Division	May 24, 2016
State of Hawai**'i** Department of Land and Natural Resources State Historic Preservation Division	March 24, 2016
State of Hawai**'i** Department of Transportation, Airports Division	May 18, 2016
State of Hawai`I Department of Transportation, Highways Division	July 6, 2016
University of Hawai'i Water Resources Research Center	-----
University of Hawai'i Environmental Center	-----
University of Hawai'i Thomas H. Hamilton Library	N/A
University of Hawai'i at Hilo Edwin H. Mo'okini Library	N/A
University of Hawai'i Maui College Library	N/A
University of Hawai'i Kaua'i Community College Library	N/A
Office of Hawaiian Affairs	March 24, 2016
Legislative Reference Bureau Library	N/A
COUNTY OF MAUI	
County of Maui, Department of Fire and Public Safety	February 10, 2016
County of Maui, Department of Environmental Management	April 13, 2016
County of Maui, Department of Housing and Human Concerns	February 11, 2016
County of Maui, Department of Parks and Recreation	February 29, 2016
County of Maui, Department of Planning	March 9, 2016

FEIS DISTRIBUTION LIST AND COMMENT LETTERS	COMMENT LETTER DATE
County of Maui, Police Department	February 25, 2016
County of Maui, Department of Public Works	May 23, 2016
County of Maui, Department of Transportation	-----
County of Maui, Department of Water Supply	June 20, 2016
Federal Agency	
Department of the Interior, Geological Survey Pacific Islands Water Science Center	-----
Department of the Interior, Fish and Wildlife Service	-----
Department of Commerce, National Marine Fisheries Service	-----
Department of the Interior, National Parks Service	-----
Department of Agriculture, National Resources Conservation Service	-----
Department of the Army, Army Corps of Engineers	-----
Department of Transportation, Federal Aviation Administration	-----
Department of Transportation, Federal Transit Administration	-----
Department of Transportation, Federal Highways Administration	-----
Department of Homeland Security, Coast Guard	-----
Public Comments	
Mr. Richard "Dick" Mayer (Letter 1 of 2)	March 28, 2016
Mr. Richard "Dick" Mayer (Letter 2 of 2)	March 28, 2016
Mr. Albert Perez, Executive Director, Maui Tomorrow	March 30, 2016

Library or Depository	
Nearest public library (Wailuku Library)	N/A
News Media	
Honolulu Star Advertiser	N/A
Maui News	N/A
Elected Official and Other	
Congressman Mark Takai	-----
Congresswoman Tulsi Gabbard	-----
Senator Mazie Hirono	-----
Senator Brian Shatz	-----
Representative Joseph M. Souki	-----
Senator Gilbert S. C. Keith Agaran	-----
Senator Roz Baker	-----
Council Member Michael P. Victorino	-----

CHAPTER XI

References

XI. REFERENCES

[i] 2007 - 2011 American Community Survey 5-year Estimate. Bureau, U.S. Census.

[ii] Maui Island Plan. Prepared by County of Maui, Department of Planning, Long-range Planning Division. December 2012.

[iii] Maui Island Plan. Prepared by County of Maui, Department of Planning, Long-range Planning Division. December 2012.

[iv] Atlas of Hawai'i, 3rd Edition. Prepared by the University of Hawai'i at Hilo (Author), James O. Juvik (Editor), Sonya P. Juvik (Editor). November 1998.

[v] A History of Waikapū. Prepared by Jill Engledow. Prepared for Mike Atherton. August 2009.

[vi] An Island Community: Ecological Succession in Hawai'i. N Lind, Andrew W. EW York, New York: Greenwood Press Publishers, 1938.

[vii] Maui Island Plan. Prepared by County of Maui, Department of Planning, Long-range Planning Division. December 2012.

[viii] Maui Island Plan. Prepared by County of Maui, Department of Planning, Long-range Planning Division. December 2012.

[ix] Atlas of Hawai'i, 3rd Edition. Prepared by the University of Hawai'i at Hilo (Author), James O. Juvik, (Editor) Sonya P. Juvic (Editor). November 1998.

[x] Atlas of Hawai'i, 3rd Edition. Prepared by the University of Hawai'i at Hilo (Author), James O. Juvik, (Editor) Sonya P. Juvic (Editor). November 1998.

[xi] Capital in Hawaiian Sugar: Its Formation and Relation to Labor and Output, 1870-1957. Prepared by J. A. Mollet. Hawai'i Agricultural Experiment Station, College of Tropical Agriculture, University of Hawai'i in cooperation with the Agricultural Experiment Stations of the Western States. Agricultural Economics Bulletin 21. June 1961.

2011 State of Hawai'i Data Book. Prepared by the State of Hawai'i, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[xii] 2011 State of Hawai'i Data Book; Prepared by the State of Hawai'i, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[xiii] 2011 State of Hawai'i Data Book. Prepared by the State of Hawai'i, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

Statistical Abstract of Hawai'i. Prepared by the State of Hawai'i, Department of Planning & Research, Honolulu, Hawai'i. May 1962.

[xiv] Maui County Data Book 2011. Prepared by the County of Maui, Office of Economic Development. Hawai'i Small Business Development Center. Hawai'i Business Research Library. December 2011.

[xv] Agricultural Resources Technical Issue Paper, June 2007. Prepared by Chris Hart & Partners, Inc. Prepared for County of Maui, Department of Planning, Long-range Planning Division.

[xvi] Maui County Data Book 2011. Prepared by the County of Maui, Office of Economic Development. Hawai'i Small Business Development Center. Hawai'i Business Research Library. December 2011.

Statistical Abstract of Hawai'i. Prepared by the State of Hawai'i, Department of Planning & Research, Honolulu, Hawai'i. May 1962.

Maui County Data Book 1993. Prepared by the County of Maui, Office of Economic Development and the Maui County Economic Development Board. December 1993.

Maui County Data Book 2000. Prepared by the County of Maui, Office of Economic Development. Hawai'i Small Business Development Center. Hawai'i Business Research Library. December 2000.

[xvii] Maui Island Plan. Prepared by County of Maui, Department of Planning, Long-range Planning Division. December 2012.

[xviii] 2012 State of Hawai'i Data Book; Prepared by the State of Hawai'i, Department of Business Economic Development & Tourism, Research & Analysis Division. 2012.

[xix] Population and Economic Projections for the State of Hawai'i to 2040. Research and Economic Analysis Division, Department of Business, Economic Development and Tourism. March 2012.

[xx] 2007 - 2011 American Community Survey 5-year Estimate. Bureau, U.S. Census.

[xxi] Maui Island Plan. Prepared by County of Maui, Department of Planning, Long-range Planning Division. December 2012.

[xxii] Maui County Data Book 2011. Prepared by the County of Maui, Office of Economic Development. Hawai'i Small Business Development Center. Hawai'i Business Research Library. December 2011.

[xxiii] Economic Development Issue Paper, Island of Maui, Maui County General Plan 2030. Plan Pacific, Inc., in association with John M. Knox & Associates, Inc., Tom Dinell, FAICP, and Chris Hart & Partners, Inc. 2007.

[xxiv] Maui County Data Book 2012. Prepared by the County of Maui, Office of Economic Development. Hawai'i Small Business Development Center. Hawai'i Business Research Library. December 2012.

[xxv] Economic Development Issue Paper, Island of Maui, Maui County General Plan 2030. Plan Pacific, Inc., in association with John M. Knox & Associates, Inc., Tom Dinell, FAICP, and Chris Hart & Partners, Inc. 2007.

[xxvi] "Breaking: $4.74 M Released for Central Maui Sports Complex." Osher, Wendy. Maui Now, 11 October 2013.

[xxvii] "Integrated Solid Waste Management Plan." Gershman, Bricknell, Bratton, Inc. February 2009.

[xxviii] Maui Island Plan. Prepared by County of Maui, Department of Planning, Long-range Planning Division. December 2012.

Hawai'i Pedestrian Toolbox: A Guide for Planning, Design, Operations, and Education to Enhance Pedestrian Travel in Hawai'i. State of Hawai'i, Department of Transportation. May 2013

APPENDIX A

Market Study, Economic Impact Analysis and Public Fiscal Assessment

Market Study, Economic Impact Analysis, and Public Fiscal Assessment of the Proposed

WAIKAPU COUNTRY TOWN

Waikapu, Maui, Hawaii

CBRE
VALUATION & ADVISORY SERVICES

THE HALLSTROM GROUP

The Hallstrom Group I CBRE, Inc.
1003 Bishop Street, Ste. 1800
Honolulu, Hawaii 96813

www.cbre.com

October 13, 2016

Michael Atherton
Waikapu Partners LLC

Michael J. Summers, President
Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Hawaii 96793

RE: Market Study, Economic Impact Analysis and Public Fiscal Assessment of the Proposed Waikapu Country Town Waikapu, Maui, Hawaii

Gentlemen:

At your request, we have completed a series of market and econometric analyses associated with the proposed Waikapu Country Town (WCT), a 499-acre master-planned sustainable community to be located on the existing Maui Tropical Plantation destination exhibit site and surrounding acreage northerly and to makai, approximately three and six miles from Wailuku and Kahului Airport, respectively.

As currently envisioned, the project will contain:

- 1,433 single family, multifamily and rural residential units;
- A variety of commercial uses totaling up to 198,857 square feet of floor space (including the 29,250 square feet in-place);
- A mixed-use live/work component;
- Up to 146 ohana unit opportunities;
- 82 acres of parks and open space; and
- A future school site.

The objective of the developer is to provide reasonably-priced housing inventory within a relatively self-contained, moderate to low density community in a desirable, Central Maui location. Current estimates are that upwards of 85 percent of the inventory will meet County affordability guidelines for households earning 140 percent or less of Maui median income levels.

Our assignment was to: determine the level of demand for the WCT inventory relative to available supply; assess the appropriateness of the site and master plan from a market perspective; and quantify the economic impacts of the project within the public and private spheres on a going-forward basis. Our study was primarily comprised of three elements:

1. Market Study. To ascertain whether there currently exists, or will exist, sufficient demand in the Central Maui/Wailuku-Kahului residential real estate sector to successfully absorb the finished subject inventory in a timely manner given its characteristics and those of competing in-place and proposed regional developments.

2. Economic Impact Analysis. To estimate the general and specific "new" effects on the local economy which will result from WCT build-out, including construction and business employment, wages and income, contractor/supplier profits, end-user expenditures, and other regional monetary and employment effects. This study also forecasts the de facto population of the subject community including residents and workers, household income and discretionary spending levels.

3. Public Fiscal Benefit Assessment. To quantify the "new" tax receipts and secondary benefits which will be accrue to the State of Hawaii and the County of Maui resulting from the actualization and operation of WCT versus the "new" added costs to the government.

The subject property, identified on State of Hawaii Tax maps as Second Division Tax Map Key 3-6-2, Parcels 1 and 3; 3-6-5, Parcel 7; and 3-6-4, Parcels 3 and 6 varies from near level to moderately sloping; has excellent access fronting a regional highway, offers many superior view panoramas; and the development acreage is within the directed growth boundary of the rapidly expanding Honoapiilani Highway corridor stretching into Wailuku Town. The proposed 499 acre community is within a larger 1,576 acre holding, of which some 1,070 acres will remain in the State Agricultural District with 800–acres to be dedicated to agricultural classification in perpetuity.

The pertinent results from our studies are presented in the following report, which opens with an Executive Summary describing our salient conclusions. The remainder of the report is comprised of a series of six addenda exhibits containing the tabular presentation of our data, analysis and modeling for each aspect of the assignment.

The master plan will provide the potential for up to 146 "ohana" units in the community, although their location has yet to be determined and the timing of their eventual construction is unknown. We have included their relative impacts in our analysis as there is demand for such units and ohana possibilities increase the desirability of those lots provided with the potential.

Our economic impact analysis and public fiscal assessment focus on the new impacts to the island economy and public coffers resulting from undertaking the WCT project. To the extent the full-time resident population component of the community is merely moving from one location on the island to another, their income and spending, and tax revenues and government costs are already accounted for within the economy and public sectors. They are in-place and existing and not the specific result of WCT.

This represents an evolution in our analysis since our prior edition of the report in response to industry-changes and community input. In our previous versions, the project was viewed as a holistic development which was essentially free-standing from the Maui economy. This resulted in the counting of all household income, spending, tax benefits and costs for all residents of WCT.

However, the vast majority of the projected WCT population is ALREADY residents of Maui who are merely relocating to WCT. As such, their economic and fiscal impact is already accounted for on the island and is not NEW as a result of the project. Their household income, discretionary spending, public education students, tax dollars generated and public service costs are in-place and accounted for, resulting in our prior reports essentially double-counting some impacts.

The economic analysis industry has moved away from this perspective in modeling economic and fiscal impacts and towards accounting for only "new" impacts that would otherwise not exist in the community; while acknowledging it does result in a degree of under-counting of new natural economic expansion/growth that is simultaneously occurring in the resident population.

Our economic and fiscal models have adopted this more conservative viewpoint, and reflect only the new economic impacts, including capital investment, spending by non-resident WCT owners, and their taxes and public costs. All of the economic impacts arising from the resident population (assumed to be relocating Mauians) have been excluded, with the exception of real estate taxes associate with their new housing unit as whatever one they vacated on the island would still be producing real property taxes.

The modified outcomes, in addition to including the enumeration of the ohana units, show a marked difference in regards to some findings as the evolved modeling is by definition a much more conservative perspective and it is likely the true impact will be between the conclusions resented herein and our prior findings.

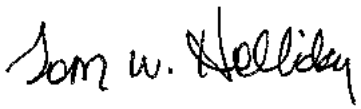
As part of our investigation program, we have: visited the subject property and its environs; researched the Central Maui and Wailuku-Kahului residential submarkets; interviewed knowledgeable parties active in the regional economy; reviewed government statistics, policies and publications; accessed on-line databases; and compiled materials from published and private sources.

All conclusions presented herein are subject to the limiting conditions, assumptions and certifications of The Hallstrom Group | CBRE, Inc., in addition to any others specifically set forth in the text. All work has been completed in conformance with the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute, and the Uniform Standards of Professional Appraisal Practice (USPAP).

We appreciate the opportunity to be of service to Waikapu Partners LLC in regards to this uniquely-designed, Maui-appropriate, prominent, proposed sustainable mixed-use community.

Respectfully submitted,

THE HALLSTROM GROUP | CBRE, INC.



Tom W. Holliday, CRE, FRICS
Vice President

/as

CBRE
VALUATION & ADVISORY SERVICES

THE HALLSTROM GROUP

The Hallstrom Group I CBRE, Inc.
1003 Bishop Street, Ste. 1800
Honolulu, Hawaii 96813

www.cbre.com

Market Study, Economic Impact Analysis,

and

Public Fiscal Assessment

of the

PROPOSED WAIKAPU COUNTRY TOWN

Located at

Waikapu, Maui, Hawaii

Prepared for

Mr. Michael Atherton
Waikapu Partners, LLC

Mr. Michael Summers
Planning Consultants Hawaii, LLC

As of

July 2015

TABLE OF CONTENTS

	Page
INTRODUCTION	1
PRIMARY STUDY CONCLUSIONS	9
Market Study	10
Economic Impact Analysis	15
Secondary Impacts	18
Public Fiscal Benefits	19
MARKET STUDY OF THE MASTER PLAN COMPONENTS AND ABSORPTION ESTIMATES	20
The Study Area Residential Market	20
The WCT Commercial Component	34
ECONOMIC IMPACTS FROM DEVELOPMENT	37
PUBLIC FISCAL COSTS AND BENEFITS ASSOCIATED WITH THE PROJECT	46
CERTIFICATION	52

ADDENDA

A - Residential Market Study Tables

B - Commercial Market Study Tables

C - Economic Impact Analysis Tables

D - Public Fiscal Benefits Assessment Tables

E - Qualifications of the Analysts

INTRODUCTION

The proposed Waikapu Country Town (WCT) master planning area comprises an approximately 499 acre portion of mostly undeveloped, agriculturally-classified lands located southerly of Waikapu village and mauka of Kuihelani Highway. The site is adjacent to the King Kamehameha Club and Kahili golf courses, and encompasses (and will include) the existing Maui Tropical Plantation site.

The holding stretches from the central valley floor up the lower easterly flanks of the West Maui Mountains, ranging from nominal to moderately-sloping terrain, and varying in elevation from circa 200 to 600 feet above sea level. It is within the southwestern-most node of the Wailuku-Kahului "Directed Growth Boundary", is bisected by Honopiilani Highway, offers panoramic views across the isthmus to Haleakala from many points, and has a desirable climate.

WCT is within a larger 1,576 acre holding, of which 14 acres (encompassing the existing Maui Tropical Plantation) are currently within the State Land Use (SLU) "Urban" District and 1,562 are within the "Agricultural District". Approximately 485 acres are being proposed of redistricting from Agricultural to the Urban and "Rural" districts to support the master plan.

The WCT project site is divided between "Urban", "Small Town" and "Rural" on the Maui Island Plan Directed Growth Map for Waikapu/Kahului.

The remaining approximately 1,070 acres will continue to be designated Agricultural, of which some 800 acres will be dedicated in perpetuity for agricultural classification/use.

According to Hawaii Land Design and Planning Consultants Hawaii LLC, who envisioned and drew-up the master plan:

> WCT will be a "complete community," encompassing a mixture of single- and multi-family residential units, commercial, and civic uses. In accordance with the MIP's Directed Growth Area Guidelines, WCT includes 1,433 residential units together with neighborhood retail, commercial, a school, parks and open space. The town will be bound by agricultural land that will be preserved in perpetuity through a conservation easement. The utilization of conservation subdivision

design (CSD) practices will preserve additional rural land for farming, open space, and open land recreation.

WCT will be built in two five year phases both mauka and makai of Honoapiilani Highway. Development mauka of the highway will focus inward onto a "village center," incorporating the existing buildings and grounds of the MTP. The Master Plan calls for a diverse mixture of affordable and market priced housing, along with commercial, entertainment, and civic uses within and around the village center.

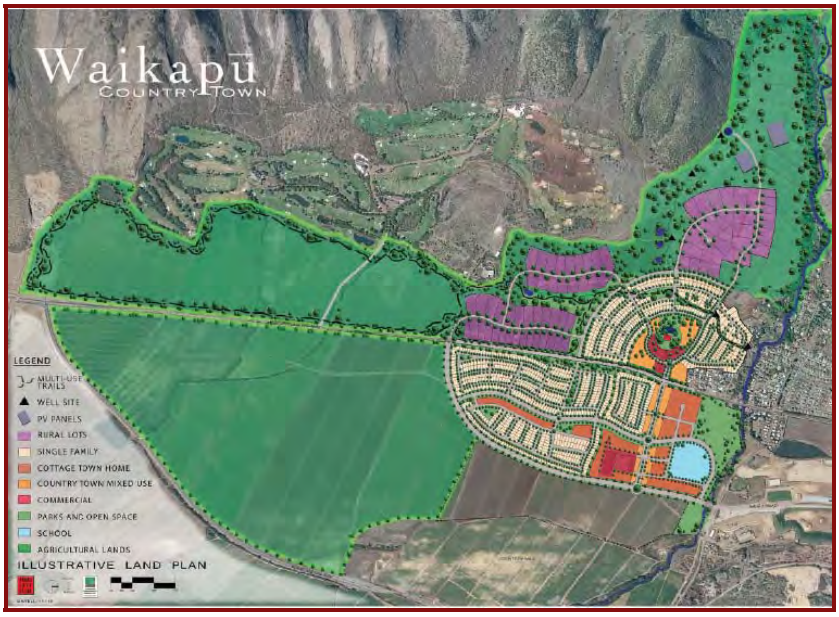
Development makai of the highway will focus onto a pedestrian-oriented "main street," a nearby elementary school, and parks. The makai development is bound to the east by the planned extension of the Waiale Road, which will intersect with Honoapiilani Highway. A primary objective of the project is to develop a community where walking and biking are the preferred modes of transportation and recreation for short commutes. Therefore, in addition to proposing mixed-use and more compact development patterns, approximately eight miles of hiking, biking and walking trails will be incorporated into the project. Public transit will also be accommodated in strategic locations to facilitate the use of transit to job-rich areas in Wailuku/Kahului and South and West Maui.

For the purpose of assessing the project's development impacts, the conceptual master plan and development program is consistent with the MIP's allocation of 1,433 units to the project. The MIP has an allowance for affordable housing and Ohana units. Affordable housing and Ohana units are not counted towards the total number of units allocated in the MIP.

The Applicant understands that local market conditions will ultimately determine the types of units sold and density of development within the project. It is intended that at full build-out the overall character of development, mix of uses and development pattern will be consistent with the master plan vision, design guidelines, and zoning ordinances. However, should future market demand warrant additional residential units, and/or a higher density of development within the WCT Planned Growth Area, then a future amendment to the MIP may be required together with an analysis of the impact of the additional units upon infrastructure and public facility systems."

The current WCT master plan is shown below, followed by the Conceptual Development Program. The development will be undertaken in two phases with an anticipated pre-sale commencement date in 2017 and completion of all infrastructure and primary components by 2026.

In addition to the 1,433 units which are the subject of this study there is the potential for up to 146 additional "Ohana" units to be built over time within the single family subdivisions. In our detailed analysis of the "base" 1,433 units of the project we have also included the ohana units assuming maximum-build-out of all between 2021 and 2030; although the precise timing of such construction is unknowable at this time. .



PROPOSED WAIKAPU COUNTRY TOWN LAND DEVELOPMENT PROGRAM

Use	Area in Acres (1)		Housing Units	Square Feet	
Urban Single Family	131.05		970		
Rural Single Family	124.82		80		
Multi-Family/Town Home	30.29	*	256		
Country Town Mixed-Use	20.21	*	127	58,475	
Commercial/Employment	12.89	*		140,372	(2)
Existing Town Center/Lagoon	4.48	*			
School	12.00	*			
Parks & Open Space	82.10				
Roadways	81.03				
TOTALS	**498.87**		**1,433**	**198,847**	

(1) Areas marked with asterisk (*) are "gross" areas, all others "net" areas.
(2) Includes 111,122 sq. ft. new construction and 29,250 sq. ft. of existing commercial.

The WCT vision will transform a property that is:

- Centrally-located.
- Highway-fronting.
- Underutilized.
- Within an expanding/desirable area of the regional directed growth boundary.

Actualization of the master plan will create a regional asset providing:

- Needed reasonably-priced housing.
- Live/work space and small business opportunities.
- A unique Country Town core.
- A wide variety of residential product from multifamily to rural house lots.
- Neighborhood-serving commercial and mixed-use components.
- Within a relatively comprehensive, sustainable community complementary with existing Waikapu Village.

It will attract significant new capital investment, create jobs in construction and on-going business activity, and stimulate the Maui

economy. This will in turn generate enhanced employment and business opportunities for island residents and companies while further expanding the tax base for the state and county.

From a market overview perspective, the proposed development will have the necessary attributes to be compatible with, and competitive within, the Central Maui real estate sector:

- *It is within an expanding, high-demand area.* Wailuku-Kahului has been the historic focal point of residential (and other) development and, while South Maui is also in an expansion mode, significant additions in Central Maui will keep the region at the fore-front of the island's housing sector.

  The demand for residential units in the area is currently strong, and as the hub for industrial, commercial, service, transportation and government activities on Maui, it will remain a desirable, competitive market.

- *In concert with market trends.* Mixed-use, master-planned developments have been part of the market in Hawaii for several decades, and they have generally provided higher-quality, more desirable housing and lifestyle opportunities than in standard subdivisions. Although many Maui projects were initially oriented heavily towards resort and upper-end development, there are newer projects in-construction and proposed which are seeking to provide more diverse product types.

  WCT represents the evolving edge of such master planning by coupling a diverse housing inventory within a fairly comprehensive community evoking "small-town" scale, intensities and designs; surrounded by a thousand acre agricultural buffer. But, having direct access to two highways and proximate to the supporting services in Wailuku-Kahului.

- *Maximize the reasonable development potentials of a well-located parcel*. Given the superior locational and access attributes of the subject property, within the context of an expanding Wailuku-Kahului development core, and the housing and economic benefits which will flow to Maui from the project, the WCT master plan is a reasonable confluence of market and general community objectives.

- *WCT is representative of the highest and best use of the property*.

The Hallstrom Appraisal Group | CBRE, Inc. assignment was to analyze the proposed WCT master plan from a real estate market perspective and to identify and quantify probable market and economic impacts associated with its development in light of competitive, regional, prevailing and forecast trends to answer four basic study questions:

1. Is there sufficient demand to absorb the various "marketable" components of the subject community during a reasonable exposure period given competing developments and projected statewide/regional market trends?

2. Will the community be an appropriate use of the underlying site relative to market needs?

3. What will be the general/specific and direct/indirect economic impacts on Maui resulting from the subject community via employment, wages, business operations, population, and other economic activity related to the real property asset?

4. What will be the benefits to the state and county "public purse" from the tax receipts and fees flowing from its development?

These issues were addressed through a comprehensive research and inquiry process utilizing data from market investigation, governmental agencies, various Hawaii-based media, industry spokespersons/sources, on-line databases, and published public and private documents.

The pertinent results of our study are highlighted in the following Executive Summary, comprising the body of our report, which contains a concise narrative and tabular synopsis of our conclusions. Additional materials, contained in data tables and models depicting the subject community's lifespan from commencement to completion, are presented in the Addenda.

Our narrative presentation is divided into four sections:

1. Primary Study Conclusions.

2. Market Study of the WCT Components and Absorption Estimates.

3. Economic Impacts of the Proposed Community.

4. Public Fiscal Benefits Associated With WCT.

Our initial market study scope was limited to the residential component of the proposed Waikapu Country Town community, which is the motivating constituent of the master plan.

However, we have also included a brief summary analysis of the business commercial element which was viewed specifically as:

- Serving the neighborhood retail/service/dining needs of the project residents and day workers.
- Providing live/work opportunities for small business, self-employed and entrepreneurs.
- Building on the existing low-intensity activity of the Maui Tropical Plantation to create a unique, scenic village core.

The commercial component is intended to be a supporting feature of the community, contributing to its relatively comprehensive planning and lifestyle theme, long-term sustainability, and internal employment and business opportunities. It is not intended to be directly competitive with existing and proposed Central Maui shopping centers that draw mass patronage from throughout the region (or island).

Primary source information regarding the subject community used in our study included:

- Maps, master plans, unit counts, density analysis, cost estimates and background materials provided by Waikapu Partners LLC, Planning Consultants Hawaii LLC, Hawaii Land Design, and other members of the development/consultant team.
- Resident population and housing projections, community plan materials and other data from the Maui County Planning Department.
- The United States 2010 Census and subsequent updates.
- Sales and listing data from the Maui Board of Realtors and Hawaii Information Service.
- Data from our files.

The WCT site and environs have been viewed by our firm on many occasions and specifically for this assignment. The effective date of study was June 15, 2015.

REVISION TO STUDY CONCLUSIONS

We note there have been meaningful changes to some aspects of our economic impact analysis and public fiscal assessment since the prior editions of this study through the adoption of a conservative perspective which seeks to remove any double-counting within the modeling process. It likely results in an under-counting of impacts, but is an improvement over past models which undoubtedly over-counted some items.

The economic analysis industry has moved to this evolved perspective in response to more fully integrating a single proposed project into the larger economic sphere and in response to input from communities across the nation.

In our previous versions, the WCT was viewed as a holistic development which was essentially free-standing from the Maui economy. This resulted in the counting of all household income, spending, tax benefits and costs for all residents of WCT.

However, the vast majority of the projected WCT population is ALREADY residents of Maui who are merely relocating to WCT. As such, their economic and fiscal impact is already flowing through the island and is not NEW as a result of the project. Their household income, discretionary spending, public education students, tax dollars generated and public service costs are in-place and accounted for, resulting in our prior reports essentially double-counting some impacts.

Our revised economic and fiscal impact modeling is solely oriented towards "new" impacts that would otherwise not exist in the community and excluding those of relocating Maui households. From a household income and discretionary spending perspective, the resident population is assumed to live on Maui prior to their residing at WCT and is therefore already contributing their State GET and Income taxes, so these are excluded from the model. They are merely moving their home from one location to the other on the island and their economic public fiscal footprint will remain generally unchanged apart from the additions to the County's real property tax base.

The exception is for the full-time resident real property taxes, as their new home at WCT will mean increased real property assessments and taxes, with their previous homes still having a tax load that would be paid by a subsequent owner. The tax impacts of on-going maintenance/renovation costs of their new homes are also included in the model.

In this report we have filtered out the existing/in-place economic and fiscal impacts of Maui residents and re-oriented analysis towards considering only the non-resident component of WCT, in regards to economic expansion, tax benefits flowing to the State and County of Hawaii and the cost of providing government services to them on a per capita basis.

Our economic and fiscal models have adopted this more conservative viewpoint, and reflect only the new economic impacts, including capital investment, spending by non-resident WCT owners, and their taxes and public costs. All of the economic impacts arising from the resident population (assumed to be relocating Mauians) have been excluded

The modified outcomes, in addition to including the enumeration of the ohana units, show a marked difference in regards to some findings as the evolved modeling is by definition a much more conservative perspective and it is likely the true impact will be between the conclusions resented herein and our prior findings.

PRIMARY STUDY CONCLUSIONS

Based on our analysis of the subject property, its environs, and envisioned development we have reached the following conclusions as of June 2015 regarding the probable market standing and economic impacts of the proposed Waikapu Country Town project. Our study time-frame which serves as a basis for subject projections extends two decades to 2035, although it is anticipated all of the components of the community will be fully absorbed in a shorter period.

As our study and forecast period extends over 20-plus years with subject build-out and absorption requiring only a portion of the time-frame, our market-based findings and projections are not specifically time-sensitive, and should the project timeline move from commencement in 2016-17 to 2018-19 or in the near-term beyond, we would not anticipate major changes to our state conclusions.

Market Study

- Hawaii has steadily rebounded from the 2008-09 recession and associated down-cycle in the real estate market and is now within an extended-term favorable economic period featuring strengthening property sectors. Maui and Oahu have enjoyed the broadest and most extensive upward trending and had regained or surpassed virtually all of the ground "lost" by mid-2015. Expectations are for continuing economic expansion within the current up-cycle during 2015-17 (and into the mid-term) resulting in increasing demand for real estate inventory within a limited supply environment.

- Among the favorable economic indicators and trends on Maui, the unemployment rate has dropped to a current level of about 4.2 percent from a high of 9.1 percent during the depths of the recession; median household income has grown two percent in each of the last three years; residential sales activity and prices are moving upwards; commercial and industrial space absorption showed strong gains in 2014-15; and, total visitor days and spending have had annual escalations averaging more than 5 percent and 10 percent respectively since 2010. Only the commercial space market continues soft in some regions of the island.

- Regardless of the point in the economic cycle, there remains a chronic unmet demand for additional affordably-priced housing on Maui. While numerous directed projects have been proposed, along with other mixed-use developments with a workforce housing component, they have been slow to reach fruition; and, those in-development are failing to meet all demand segments in the upwardly-moving market.

- The "Wailuku-Kahului Study Area" (or "Central Maui") is the center for government, transportation and non-visitor economic activity on the island, and its most populous district. In addition to its historic standing as the location of a significant share of urban uses, it has again become a focal point for light industrial, commercial and residential development over the past two decades, with numerous major projects actively adding inventory, in-construction or proposed. The proximity to services, goods, transportation facilities, businesses and employment opportunities, ready access to the island's highway system, and a desirable climate will facilitate continuing demand for real estate into the long-term; although it will "lose"

some of its market dominance as development continues in South (primarily) and West Maui.

- There were some 57,618 residents in the Wailuku-Kahului region as of mid-year 2015, and projections of the resident population by 2035 (our study period time-frame) based on County and State forecasts range from circa 78,800 to 97,100, as shown below:

Scenario	Year-End 2013	Projected Wailuku-Kahului Population 2015	2020	2025	2030	2035
One: Minimum Based on Adjusted Planning Department Baseline Population Forecasts						
Residents	56,919	57,618	62,642	67,909	73,269	78,764
Two: Maximum Based on Planning Department Historical Trend Run Population Forecasts						
Residents	56,919	60,114	68,010	76,850	86,679	97,080

- There are an estimated 19,200 housing units in Central Maui of which some twelve percent are owned by non-residents as second/vacation homes. The average resident household size is just under 3.50 persons and is forecast to decline meaningfully in coming decades as a result of family/household trends and a changing mix of unit types from new development.

- There are an estimated twelve million square feet of gross leasable light industrial and commercial floor space in Central Maui, about three-quarters of the island-wide total, but a limited visitor-oriented component with only 462 total transient units (just 2.3 percent of the island total) and limited tourist-dominated retail.

- Waikapu is potentially a highly competitive location within the Maui housing market. It is considered to have distinctive, unique characteristics relative to nearby Wailuku and Kahului, although it represents the southerly boundary of their greater urban sphere. All of the just over 900 units of residential inventory built in the Waikapu Village area to date (less than five percent of the regional total) have been successfully absorbed, and the number of units available for resale is typically limited with only six active house listings at the report date, or just 0.66% of the total units in the community. It is considered desirable for its relative ease of access to the Wailuku/Kahului commercial and service centers as well as the resort employment areas in West and South Maui; for its cooler climate; panoramas across the isthmus to Haleakala; and, small town ambience.

- The subject property is a superior location for the proposed development in regards to access, views, topography, shape, consistency with nearby uses and land planning objectives, climate, and ability to provide a quality lifestyle and business opportunities for a wide-range of owners and end-users. It will have the attributes necessary to be highly competitive in all its product sectors, and will capture a reasonable market share during its offering period.

- We estimate the demand for new residential units in the Wailuku-Kahului study area will be from 9,647 to 16,814 units over the next 21 years (through 2035); including allowances for non-resident purchasers and vacancies, with a mid-point demand of 13,230 units. The number of existing unsold and planned resident housing units within the regional "Directed Growth Boundary", excluding the proposed WCT product, totals some 7,296 units. This indicates there will be a shortfall in the sector of from 2,351 to 9,518 new residential units; with a mid-point under-supply of 5,935 units. Our analysis indicates there will be sufficient unmet demand to readily absorb the 1,433 units of subject inventory during the projection period.

- The median price for a single family home in Central Maui (which includes many smaller, older homes/units) during the first half of 2015 was $507,300 and at $308,750 for a multifamily unit. Both indicators show meaningful appreciation since prices reached a post-recessionary nadir in 2011. Median prices are anticipated to increase into the long-term as thousands of higher priced new units manifesting the higher costs of land, construction, impact fees and entitlement, are added to the inventory, and appreciation (though cyclical) continues.

- We estimate approximately 75 percent of the demand for resident housing in the Wailuku-Kahului Study Area will be for units with a current price of $660,000 or less; the upper-price threshold for meeting County affordability standards (160 percent of median household income), with 30 percent of demand for units having a current price of less than $330,000 (the 80 percent of median household income threshold).

- Multifamily units will comprise an increasing proportion of the total regional inventory, moving from the current 25 percent level to 45 percent over the coming two decades; by which time they will represent almost half the new product being added. About 73 percent of the proposed subject product is currently

envisioned to be single family (homes or lots) and 27 percent multifamily units; a mix reflecting the lower-intensity/rural nature of WTC relative to other Central Maui developments. However, the master plan and Project District Ordinance will allow for adjustments in the unit mix as the market evolves over-time and should demand for multifamily units in the community increase.

- Pricing for the subject inventory will comply with the County of Maui "Residential Workforce Housing Policies". At this time, based on prevailing construction costs and interest rates, proposed lot sizes, and market conditions, the developer projects as much as 85+ percent of the inventory could potentially have prices meeting affordability guidelines for households with 140 percent or less of median household income on the island.

- Based on the limited availability of alternative Central Maui supply relative to demand and the favorable competitive characteristics of the subject location and proposed community, we estimate the 1,433 proposed residential units of WCT will require about 10 years to be fully absorbed following anticipated commencement of pre-sales in 2017, or at an average rate approaching 150 units annually. This represents only some 20 percent of total regional mid-point demand during the sales period; a moderate perspective which could readily be swifter if some proposed projects fail to reach fruition and the market standing of WCT achieves expectations. Ground-breaking and initial construction is not anticipated until circa 2018-2019.

- The master plan will provide the potential for up to 146 "ohana" units in the community, although their location has yet to be determined. It is assumed the ohana units will be used for long-term rentals and/or permanent housing for Maui residents. In light of the well-documented long-term demand for affordable housing on the island (particularly rentals), coupled with the results of our general market analysis, we have assumed there will be sufficient demand to readily absorb the ohana units and have not completed a specific assessment. As there is no certainty when or where the units will be built in the project, we have analyzed their economic and fiscal impact within our models assuming maximum build-out of the 146 units between 2021 and 2030.

- Although the WCT holding has superior characteristics for general commercial development, including extensive frontage on two highways (and proposed connector road), and a gateway/intercept location, it is not the intent of the developers to compete for a broad spectrum of retail, restaurant and service tenants. Beyond a typical, appropriately-scaled village center to meet the daily "neighborhood" shopping needs of residents, guests and workers within a sustainable community, the remaining added commercial spaces are envisioned as creating a low-intensity, design-controlled, small-town environment similar to Makawao, Paia, Lanai City Square, Hanalei, or as seen in the exiting shops within Maui Tropical Plantation, with additional opportunities for live/work spaces and galleries.

- We estimate the demand for neighborhood commercial space by WCT residents and day workers at build-out will be some 85,100 square feet, with patronage by guests in the community, other Waikapu households, and passer-bys contributing an additional 34,000 square feet of demand on a stabilized basis. The remaining 50,500 square feet (of the total 169,600 square feet proposed) will be modestly absorbed over-time with specialized/niche businesses, many with cross-over appeal to residents and visitors, and keeping with the small town context. The developers are hopeful the existing on-site Tropical Plantation shops will remain at WCT. We estimate it will require about 12 years for the proposed subject commercial space to be fully absorbed.

Our annualized mid-point subject residential unit absorption estimates are summarized on the table below.

PROJECTED SUBJECT RESIDENTIAL UNITS ABSORPTION
Assuming 1,433 Residential Units
With Sales Starting in 2017

Year		Construction, Sale and Absorption Timing	Absorbed Residential Units (Pre-Sold/Reserved)
Calendar	Development		
2016	1	Infrastructure Emplacement Commences	
2017	2	Infrastructure Completed, Verttical Construction & Pre-Sales Begin	150
2018	3	Initial Buildings Completed and Occupied	120
2019	4	Vertical Construction, Absorption and Sales On-Going	130
2020	5	Construction, Absorption and Sales On-Going	140
2021	6	Construction, Absorption and Sales On-Going	150
2022	7	Construction, Absorption and Sales On-Going	150
2023	8	Construction, Absorption and Sales On-Going	150
2024	9	Construction, Absorption and Sales On-Going	150
2025	10	Construction, Absorption and Sales On-Going	150
2026	11	Residential Component Completed	143
	Totals		**1,433**
2021 to 2030		**Construction of Ohana Units Assumed to Occur with Maximum Build-Out**	**146**

Source: The Hallstrom Group/CBRE

The forecast absorption of the commercial component is shown below.

PROJECTED SUBJECT COMMERCIAL SPACE ABSORPTION BY PERIOD

Gross Leaseable Area in Square Feet			
2016-2020	2021-2025	2026-2030	Total
42,399	110,238	16,960	169,597

Source: The Hallstrom Group/CBRE

Economic Impact Analysis

We have constructed a model depicting the economic impact of the WCT project on the Maui and Statewide community during the course of its "lifespan" from anticipated ground-breaking in 2016, through build-out and full absorption (2026-27), and reaching full "stabilization" by 2030.

The model builds on the absorption estimates and data contained in our market study. The potential ohana component at maximum build-out of 146 units is included.

All estimated amounts are in constant 2015 dollars.

- The WCT development will bring in $644.3 million of new, direct capital investment and significant indirect expenditures into the island's real estate market during its build-out over a 12

year period (from 2016 to circa 2026-27) for the "base" 1,433 units with an additional circa three years to complete the 146 unit ohana units (by 2030). It will generate some $817.2 million in total "new" Maui economic activity during the construction and initial operations period, and some $32.1 million in annual new economic activity on a stabilized basis thereafter.

- The construction of the WCT components will directly create an estimated 2,476 "worker-years" of employment (the equivalent of 52 work weeks at 40 hours per week) in the trades and associated businesses during build-out, averaging about 165 worker years annually, with an estimated $201 million in wages (averaging about $13.4 million per year).

- The on-going operations and maintenance of the business commercial, and residential components will directly provide an estimated 4,251 worker-years and $151.6 million in total wages over the 13-year period from opening of the first businesses until full absorption and stabilization are achieved (2018 to 2030). The operating businesses and maintenance of the housing units will support a projected 531 "full-time equivalent" positions following stabilization (many of which are anticipated to be held by WCT residents) with annual wages of $2.2 million.

- Associated secondary/off-site employment during the overall development and absorption time-frame will total 1,789 worker-years with wages of $91.3 million. After "stabilization" the community will contribute to the support of some 149 secondary/off-site positions with $7.6 million in yearly wages off-site.

- We project that from 5.9 percent (in 2020) to 22.6 percent (in 2030) of gross commercial sales in the project stores and restaurants will be new spending on Maui , growing to a stabilized level of $23 million annually. The total base economic impact on Maui in new monies will total at least $814.1 million during build-out/absorption and $32.1 million annually upon stabilization.

- These figures do not include the direct and off-site employment, wages and business activity generated by the in-place 29,000 square feet of the Tropical Plantation commercial spaces.

- At completion the de facto population of the community will be some 4,085 persons, comprised of 3,921 full-time residents (with an overall average household size of 2.87 persons among all unit types) and some 163 part-time residents and second home owners. The cumulative resident household income during the 13-years of residential occupancy and absorption of the modeling period (2018 through 2030) will total $1.3 billion, and will stabilize at $156.6 million annually thereafter. Discretionary expenditures into Maui businesses by the WCT de facto population will be some $707.4 million during build-out and average $83.1 million per year on a stabilized basis. However, these for the most part will not be new earned and spent monies flowing into the Maui economy, merely the relocation of the household earning/spending it.

- The part-time second home de facto residents will be bringing new money and spending to Maui, totaling $21.7 million during project build-out and stabilizing at $4.8 million per year.

- Application of the State Input-Output Model macro multipliers depicting direct, indirect and induced economic impacts arising from development of WCT results in significantly higher economic out-flow indicators than those from our direct, subject-specific micro model.

  The total State economic impact from construction of the project would reach $1.37 billion, there would be 8,911 total worker-years of jobs created, and the total increase in earnings statewide would be $406.1 million.

  The State model also estimates the total annual additional new economic output from business operations within WCT would be more than double the gross revenues at $67.1 million annually on a stabilized basis, the total number of worker years attributable to the subject dollars flowing through the economy would be 609 positions annually, and the increase in direct earnings would be $21.2 million per year.

Secondary Impacts

- The WCT project will have minor impacts on the socio-economic aspects of the surrounding community that relate to real estate issues.

  1. The proposed residential components will be compatible with existing and proposed housing developments located within the Directed Growth Boundary northerly of the property in regards to inventory type, pricing and market standing.

  2. The proposed commercial component will be appropriate in scale, design and uses within a "small town" context; intended to support the WCT residents and provide unique, low-intensity business opportunities. It will not contain big box or regional-type retailers, or is not intended to be directly competitive with on-going major commercial development in Wailuku and Kahului.

  3. 1,070 acres mauka and southerly of the village center will be kept in the Agricultural District (800 acres within perpetual agricultural easement) as a buffer from the urban uses for further outlying agricultural and conservation lands.

  4. Property values in the Central Maui are largely driven by external, cyclical economic factors within an existing (and expanding) cumulative mass, not any single new project. WCT will not, in itself, drive regional market values or real property assessments of nearby real estate upwards.

  5. It is not expected there will be meaningful in-migration to Maui as a direct result of the operating components of the project.

  6. A significant percentage of the WCT residential inventory is anticipated tube sold at prices consistent with Maui County workforce housing guidelines, providing new, competitively-priced inventory across a broad-spectrum of purchaser demographics; contribute impact fees (and a school site) in support of regional civic and educational facilities; and provide live/work

opportunities in a sustainable, appropriately-scaled project.

7. Residents and patrons of the community will have frontage along at least one major highways providing direct access to many areas of Maui without having to travel through, and increase the congestion of, the Wailuku-Kahului urban core.

Public Fiscal Benefits

- The County of Maui will realize new Real Property Taxes ($27.7 million), other secondary receipts, and impact fees totaling $47.9 million during the 15-year projection period (2016-2030), and $4.9 million annually on a stabilized basis thereafter. After new per capita costs for services are considered the County will earn a net "profit" $42.2 million during build-out and $4.2 million annually after stabilization.

- The State of Hawaii will receive new Gross Excise and Income taxes, secondary revenues, and impact fees of $95.4 million during the 2016-2030 period, and $4.4 million per year thereafter. Overall, after new per capita governmental costs are deducted, the State will generate net benefits of $82.6 million during build-out and $2.9 million annually on a stabilized basis.

Given the existing emergency services and social services infrastructure available in nearby Wailuku and Kahului, the provision of a school site within WCT, payment of impact fees, and young age of the project components, it is likely the "actual" public cost burden associated with the project would be less than the per capita assessment or independently require the need for major new public facilities.

The major economic impacts and public fiscal conclusions are summarized on the following table. The column on the left summarizes the cumulative impacts during the initial 15-year projection period (2016-2030) covering build-out/absorption and ramp-up to stabilization, and the right hand column the annual impacts after stabilization. Our calculations include the base 1,433 units of the project and the maximum build-out of 146 ohana units.

SUMMARY COMPARISON OF MAJOR ECONOMIC IMPACTS AND PUBLIC FISCAL COSTS/BENEFITS All Amounts Expressed in Constant, Uninflated 2015 Dollars		
Analysis Item	Cumulative During Projection Period 2016-2030	Stabilized Annually Thereafter
Direct Capital Investment	$644,304,552	
Local Contractor's Profits	$64,430,455	
Local Supplier's Profits	$25,772,182	
Worker Years of Jobs	8,946	746
Employee Wages	$465,899,240	$27,096,572
Resident Population		3,921
Full-Time Resident Household Income	$1,334,322,822	$156,629,499
De Facto Population Expenditures (On & Off Site)	$707,386,126	$83,084,350
Total New Operating Gross Receipts	$172,813,024	$32,090,792
Total New Maui "Base" Economic Impact	$817,117,576	$32,090,792
ACCOUNTS FOR NEW TAX REVENUES AND EXPENDITURES ONLY		
County of Maui Gross Tax and Fee Receipts	$47,949,874	$4,853,230
State of Hawaii Gross Tax and Fee Receipts	$95,379,394	$4,369,210
County of Maui Costs of Services (per capita basis)	$5,516,032	$620,290
State Costs of Services (per capita basis)	$12,714,816	$1,429,808
County of Maui Net Benefits or (Loss)	$42,433,842	$4,232,940
State Net Benefits or (Loss)	$82,664,578	$2,939,401

Source: The Hallstrom Group/CBRE

MARKET STUDY OF THE MASTER PLAN COMPONENTS AND ABSORPTION ESTIMATES

The Study Area Residential Market

The tables containing the model components summarized in this section are presented in Addenda Exhibit I, Tables 1 through 15. All tabular inserts into the text are also contained as full-size tables in the addenda for easier readability.

An established pre-contact Hawaiian village, Wailuku, and later her sister city of Kahului, have been the center of Maui commerce, transportation, civic and residential development for more than 150 years. It became the County Seat in 1905.

Residential development was focused on the needs of the thousands of in-migrating sugar plantation workers and their families, with scattered outlying rural ranches/farms and small villages.

The area had a relatively static population for many generations, reflective of a stable agrarian-based, isolated economy, and development and facilities expansion was slow-paced.

The 1970 census reported the "Wailuku District" resident population at 22,219 persons, and the region had an estimated 5,750 housing units.

The coming of the island's tourism industry, bringing a new wave of in-migration, coupled with an on-going evolution towards a modern service-based economy, has resulted in rapid expansion of the resident population (and to a lesser degree de facto population) and in real development (residential, industrial and commercial).

At mid-year 2015, there were an estimated 57,618 residents in what is now called the "Wailuku-Kahului Community Plan" area. This represents a near-tripling of the count from 45 years previously, an increase of 35,400 persons, and a compounded annual population growth rate of 2.14.

Projections published by the County of Maui Planning Department in their *Socio-Economic Forecast: The economic projections for the Maui County General Plan 2030* (June 2006) estimate the resident population of Wailuku-Kahului will reach between 73,269 and 86,679 persons by 2030.

The *Maui Island Plan – General Plan 2030*, adopted in December 2012 projects the total resident population of the study area will only reach 64,853 persons by 2030; a significant drop from the prior forecasts and reflective of the recessionary period in which they were made.

However, on consideration, these newer estimates are problematic as they show the resident population of Wailuku-Kahului **declining** by 2,090 persons between 2010 and 2015 (from 54,433 to 52,343 persons), an apparent inaccuracy; particularly given the rapid housing development in the area during the period.

Discussion with County Planners indicates they are aware of the discrepancy but stated that the figure for 2030 remains valid within the context of the Island Plan even if the interim model-outputs need revision. Further, they confirmed continuing to utilize the housing demand and land use forecasts based on the 2006 projections.

Given the recessionary depths in which the 2012 forecasts were made, our belief these recent projections will result an understatement of at least 5,000 to 10,000 persons in the region by 2030, and that the

Planning Department continues to rely on the 2006 land use/housing forecasts to some degree, we have utilized the 2006 model for the WCT analysis.

If the 2015 Island Plan forecast were revised to reflect the reality of the growing (not shrinking) regional population from 2010 through 2015 and then trended forward to 2030 the resulting projections would fall into the range of the prior (2006) regional population estimates.

To provide at least a two decade study perspective we have lengthened the time-frame to 2035 by escalating the Planning Department forecasts by an additional five years at the effective 2025-2030 growth rate in the model. We project that by 2035 the resident population in the study area will be between 78,764 and 97,080 persons.

The average household size has dropped meaningfully in the past four decades to about 3.42 persons by mid-2015, down from the 3.46 persons shown in the 2010 census as shown below.

2010 CENSUS FIGURES FOR THE WAILUKU-KAHULUI PLANNING AREA

Census Designated Place	Resident Population	Total Housing Units	Number of Households (1)	Average Household Size (2) Computed	Average Household Size (2) Survey	Homeownership Rate	Non-Resident Ownership (3)	Multi-Family Units as % of Inventory
Kahului	26,337	7,773	6,721	3.92	3.65	56.7%	13.5%	28.2%
Wailuku	15,313	6,250	5,326	2.88	2.92	63.8%	14.8%	28.7%
Waihee-Waiehu	8,841	2,459	2,517	3.51	4.06	81.6%	3.0%	* 9.2%
Waikapu	2,965	909	879	3.37	3.37	78.0%	3.3%	0.0%
CDP Total	**53,456**	**17,391**	**15,443**	**3.46**	**3.49**	**63.9%**	**12.0%**	**24.2%**

(*) Estimated.

(1) Average during six-year period 2007-012. This causes a slight disconnect in regards to the Waihee-Waiehu CDP figure.

(2) "Computed" calculated by dividing resident population total by number of households. "Survey" are based on answers given to US Census.

(3) Percentage of total housing units not used by resident households. Does not include short-term/vacation/transient rentals

Source: 2010 US Census, and The Hallstrom Group/CBRE

The average household size is anticipated to continue dropping over the coming 20 years to about 3.10 to 3.14 persons as families/household demographic dynamics continue to change (nationwide) and new development changes the traditional mix of unit types in the area. Within the subject community we forecast an overall household size of 3.2 persons for single family homes, 2.6 persons for multifamily units and 1.5 persons for ohana units. This equates to an overall average household size of 2.87 persons, comparable with the current level in Wailuku which has the most similar mix of residential inventory among the regional towns of some 2.81 persons, as shown in the following excerpt from the US Census.

There were an estimated 19,200 housing units in the Wailuku-Kahului planning area as of the study date (mid-2015), an increase of some 1,800 from the 2010 census, with some 12-plus percent of the inventory owned by non-residents and used for vacation/second homes.

Today, about 75 percent of the residential inventory in the study area is of a single family type; 25 percent multifamily.

It is expected that the division in product type will continue to favor single family homes/lots, but that condominium development will meaningfully increase as a percentage of the total market as available entitled, serviced building sites become further scarce, infrastructure and land costs rise, and unit prices increase over time. Within the major in-development and proposed Central Maui master planned projects, the aggregate inventory is about evenly split between single and multifamily product.

Relative to many neighbor island areas, the balance between demand and supply in Wailuku-Kahului has been more stable than most, a product of its desirability for long-term residents. Like most elsewhere on Maui the market will be under-supplied from a long-term perspective and there remains significant unmet need for additional affordable housing opportunities.

Acknowledging the long-term trend towards smaller households, along with a conservative allowance of non-resident purchasers of at least 12 percent, and a vacancy allowance of three percent to achieve a stable market, we have quantified the total demand for new housing inventory in Wailuku-Kahului at from 9,647 to 16,814 units between mid-2015 and the end of 2035, with a mid-point of 13,230 units.

QUANTIFICATION OF HOUSING UNIT DEMAND FOR THE WAILUKU-KAHULUI STUDY AREA 2015 TO 2035						
	2015	2020	2025	2030	2035	Additional Units Required by 2035
Scenario One: Minimum Based on Adjusted Planning Department Baseline Population Forecasts (2)						
Resident Population	57,618	62,642	67,909	73,269	78,764	
Average Household Size (2)	3.42	3.35	3.28	3.21	3.14	
Total Resident Units Required	16,847	18,699	20,704	22,825	25,084	
Vacancy Allowance (3 % of resident unit demand)	505	561	621	685	753	
Non-Resident Purchaser Allowance (3) (12% of resident unit demand)	2,022	2,244	2,484	2,739	3,010	
TOTAL MARKET UNIT DEMAND	**19,374**	**21,504**	**23,810**	**26,249**	**28,847**	**9,647**
Scenario Two: Maximum Based on Planning Department Historical "High" Population Forecasts (Unadjusted)						
Resident Population	57,618	68,010	76,850	86,679	97,080	
Average Household Size (2)	3.42	3.34	3.26	3.18	3.10	
Total Resident Units Required	16,847	20,362	23,574	27,258	31,316	
Vacancy Allowance (3% of resident unit demand)	505	611	707	818	939	
Non-Resident Purchaser Allowance (3) (12% of resident unit demand)	2,022	2,443	2,829	3,271	3,758	
TOTAL MARKET UNIT DEMAND	**19,374**	**23,417**	**27,110**	**31,346**	**36,014**	**16,814**

These figures are consistent with the 2006 Land Use Forecast (by Plan Pacific Inc.) which projects the need for a total of 28,719 housing units in the study region in 2030, while our model estimates the range at from 26,249 to 31,346 by that year.

The 2012 Island Plan section on housing states it is based on the Land Use Forecast and the previously cited 2006 forecasts, but does not provide specific unit count projections to couple with the revised population estimates.

Using housing affordability calculations and historic trends in the relationship between Maui residential pricing and household income level, we have estimated the range in unit selling prices best fitting the forecast demand for new units in the region over the next 20 years.

**STRIATED PROJECTIONS OF HOUSING UNIT DEMAND
BY SELLING PRICE IN THE WAILUKU-KAHULUI TUDYAREA 2014 TO 2035
Expressed in Constant 2015 Dollars**

Period	Periodic Demand 2015	2016 to 2020	2021 to 2025	2026 to 2030	2031 to 2035	Total Demand 2014-2035
1. Minimum Demand Forecasts						
Less Than $330,000 (1)	**52**	**639**	**692**	**732**	**779**	**2,894**
Percent of Total Demand	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
$330,000 to $660,000 (2)	**78**	**958**	**1,037**	**1,098**	**1,169**	**4,341**
Percent of Total Demand	45.00%	45.00%	45.00%	45.00%	45.00%	45.00%
$660,000 to $1,000,000	**35**	**426**	**461**	**488**	**520**	**1,929**
Percent of Total Demand	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Over $1,000,000	**9**	**106**	**115**	**122**	**130**	**482**
Percent of Total Demand	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Total Market Demand	**174**	**2,130**	**2,305**	**2,439**	**2,598**	**9,647**
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
2. Maximum Demand Forecasts						
Less Than $330,000 (1)	**52**	**1,213**	**1,108**	**1,271**	**1,400**	**5,044**
Percent of Total Demand	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
$330,000 to $660,000 (2)	**78**	**1,819**	**1,662**	**1,906**	**2,100**	**7,566**
Percent of Total Demand	45.00%	45.00%	45.00%	45.00%	45.00%	45.00%
$660,000 to $1,000,000	**35**	**808**	**739**	**847**	**934**	**3,363**
Percent of Total Demand	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Over $1,000,000	**9**	**202**	**185**	**212**	**233**	**841**
Percent of Total Demand	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Total Market Demand	**174**	**4,042**	**3,693**	**4,237**	**4,668**	**16,814**
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

(1) This price is considered "affordable" for households earning 80% of the median county household income ("Low Income").
(2) This price is considered "affordable" for households earning from 81% to 160% of county median (includes "Below Moderate" to "Gap Income" categories).

Source: Maui County, DBEDT, MLS and The Hallstrom Group/CBRE

New housing units in Wailuku-Kahului will need to be priced at (in 2015 dollars and second quarter prevailing interest rates):

- 30 percent under $330,000, which meets affordability guidelines for a household of four earning 80 percent of the County median household income ("Low Income");
- 45 percent from $330,000 to $660,000, considered affordable to households earning from 81 percent to 160 percent of median County income ("Below Moderate" to "Gap Income" categories), with the greatest portion of this demand focused towards the lower end of the range for households earning from 81 percent to 120 percent of median income;
- 20 percent from $660,000 to $1,000,000; and
- 5 percent at over $1,000,000.

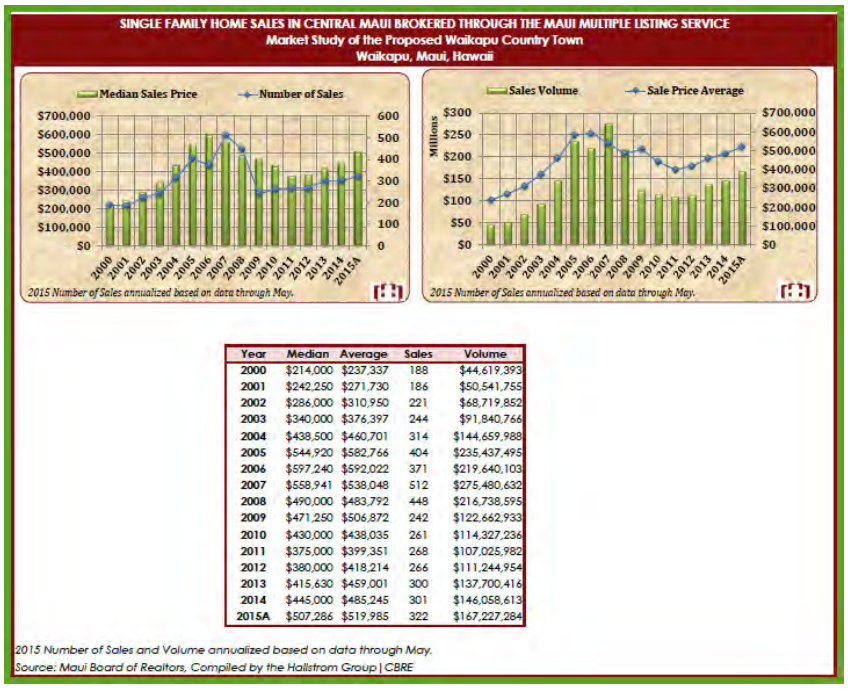
Through May 2015, the median and average sales prices for "Central Maui" residential inventory sold through the Maui Board of Realtors Multiple Listing Service (which may not include all original unit sales) were:

Single Family Median $507,286
Average $519,985

Condominium Median $308,750
Average $316,655

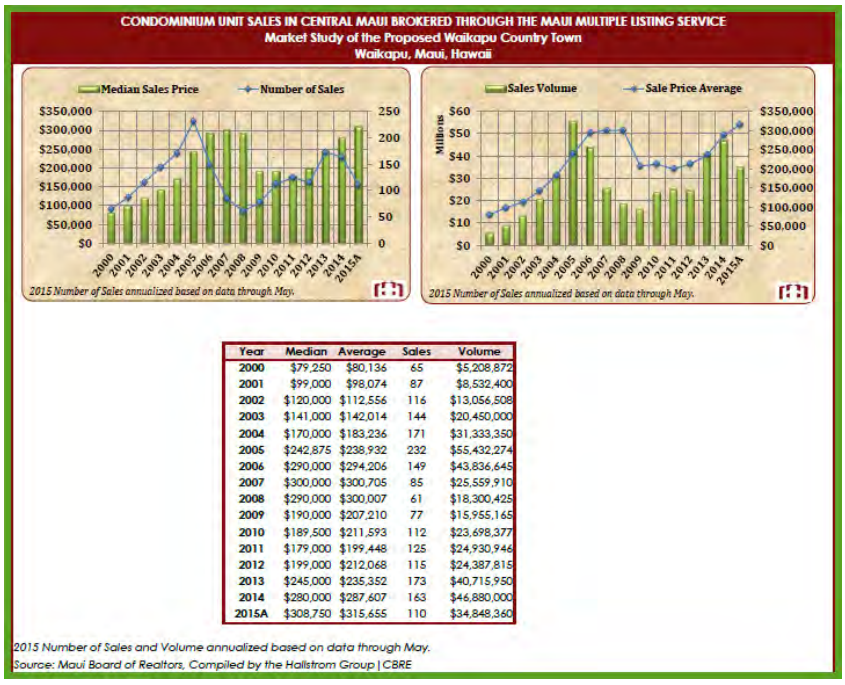
Land Median $415,000
Average $442,874

We note the "Land" category may contain some non-house lot transactions.



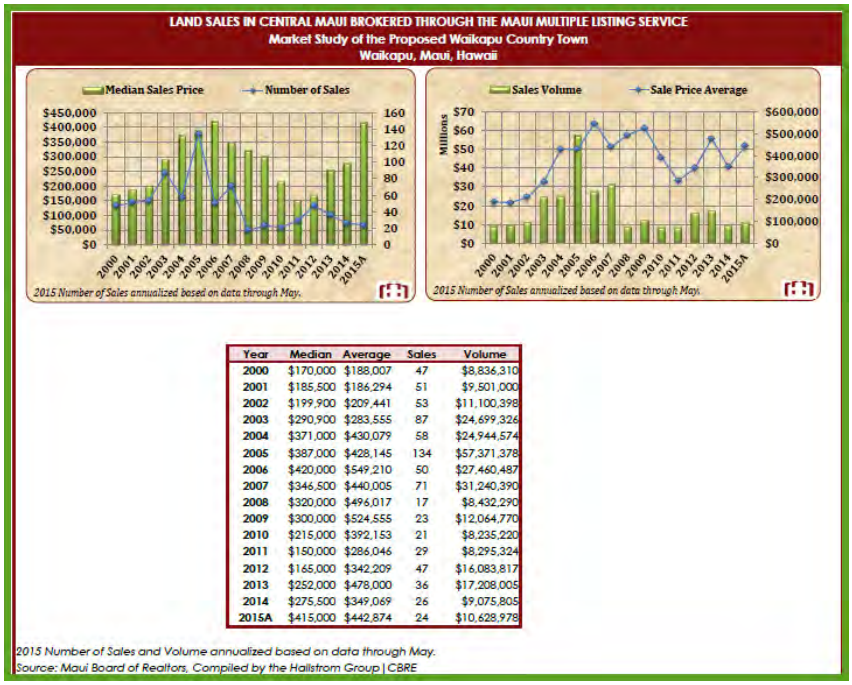
Year	Median	Average	Sales	Volume
2000	$214,000	$237,337	188	$44,619,393
2001	$242,250	$271,730	186	$50,541,755
2002	$286,000	$310,950	221	$68,719,852
2003	$340,000	$376,397	244	$91,840,766
2004	$438,500	$460,701	314	$144,659,988
2005	$544,920	$582,766	404	$235,437,495
2006	$597,240	$592,022	371	$219,640,103
2007	$558,941	$538,048	512	$275,480,632
2008	$490,000	$483,792	448	$216,738,595
2009	$471,250	$506,872	242	$122,662,933
2010	$430,000	$438,035	261	$114,327,236
2011	$375,000	$399,351	268	$107,025,982
2012	$380,000	$418,214	266	$111,244,954
2013	$415,630	$459,001	300	$137,700,416
2014	$445,000	$485,245	301	$146,058,613
2015A	$507,286	$519,985	322	$167,227,284

2015 Number of Sales and Volume annualized based on data through May.
Source: Maui Board of Realtors, Compiled by the Hallstrom Group | CBRE



Year	Median	Average	Sales	Volume
2000	$79,250	$80,136	65	$5,208,872
2001	$99,000	$98,074	87	$8,532,400
2002	$120,000	$112,556	116	$13,056,508
2003	$141,000	$142,014	144	$20,450,000
2004	$170,000	$183,236	171	$31,333,350
2005	$242,875	$238,932	232	$55,432,274
2006	$290,000	$294,206	149	$43,836,645
2007	$300,000	$300,705	85	$25,559,910
2008	$290,000	$300,007	61	$18,300,425
2009	$190,000	$207,210	77	$15,955,165
2010	$189,500	$211,593	112	$23,698,377
2011	$179,000	$199,448	125	$24,930,946
2012	$199,000	$212,068	115	$24,387,815
2013	$245,000	$235,352	173	$40,715,950
2014	$280,000	$287,607	163	$46,880,000
2015A	$308,750	$315,655	110	$34,848,360

2015 Number of Sales and Volume annualized based on data through May.
Source: Maui Board of Realtors, Compiled by the Hallstrom Group | CBRE



Year	Median	Average	Sales	Volume
2000	$170,000	$188,007	47	$8,836,310
2001	$185,500	$186,294	51	$9,501,000
2002	$199,900	$209,441	53	$11,100,398
2003	$290,900	$283,555	87	$24,699,326
2004	$371,000	$430,079	58	$24,944,574
2005	$387,000	$428,145	134	$57,371,378
2006	$420,000	$549,210	50	$27,460,487
2007	$346,500	$440,005	71	$31,240,390
2008	$320,000	$496,017	17	$8,432,290
2009	$300,000	$524,555	23	$12,064,770
2010	$215,000	$392,153	21	$8,235,220
2011	$150,000	$286,046	29	$8,295,324
2012	$165,000	$342,209	47	$16,083,817
2013	$252,000	$478,000	36	$17,208,005
2014	$275,500	$349,069	26	$9,075,805
2015A	$415,000	$442,874	24	$10,628,978

2015 Number of Sales and Volume annualized based on data through May.
Source: Maui Board of Realtors, Compiled by the Hallstrom Group | CBRE

The disparity between "median" and "average" prices is among the lowest margin for any area on Maui, due to the scarcity of very high-end beachfront and in-resort inventory.

Based on review of EIS and master planning materials for the major proposed project in the Wailuku-Kahului study region, and data from the Planning Department, we project that by 2035 approximately 49 percent of the new housing inventory being constructed will be multifamily units, up from the current level of 25 percent, with single family (homes and lots) falling from 75 to 51 percent of the added product. By 2025, the mid-way point of our projection period, multifamily units will be at 45 percent of the offered inventory and single family 55 percent.

DIVISION OF PROJECTED DEMAND BY UNIT TYPE
FOR HOUSING UNITS IN WAILUKU-KAHULUI STUDY AREA 2015 TO 2035

	Periodic Demand (1)					Total
	2015	2016 to 2020	2021 to 2025	2026 to 2030	2031 to 2035	Demand 2015-2035
1. Using Minimum Demand Projections						
Single Family Homes	110	1,044	1,037	1,073	1,117	4,381
Percent of Total	63%	49%	45%	44%	43%	45%
Single Family Lots	21	234	231	220	208	913
Percent of Total	12%	11%	10%	9%	8%	9%
Multifamily Units	44	852	1,037	1,147	1,273	4,352
Percent of Total	25%	40%	45%	47%	49%	45%
Total	**174**	**2,130**	**2,305**	**2,439**	**2,598**	**9,647**
	100%	100%	100%	100%	100%	100%
2. Using Maximum Projections						
Single Family Homes	110	1,981	1,662	1,864	2,007	7,624
Percent of Total	63%	49%	45%	44%	43%	45%
Single Family Lots	21	445	369	381	373	1,590
Percent of Total	12%	11%	10%	9%	8%	9%
Multifamily Units	44	1,617	1,662	1,991	2,287	7,601
Percent of Total	25%	40%	45%	47%	49%	45%
Total	**174**	**4,042**	**3,693**	**4,237**	**4,668**	**16,814**
	100%	100%	100%	100%	100%	100%

Source: The Hallstrom Group/CBRE

Relative to past down economic cycles, there was not a significant amount of unsold new product "overhanging" in the study area waiting to be absorbed as the market recovered; and what existed was quickly absorbed in the recovery. As a result all projected demand must be met via new development.

There are numerous residential projects entitled, proposed, or announced in the study area.

As key part of the Maui Island Plan (2012) was to establish a "Directed Growth Plan" described as:

> "Growth areas are established where future growth is desired. This will make development more predictable for everyone, including County service and infrastructure providers. This will help reduce development costs, provide more affordable housing, and lower taxes to the public."

The Planning Department, working with Citizen Advisory Committees (CACs), created a series of "Directed Growth Maps" maps showing existing in-place development and the extent/boundaries of the areas where future development should (and should not) occur.

Development areas are classified as either "Urban", "Small Town" or "Rural".

The proposed residential and commercial use areas of the larger WCT property are within the "Small Town" and "Rural" boundary areas of the Waikapu/Kahului section (Map C-3).

The WCT master plan appears to conform to the mapping guidelines.

While conformance with the directed growth maps acknowledges the planning/logistical and general community support for the WCT project, it still must successfully compete in the Central Maui real estate market for new home buyers with a significant number of other in-construction and proposed developments.

The level of potential supply of residential units in the WCT market area is significant.

The Maui County Planning Department, Long Range Planning Division has identified 39 projects (including WCT) totaling 8,700 potential units within the development boundary areas in Central Maui, summarized into three categories as follows:

POTENTIAL RESIDENTIAL UNIT SUPPLY IN CENTRAL MAUI AS IDENTIFIED BY MAUI PLANNING DEPARTMENT, INCLUDING WAIKAPU COUNTRY TOWN

Project Status	Number of Units		
	Single Family	Multifamily	Total
Planned/Committed (1)	1,618	1,710	3,328
Percent of Total	48.6%	51.4%	100.0%
Planned/Designated (2)	892	319	1,211
Percent of Total	73.7%	26.3%	100.0%
Proposed (3)	1,771	2,390	4,161
Percent of Total	42.6%	57.4%	100.0%
Totals	**4,281**	**4,419**	**8,700**
Percentage	49.2%	50.8%	100.0%

(1) Have conforming Community Plan and zoning entitlements, or approved ag. Or DHHL subdivision.

(2) Have urban or rural Community Plan designation but lack conforming zoning entitlements.

(3) Are currently lacking urban or rural Community Plan designation and conforming zoning entitlements. Includes the subject project.

The majority of units, 5,372 or 72 percent of the total, are in proposed developments lacking some level(s) of approvals.

The 8,700 total potential units, including the WCT, falls below our forecast demand range for Wailuku-Kahului of 9,647 to 16,814 units. Thus even if all of the proposed units are built in a rapid manner during the coming two decades (a highly unlikely prospect) they will still fail to meet minimum demand requirements through 2035 by nearly 1,000 units. It is probable the shortfall in supply will be from 4,000 to 6,000 units, assuming WCT is built-out.

If WCT is excluded from the proposed development totals, the number of proposed units drops to 7,270 (rounded), resulting in a minimum shortfall of 2,380 units and a probable undersupply of from 5,400 to 7,400 units.

Further, not all of the proposed units in the study region will be available to meet demand in a timely or competitive manner as:

- Not all of the unapproved units will successfully gain necessary entitlements.

- Many development sites currently lack water and/or other critical service systems and may never obtain them, or will require decades for regional systems to extend/expand to service their property.

- Master planned projects, particularly larger proposed communities, are often not built out to maximum densities.

As a result, we consider is highly unlikely that all of the proposed regional units will be built and offered on the market during our projection time-frame stretching to 2035, encompassing the period when WCT will be constructed.

Excluding the WCT proposed units (which total only 1,404 on the list) there are 7,296 potentially competitive units in the study area.

For analytical purposes we have assumed that 100 percent of the number of proposed units, a highly bullish figure, would be constructed between 2016 and 2035. To the extent fewer units are built, which we consider probable, there will be less potential competition for the WCT.

This total will be insufficient to meet the minimum demand for housing in Wailuku-Kahului over the next 20 years.

We have estimated the probable market acceptance levels and resulting absorption of the residential component of the WCT master plan using three methodologies.

- Gross Demand/Supply Comparison -- This technique assumes that if there is insufficient existing and planned supply to meet projected market gross demand levels during the projection period there is rational support for the subject units.

- The Residual Method -- In this technique, the competitive inventory planned for the study area over the projection period is placed on a time-line depicting their combined anticipated rates of absorption or assuming a reasonable market share. To the extent this periodic supply of units falls short of the forecast periodic demand for product in Wailuku-Kahului, an undersupply situation is present and there is "residual" demand remaining for the WCT inventory. This method is considered the most conservative as it allows the proposed competitive product to achieve their full absorption potential before any residual demand flows to absorb the subject.

- The Market Shares Method -- This approach accounts for the probable competitiveness of the subject inventory regardless of the total level of product being otherwise offered on the market. In essence, it is an estimate of how much of the total forecast demand in the Wailuku-Kahului region the subject could expect

to capture on an annual basis in light of its location, product type, estimated pricing, perceived competitiveness, and amenity/lifestyle characteristics.

Without the WCT units Gross Demand for additional housing units in the study area will fall short of anticipated supply by between 2,351 (minimum) and 9,518 units (maximum), with a mid-point shortfall of some 5,934 units, by 2035. This method indicates full absorption of the subject units could be achieved within a six to twelve year period.

Even if all 7,296 of the proposed non-subject units in the region achieve reasonable development speed and absorption velocities and are fully built-out and absorbed by the early 2030s, there will still remain substantial unmet Residual Demand (mid-point) for both single family homes/lots and multi-family units in every five-year projection period from 2016 through 2035.

And, as WCT has water and support systems available to pursue timely development it should receive most (if not substantially) all of the regional residual demand.

Using mid-point demand estimates, the residual demand available will be sufficient to absorb the subject units in a timely manner within a 6 to 10-year exposure period (pre-sale to sell-out) commencing in 2017.

PROJECTION OF POTENTIAL SUBJECT UNIT ABSORPTION USING THE RESIDUAL METHOD BASED ON TOTAL DEMAND FOR RESIDENTIAL UNITS IN THE WAILUKU-KAHULUI STUDY AREA
Based on Proposed Units Within the Proposed Directed Growth Boundary for Wailuku-Kahului, Using Mid-Point Demand Estimates

Segment	TOTAL UNITS PROPOSED Excluding Subject	Sales Period 2015	2016-2020	2021-2025	2026-2030	2031-2035	Total
Single Family (1)							
Identified Supply (2)	3,585	100	1,000	1,000	1,000	485	3,585
Market Share Percentage of Total Supply		57%	50%	50%	50%	43%	49%
Regional SF Lot/Home Demand (mid-point)	**7,254**	**100**	**1,852**	**1,650**	**1,769**	**1,853**	**7,223**
Shortage or (Excess) Supply	**3,669**	**0**	**852**	**650**	**769**	**1,368**	**3,638**
Potential Residual Subject SF Demand							
at 90% Capture Rate	3,302	0	766	585	692	1,231	3,274
at 80% Capture Rate	2,935	0	681	520	615	1,094	2,910
Multi Family							
Identified Supply (2)	3,711	74	1,000	1,000	1,000	637	3,711
Market Share Percentage of Total Supply		43%	50%	50%	50%	57%	51%
Regional MF Unit Demand (mid-point)	**5,976**	**74**	**1,234**	**1,350**	**1,569**	**1,780**	**6,007**
Shortage or (Excess) Supply	**2,265**	**0**	**234**	**350**	**569**	**1,143**	**2,296**
Potential Residual Subject MF Demand							
at 90% Capture Rate	2,039	0	211	315	512	1,029	2,066
at 80% Capture Rate	1,812	0	188	280	455	914	1,837

Given the desirable location, its master-planned amenities, anticipated pricing, and generally comprehensive lifestyle envisioned for WCT, it will achieve a solid market standing and prove strongly competitive in the regional housing market; able to garner a significant share of

demand even though there may be large numbers of competing units proposed.

We estimate the subject could readily achieve an average Market Shares (or "Capture") Rate approaching 20 percent, or just one/fifth, of the total Wailuku-Kahului demand for new housing units.

A total absorption period for the subject residential product of between about 8.5 years and 15.5 years is indicated by this analysis.

SUMMARY OF SUBJECT PROJECTED DEMAND LEVELS
USING THE MARKET SHARES METHOD
Assuming Pre-Sales Commence in 2017

Scenario One: Using Minimum Demand Assumptions

Sales Year Date	Period	Total Regional Demand	Effective Subject Share	Indicated Total Subject Absorption (1)
2017	1	426	20.00%	85
2018	2	426	18.00%	77
2019	3	426	19.00%	81
2020	4	426	20.00%	85
2021	5	461	20.00%	92
2022	6	461	20.00%	92
2023	7	461	20.00%	92
2024	8	461	20.00%	92
2025	9	461	20.00%	92
2026	10	488	20.00%	98
2027	11	488	20.00%	98
2028	12	488	20.00%	98
2029	13	488	20.00%	98
2030	14	488	20.00%	98
2031	15	520	20.00%	104
2032	16	520	10.00%	52
Totals		**7,488**	**19.14%**	**1,433**

Scenario Two: Using Maximum Demand Assumptions

Sales Year Date	Period	Total Regional Demand	Effective Subject Share	Indicated Total Subject Absorption (1)
2017	1	808	22.00%	178
2018	2	808	20.00%	162
2019	3	808	21.00%	170
2020	4	808	22.00%	178
2021	5	739	22.00%	162
2022	6	739	22.00%	162
2023	7	739	22.00%	162
2024	8	739	22.00%	162
2025	9	739	13.00%	96
Totals		**6,927**	**20.69%**	**1,433**

ANALYSIS MID-POINT			
12.05 Years	**7,207**	**19.88%**	**1,433**

(1) Excludes potential Ohana units.

Source: The Hallstrom Group/CBRE

Correlation of the three absorption techniques indicates the 1,433 proposed units of the WCT master plan will achieve full absorption

within approximately ten-years of initial pre-sale offerings; which are anticipated to commence in 2017.

The WCT Commercial Component

The tables containing the model components summarized in and inserted into this section are presented in Addenda Exhibit II, Tables 1 and 2.

As previously noted, the residential component of WCT, the driving force behind the master plan, was our analytical focus. With on-site commercial demand a secondary consideration and only briefly analyzed.

Commercial uses are intended as a supporting component enhancing the lifestyle of and economic opportunities for the project residents; to be restricted in character; and, not in direct competition with the more intensive general commercial inventory in Wailuku and Kahului.

Our commercial analysis is internally focused, not a detailed regional demand/supply analysis.

The primary objective for commercial uses at WCT will be to:

- Meet the daily "neighborhood" retail, restaurant, service and support commercial demands created by residents and workers in the community along with their guests and customers.
- Support live/work, small business, and sole proprietor opportunities within a mixed-use environment.
- Create a more comprehensive, sustainable and desirable community with a true "town core" providing employment opportunities and proximate services.
- Build on the existing unique retail platform at the Maui Tropical Plantations site and attract a mix of locally-owned specialty and artisan/craft shops that would appeal to visitors and residents as a destination experience.

It is not an objective of the updated master plan for WCT to become a major regional/island shopping destination or support big box development.

Demand for business commercial space is a direct function of the number of consumers in the effective trade area. Each individual, resident or visitor, generates the "need" for more retail opportunities.

At present, there is some 4.6 million square feet of commercial floor space on Maui, or the equivalent of 29.9 square feet of gross leasable area per resident and 22.2 square feet per capita of the de facto population (residents and visitors).

This is slightly above the statewide averages of 23.6 square feet and 22.6 square feet, respectively, and a moderate to lower-moderate amount for an economy of Maui's size and composition relative to similar markets; particularly given that being an island consumers can't readily access other nearby trade areas.

SUMMARY OF EXISITING COMMERCIAL SPACE DEVELOPMENT IN HAWAII AND AMOUNT PER CAPITA
As of End of First Quarter 2015, Major Islands Only

County	C &C of Honolulu	Maui	Kauai	Hawaii	State Totals
Resident Population	1,001,706	154,020	71,885	200,016	1,427,626
De Facto Population	1,097,734	208,185	95,420	229,964	1,631,302
Gross Leaseable Area in Major Centers in Sq. Ft. (1)	19,995,007	4,069,738	1,267,749	3,234,939	28,567,432
Other Gross Leaseable Area in Sq. Ft. (2)	3,683,500	543,150	200,200	653,125	5,079,975
Total Estimated Commercial GLA (Square Feet)	**23,678,507**	**4,612,888**	**1,467,949**	**3,888,064**	**33,647,407**
2. Per Capita Spatial Allowance (Square Feet per Person)					
Per Resident Population Member	23.6	29.9	20.4	19.4	23.6
Per De Facto Population Member	21.6	22.2	15.4	16.9	20.6
3. General Market Operating Overview					**State Average**
Vacancy Rate	4.9%	9.5%	10.3%	4.8%	5.8%
Estimated Vacant Square Feet of GLA	1,160,247	438,224	151,199	186,627	1,936,297
Weighted Avg. Monthly Base per Square Foot Rents (3)					
Low	$2.73	$2.96	$2.95	$2.42	$3.62
High	$14.37	$4.51	$4.64	$4.41	$8.16
Average Monthly per Square Foot Operating Expenses (3)	$2.41	$1.22	$0.98	$1.30	$1.90
Space Absorbed in 2014 (Full-Year)	**(79,901)**	**(13,309)**	**7,435**	**(5,367)**	**(91,142)**
Space Absorbed in 1st Qtr. 2015	**(832)**	**(16,022)**	**5,253**	**23,611**	**12,010**

(1) Complexes with about 50,000 square feet and up.
(2) Includes smaller projects, freestanding buildings and hotels. Does not include space within mixed-use and multi-tenant buildings located in Light Industrial parks.
(3) Based on recent leases. Historic leases may be outside of stated range.

Source: State DBEDT and The Hallstrom Group | CBRE

Neighborhood retail uses typically constitute about 45 to 55 percent of per capita demand, with Service Commercial, Medical and Support commercial spaces combining for another 20 to 30 percent of the total. The remaining 15 to 35 percent of per capita demand is oriented towards big boxes, major centers, destination and specialty retailers and in-hotel space.

Using these figures in conjunction with the projected WCT resident and de facto populations, numbers of on-site workers, and conservative allowances for patronage by guests, other Waikapu residents and passer-bys, we have estimated the amount of neighborhood gross leasable floor space would be required to moderately service WCT on an internal basis.

Our calculations indicate the WCT master plan should include a minimum of some 138,642 square feet of neighborhood commercial space in order to be a sustainable community and meet the daily needs of a functioning town, as show on the following table.

SUMMARY OF NEIGHBORHOOD COMMERCIAL SPACE DEMAND CREATED BY WAIKAPU COUNTRY TOWN BY BUILD-OUT AND STABILIZATION

1. Stabilized Subject Population		
De Facto Population		4,085
Full Time Eqivalent On-Site Workers		597
2. Project Resident Per Capita Demand for Commercial Space (in Gross Square Feet per Person)		
Total for All Commercial Needs (1)		30.0
"Neighborhood Retail" Space Demand as Percent of Total		55%
Total Per Capita "Neighborhood Retail" Commercial Space Demand in Square Feet		16.5
Allowance for "Service Commercial/Medical" Space (40% of Neighborhood demand)		6.6
Allowance for "Support/Other/Destination Commercial" Space (20% of Neighborhood demand)		3.3
Total Per Capita Floor Space Demand for Resident-Oriented/Neighborhood Commercial Space		26.4
Capture Rate of In-Project Resident Neighborhood Demand		90.0%
Total Floor Space Demand for Resident-Oriented/Neighborhood Commercial Space		97,060
3. In-Project Worker Per Capita Demand for Commercial Space (in Gross Square Feet per Person)		
Estimated Percent of Workers not Residing in Project		50.0%
Non-Resident Workers Patronizing Subject Commercial Businesses		299
Total Per Capita Floor Space Demand by Workers for Neighborhood Commercial Space (2)		6.6
Total Floor Space Demand by Workers for Neighborhood Commercial Space		1,970
3. Indicated Subject Commercial Floor Space Demand		
From Subject Project Population		99,030
Patronage From Other Sources	**% of Community Demand**	
Nearby Population in Non-Subject Projects	15%	14,854
Guests/Passer-Bys and Others	25%	24,757
Total Estimated Gross Floor Space Demand at Stabilization		**138,642**

(1) Based on mid-point per person spatial demand in 2030.
(2) Based on capture rate of 25 percent of per capita resident demand in square feet.

Source: The Hallstrom Group/CBRE

The remaining approximately 30,000 square feet of proposed subject commercial floor space would be absorbed by live/work and small businesses, and specialty retailers/service providers in the Town Core and on the Maui Tropical Plantation site.

Overall, we estimate it will require approximately 11 to 12 years, from the start of space pre-leasing in 2017 until 2027-28 to absorb the proposed additional 169,597 square feet of floor area at WCT, an average of about 15, 000 square feet annually.

ECONOMIC IMPACTS FROM DEVELOPMENT

Selected summary tables from the modeling process and as inserted into the text are contained in Addenda Exhibit III, Tables 1 through 9. The primary sources and variables contributing to the model are footnoted on each table. All monetary figures are expressed in constant 2015 dollars.

WCT will be a major addition to the Maui economy over the coming decades, creating significant numbers of construction and on-going jobs during its build-out and beyond, attracting meaningful capital investment, and providing new and unique business opportunities.

In order to forecast the primary economic impacts resulting from the development of the WCT, we have constructed a model depicting the "lifespan" of the project from groundbreaking (assumed in 2016), through the completion of construction/absorption and full stabilization by 2030.

The total "Build-Out" time-frame in the model stretches across 12-years, commencing in 2016, with pre-sales/leasing starting in the second year (2017), and the initial buildings completed in the third year (2018). The residential component will be completed and fully absorbed by 2026, the commercial component by 2027-28, the 146 ohana units by 2030, and fully stabilized operations by 2030.

We note even if the project timeline slips due to entitlement or other issues, the quantified economic impacts would not meaningfully change (apart from inflation). The job counts, resident population, economic activity, and other forecasts would remain relatively constant whether WCT breaks-ground in 2016-17 or 2018-19.

Sources for the primary model factors include:

- Construction timing/phasing and costs were estimated by the development team.
- Job counts were taken from similar projects and operations, and/or based on industry standards.
- Wages are based on data from the State Department of Labor & Industrial Relations.
- Household size, income and spending, and de facto population estimates were based on government materials including US

Department of Housing and Urban Development and census data.

- Business activity variables are based on our analysis of similar use-types on Maui and statewide.

The development and build-out of WCT over a circa 12 year period will infuse some $644.1 million in capital investment into the Maui economy. Local contractor and supplier profits are estimated to total more than $90.1 million.

PROPOSED DEVELOPMENT SCHEDULE AND ESTIMATED CONSTRUCTION COSTS
All Amounts Expressed in Constant 2015 Dollars, Includes Ohana Units

	Development, Sales & Stabilization Period			Totals During Build-Out
	2016 to 2020	2021 to 2026	2026 to 2030	
Infrastructure Emplacement	$79,569,400	$119,687,500		**$199,256,900**
Commercial Construction (1)	$14,297,338	$37,173,079	$5,718,935	**$57,189,352**
Residential Construction (2, 3)	$166,167,050	$172,158,100	$49,533,150	**$387,858,300**
TOTAL PERIODIC CONSTRUCTION COSTS	**$260,033,788**	**$329,018,679**	**$55,252,085**	**$644,304,552**
Contractor Profits	$26,003,379	$32,901,868	$5,525,209	**$64,430,455**
Supplier Profits	$10,401,352	$13,160,747	$2,210,083	**$25,772,182**

(1) Includes 169,597 square feet of retail, restaurant, service and office/other components. Estimated average direct development cost of $337 per sq ft.
(2) Estimated average direct development cost of $175 per square foot for single family homes, multifamily units and ohana units.

(3) Assuming average size for 970 urban homes of 1,473 square feet and 80 rural homes of 3,375 square feet, with overall average of 1,618 square feet. Average multifamily unit size of 804 square feet and average ohana unit size of 575 square feet.

Note: Excludes any potential Ohana units.

Source: The Hallstrom Group/CBRE

The construction of the 1,433 housing units, 146 ohana units, and 169,600 square feet of commercial floor area and in the project will require an estimated 2,476 "worker years" in a variety of trades, suppliers and services; an average of 165 Full Time Equivalent (FTE) positions per year for the 15 years of building.

Most of these positions will not be new jobs for new businesses, but work flowing to existing contractors and suppliers.

The 169,600 square feet of new commercial operations will generate some 4,251 FTE worker years during the 2016-2030 projection period, providing stabilized employment for 531 permanent positions. These jobs will be new positions in the Maui economy. This total does not include the employment, wages or business activity contributions of the

existing 29,250 square feet of commercial space in the Tropical Plantation which will be retained.

The project will also require an estimated 66 worker years of maintenance and common element employment on a continual basis, and will generate some 1,789 worker years of off-site employment from 2016-2030 and a stabilized demand for 149 FTE positions.

In aggregate, during the development of WTC 8,946 worker years of employment will be created in construction and operations, on-site/direct and off-site/indirect, with stabilized employment after completion of 746 jobs.

ESTIMATED YEARLY FULL-TIME EQUIVALENT EMPLOYMENT POSITIONS CREATED BY DEVELOPMENT

	Development, Sales & Stabilization Period			Totals During Build-Out	
Construction Employment (1)	**2016 to 2020**	**2021 to 2025**	**2026 to 2030**		
Infrastructure Emplacement	199	299		**498**	
Commercial Construction	64	165	25	**254**	
Residential Units (includes Ohana Units)	739	765	220	**1,724**	
Total Periodic Construction Jobs	**1,001**	**1,230**	**246**	**2,476**	
On-Going Business Employment					**Stabilized**
Commercial Worker Years (2)	199	1,528	2,524	**4,251**	
Total FTE Jobs in Place at End of Period	133	478	531		**531**
Maintenance & Common Element (3)	23	141	266	**429**	
Total FTE Jobs in Place at End of Period	16	41	66		**66**
Total Periodic On-Going Business Jobs	**223**	**1,668**	**2,790**	**4,681**	
Total FTE Jobs in Place at End of Period	**148**	**519**	**597**		**597**
Off-Site Employment (4)	306	724	759	**1,789**	
Total FTE Jobs in Place at End of Period	37	130	149		**149**
TOTAL PERIODIC WORKER YEARS	**1,530**	**3,622**	**3,794**	**8,946**	
TOTAL END-OF-PERIOD PERMANENT JOBCOUNT	**186**	**649**	**746**		**746**

(1) Infrastructure construction employment estimated at 1 worker-year for every $400,000 in costs. Vertical construction (all types) employment estimated at 1 worker-year for every $225,000 in costs. Includes all direct employment associated with construction, on and off-site.
(2) Employment estimated at 1 full-time-equivalent worker for every 320 square feet of gross floor area. First stores opening in 2018.
(3) Includes project common element administration, security and maintenance staff of 10 jobs, apartment staffs, and single family home services.
(4) Estimated at one cumulative off-site employment position for every four on site positions.

Source: Hallstrom Group/CBRE

Wages paid to construction workers will total an estimated $201 million. Employment related to commercial and maintenance operations over the projection time-frame will total $264.8 million including on-site/direct ($173.6 million) and off-site/indirect ($91.3 million), and stabilize at $27.1 million annually in 2030 and beyond.

ESTIMATED YEARLY EMPLOYEE WAGES CREATED BY DEVELOPMENT
All Amounts Expressed in Constant 2015 Dollars

	Development, Sales & Stabilization Period			Totals During Build-Out	
Construction Wages (1)	**2016 to 2020**	**2021 to 2025**	**2026 to 2030**		
Infrastructure Emplacement	$16,149,087	$24,291,296		**$40,440,383**	
Commercial Construction	$5,158,632	$13,412,443	$2,063,453	**$20,634,528**	
Residential Units (including Ohana Units)	$59,954,844	$62,116,479	$17,872,089	**$139,943,412**	
Total Periodic Construction Wages	**$81,262,563**	**$99,820,218**	**$19,935,542**	**$201,018,323**	
On-Going Business Wages					**Annually**
Commercial (2)	$7,110,145	$54,511,110	$90,061,834	**$151,683,088**	**$17,298,261**
Maintenance & Common Element (4)	$1,193,924	$7,168,647	$13,546,447	**$21,909,019**	**$2,183,168**
Total Periodic On-Going Business Wages	**$8,304,069**	**$61,679,757**	**$103,608,281**	**$173,592,107**	**$19,481,429**
Off-Site Employment Wages (5)	$15,608,568	$36,964,018	$38,716,225	**$91,288,810**	**$7,615,143**
TOTAL PERIODIC WAGES	**$105,175,200**	**$198,463,993**	**$162,260,047**	**$465,899,240**	**$27,096,572**

(1) Average annual wage for full-time-equivalent construction worker (all trades) at $81,182 ($39.03/hour X 2,080 hours).
(2) Average annual wage for full-time-equivalent retail trade& restaurant workers at $32,552 ($15.65/hour).
(3) Average annual wage for full-time-equivalent industrial worker estimated at $40,893 ($19.66/hour) based on average wage for manufacturing, trade, wholesale workers.
(2) Estimated average annual wage for full-time-equivalent maintenance and security workers at $33,200 ($16/hour).
(5) Average annual wage for full-time-equivalent general worker at $51,022 ($24.53/hour), the average wage for all "Total Private Workers" in the state.

Wages taken from State of Hawaii "Hawaii Workforce Infonet" "Publications and Tables > Hours and Earnings > Production Worker" through June 2015. Hourly wage figure is average over first half of year.

Source: Hallstrom Group/CBRE

At build-out the de facto population of WCT will be some 3,921 persons of which 3,921(or 96 percent) will be full-time residents. There will also be an average of 163 persons daily populating the community comprised of non-resident owners and their guests periodically using their "second" unit/home.

QUANTIFICATION OF WAIKAPU COUNTRY TOWN DE FACTO POPULATION

Product Type	Total Units	X	Percent of Units	=	Units in Category	X	Average Persons in Household	X	Average Occupancy	=	Effective Population
Single Family Homes - Full-Time Residents	1,050		85%		893		**3.2**		100%		**2,856**
Single Family Homes - Part-Time Residents/Second Homes	1,050		15%		158		**3.2**		25%		**126**
Mulrifamily Units - Full-Time Residents	383		85%		326		**2.6**		100%		**846**
Multifamily - Part-Time Residents/Second Homes	383		15%		57		**2.6**		25%		**37**
Ohana Units	146		100%		146		**1.5**		100%		**219**
									Total De Facto Population		**4,085**
									Total Full-Time Residents		**3,921**
									Total Part-Time/Second Home Residents		**163**

Resident household income during the projection period will total $1.3 billion and average $156.6 million annually on a stabilized basis. Discretionary expenditures into Maui businesses by the WCT population are estimated at $675.9 million from 2016 to 2030, and $78.3 million per year on a stabilized basis.

However, most of this will not be new spending into the Maui economy, perhaps just relocated as a result of an existing household moving to WCT.

New spending will be created by the part-time/second home owners, which we estimate at $40.2 million during build-out and $4.8 million on a stabilized annual basis.

ESTIMATED RESIDENT POPULATION, HOUSEHOLD INCOME AND DISCRETIONARY EXPENDITURES
All Amounts Expressed in Constant 2015 Dollars

	Development, Sales & Stabilization Period			
	2016 to 2020	2021 to 2025	2026 to 2030	Totals
Number of Units Occupied End-Of-Period	**690**	**1,284**	**1,433**	
Single Family Homes	**347**	**901**	**1,050**	
Percent of Total Units	50%	70%	73%	
Multifamily Units	**343**	**383**	**383**	
Percent of Total Units	50%	30%	27%	
Ohana Units	0	73	146	
Single Family Homes Population - Full-Time Residents (1)	944	2,452	2,856	
Single Family Homes Population - Part-Time Residents (1)	34	88	126	
Multifamily Homes Population - Full-Time Residents (2)	758	846	846	
Multiamily Homes Population - Part-Time Residents (2)	41	46	37	
Ohana Units (All Full-Time Residents) (3)	0	110	219	
				Average Household Size
Total Full-Time Resident Population	**1,702**	**3,408**	**3,921**	**2.87**
Total Part-Time Resident Population	**75**	**134**	**163**	
Total De Facto Population	**1,777**	**3,542**	**4,085**	
RESIDENT HOUSEHOLD INCOME (4)				**During Build-Out**
Annually (at end of period)	**$66,133,060**	**$135,643,367**	**$156,629,499**	
Periodic	**$99,199,590**	**$504,441,068**	**$730,682,164**	**$1,334,322,822**
TOTAL DE FACTO POPULATION EXPENDITURES (5)				
Annually (at end of period)	**$35,256,311**	**$67,821,684**	**$78,314,749**	
Periodic	**$52,884,467**	**$257,694,986**	**$365,341,082** Stabilized	**$675,920,535** **$78,314,749**
TOTAL "NEW" MAUI SPENDING BY PART-TIME RESIDENTS				
Annually (at end of period)	**$2,189,781**	**$3,908,318**	**$4,769,601**	
Periodic	**$3,284,672**	**$15,245,247**	**$21,694,797** Stabilized	**$40,224,716** **$4,769,601**

(1) Average household size of 3.2 persons.
(2) Average household size of 2.6 persons.
(3) Average household size of 1.5 persons.
(4) Single Family households at 175% of Maui household income average, multifamily households at 125% of Maui average. Ohana at 80% of Maui average.
(5) For full-time residents assumes 15% of gross income for taxes, 30% for housing costs and 5% for utlitiles. Leaving 50% of gross income as net disposable.
For non-full time residents estimated disposable income at $80 per day (50% above average daily per resident spending of $53).

Source: The Hallstrom Group/CBRE

After completion of the community, the on-site commercial/business and maintenance activity will generate an estimated $101.8 million in revenues/sales per year; the majority coming from the commercial (retail, restaurant and service) operations. During the build-out period, all activities will combine to total some $750.5 million in gross income.

During the 2016-2030 build-out/ramp-up period, the WCT de facto population is estimated will create about 44.6 percent of total on-site sales and business activity, the remaining 55.4 percent by customers (primarily on-site workers, visitors/guests, passer-bys and other Waikapu residents). On a stabilized basis, the figure is anticipated to marginally decline to 42 percent.

However, much of this economic activity will not be "new" to Maui, but a relocation of spending by the full-time residents of the project (who are moving from elsewhere on the island) and other residents changing their spending patterns. Based on the non-residents of WCT and analysis of population growth patterns in Central Maui (which represents new spending) we estimate that on a stabilized basis some 22.6 percent of the activity will represent new dollars into the Maui economy.

Additionally the on-going maintenance of the units and common element component will generate an estimated $4.3 million annually in new expenses.

The total new expenditures from the project will total $172.8 million during build-out and stabilize at $32.1 million annually.

PROJECTED ON-SITE OPERATING ECONOMIC ACTIVITY
All Amounts Expressed in Constant 2015 Dollars

	Development, Sales & Stabilization Period				
	2016 to 2020	2021 to 2025	2026 to 2030	Totals During Build-Out	Stabilized Annually
Commercial Businesses (1)	$38,159,325	$292,554,825	$419,752,575	**$750,466,725**	**$101,758,200**
Non-Project Resident Patronage %	55.00%	56.00%	58.00%	**56.33%**	**42.00%**
Outside Project Patronage Expenditures	$17,171,696	$128,724,123	$176,296,082	**$327,703,803**	**$59,019,756**
"New" Maui Spending as % of Expenditures	13.0%	26.0%	39.0%	**26.0%**	**39.0%**
"New" Maui Spending as a Result of Project	**$2,232,321**	**$33,468,272**	**$68,755,472**	**$85,202,989**	**$23,017,705**
New Spending as % of Total Sales	**5.9%**	**11.4%**	**16.4%**	**11.4%**	**22.6%**
Maintenance & Common Element (4)	$1,526,495	$9,195,596	$17,410,153	**$28,132,244**	**$4,303,486**
In-Project Resident Population Patronage %	100%	100%	100%	**100%**	**100%**
Outside Project Patronage Expenditures	$0	$0	$0	**$0**	**$0**
Total Economic Activity					
"New" Maui Spending as a Result of Project	$2,232,321	$33,468,272	$68,755,472	**$104,456,064**	**$23,017,705**
Maintenance & Common Element Expenditures	$1,526,495	$9,195,596	$17,410,153	**$28,132,244**	**$4,303,486**
"New" Maui Spending by Part-Time Project Residents	$3,284,672	$15,245,247	$21,694,797	**$40,224,716**	**$4,769,601**
TOTAL PERIODIC "NEW MAUI" PROJECT GROSS REVENUES	**$7,043,487**	**$57,909,115**	**$107,860,422**	**$172,813,024**	**$32,090,792**

(1) Estimated based on average annual sales of $600 per square foot.
(4) Estimated at $3,000 per residential unit per year (ohana units included in base property) and $2 per square foot of total leaseable area per year.

Source: Hallstrom Group/CBRE

During the 15 years projection period, WCT will have a base economic impact on Maui of some $817.1 million in new monies with a stabilized annual benefit of $32.1 million thereafter.

SUMMARY OF ECONOMIC IMPACTS ASSOCIATED WITH DEVELIOPMENT
All Amounts Expressed in Constant 2014 Dollars

Development, Sales & Stabilization Period

	2016 to 2020	2021 to 2025	2026 to 2030	Totals During Build-Out	Stabilized Annually
Construction Activity					
Construction Wages	$81,262,563	$99,820,218	$19,935,542	**$201,018,323**	
Contractor Profits	$26,003,379	$32,901,868	$5,525,209	**$64,430,455**	
Supplier Profits	$10,401,352	$13,160,747	$2,210,083	**$25,772,182**	
Other Construction Costs	$142,366,494	$183,135,845	$27,581,252	**$353,083,591**	
Total Construction Impact	**$260,033,788**	**$329,018,679**	**$55,252,085**	**$644,304,552**	
Total "New Maui" Speding Project Impact	**$7,043,487**	**$57,909,115**	**$107,860,422**	**$172,813,024**	**$32,090,792**
TOTAL BASE ECONOMIC IMPACT	**$267,077,275**	**$386,927,794**	**$163,112,507**	**$817,117,576**	**$32,090,792**

Source: Hallstrom Group/CBRE

We have also analyzed the impacts of the project for Maui and Statewide using the *State Input-Output Economic Model* Type II multipliers. These factors quantify the total Direct, Indirect and Induced "effects" of various forms of business and spending activity as it flows through the economy of the islands.

All of these forecasts are based on new dollars flowing into the Maui economy from the WCT community, and exclude income and spending from full-time residents relocating to the project,

In every instance, application of the macro Input-Output multipliers resulted in higher dollar, employment and tax revenue indicators than in our subject-focused micro model which was designed to reflect Direct and upper-level Indirect impacts only.

Among the outputs using the State method:

- The $644.3 million in cumulative WCT construction costs will generate a total State Economic Output of $1.37 billion.
- Direct subject construction wage earnings of $1201 million will yield $406.1 million in statewide wage earnings.
- Indirect and induced State taxes associated with construction will total more than $77.3 million.

- Direct effect jobs created by WCT construction employment will be 2.68 times the number of on-site workers, or a total of 6,636 worker years of employment. The total job multipliers from the construction activity as it spreads directly and indirectly across the islands will be 13.83 times the on-site employment, or more than 8,911 worker years during the build-out period.

ESTIMATES OF TOTAL ECONOMIC IMPACT FROM SUBJECT CONSTRUCTION
USING STATE INPUT-OUTPUT MODEL "TYPE II" MULTIPLIERS
All Amounts Expressed in Constant 2014 Dollars

	Development, Sales & Stabilization Period			
Year	**2016 to 2020**	**2021 to 2025**	**2026 to 2030**	**Totals**
Construction Costs	**$260,033,788**	**$329,018,679**	**$55,252,085**	**$644,304,552**
1. Economic Output Multiplier	2.12	2.12	2.12	2.12
Total State Economic Output	**$551,271,631**	**$697,519,599**	**$117,134,421**	**$1,365,925,650**
2. Earnings Multiplier	0.61	0.61	0.61	0.61
Total Increase in State Earnings	**$158,620,611**	**$200,701,394**	**$33,703,772**	**$393,025,777**
3. State Tax Multipliers	0.12	0.12	0.12	0.12
Total Increase in State Taxes	**$31,204,055**	**$39,482,241**	**$6,630,250**	**$77,316,546**
4. Total Job Multipliers	13.83	13.83	13.83	13.83
Total State Jobs Created	**3,596.3**	**4,550.3**	**764.1**	**8,910.7**
Construction Employment	**1,001**	**1,230**	**246**	**2,476**
5. Direct-Effect Job Multipliers	2.68	2.68	2.68	2.68
Total Direct Jobs Created	**2,682.6**	**3,295.3**	**658.1**	**6,636.0**
Construction Wages	**$81,262,563**	**$99,820,218**	**$19,935,542**	**$201,018,323**
6. Direct-Effect Earnings	2.02	2.02	2.02	2.02
Total Increase in Direct Earnings	**$164,150,378**	**$201,636,841**	**$40,269,794**	**$406,057,013**

Source: State Input-Output Model (approved July 2011), and The Hallstrom Group/CBRE

- The $165.8 million in new cumulative business activity during the 15-year build-out/projection period equates to a total State Economic Output of $346.5 million. On a stabilized basis, the $32.1 million in annual business activity will result in $67.1 million in total impact per year.

- Direct on-site wages paid by operating businesses of $465.9 million from 2016 through 2030 will yield $800.5 million in direct-effect statewide wage earnings. Upon stabilization, the direct wages of $27.1 million annually equates to $51.2 million in other wages.

- Indirect and induced State taxes associated with business operations will total $26.5 during build-out and $5.1 million more per year thereafter.

- Direct effect jobs created by WCT business operations will be about 2.05 times the number of on-site workers, or a total of 9,595 worker years of employment during the projection period, and 1,224 annually after stabilization.

ESTIMATES OF TOTAL ECONOMIC IMPACT FROM SUBJECT OPERATIONS
USING STATE INPUT-OUTPUT MODEL "TYPE II" MULTIPLIERS
All Amounts Expressed in Constant 2014 Dollars

	Development, Sales & Stabilization Period				Stabilized
Year	2016 to 2020	2021 to 2025	2026 to 2030	Totals	Annually
Operating Revenues	**$7,043,487**	**$57,909,115**	**$107,860,422**	**$165,769,537**	**$32,090,792**
1. Economic Output Multiplier	2.09	2.09	2.09	2.09	2.09
Total State Economic Output	**$14,720,889**	**$121,030,051**	**$225,428,281**	**$346,458,332**	**$67,069,755**
2. Earnings Multiplier	0.66	0.66	0.66	0.66	0.66
Total Increase in State Earnings	**$4,648,702**	**$38,220,016**	**$71,187,878**	**$109,407,894**	**$21,179,923**
3. State Tax Multipliers	0.16	0.16	0.16	0.16	0.16
Total Increase in State Taxes	**$1,126,958**	**$9,265,458**	**$17,257,667**	**$26,523,126**	**$5,134,527**
4. Total Job Multipliers	19.00	19.00	19.00	19.00	19.00
Total State Jobs Created	**133.8**	**1,100.3**	**2,049.3**	**3,149.6**	**609.7**
Operating Employment	**223**	**1,668**	**2,790**	**4,681**	**597**
5. Direct-Effect Job Multipliers	2.05	2.05	2.05	2.05	2.05
Total Direct Jobs Created	**456.5**	**3,420.0**	**5,718.8**	**9,595.3**	**1,223.9**
Operating Wages	**$105,175,200**	**$198,463,993**	**$162,260,047**	**$465,899,240**	**$27,096,572**
6. Direct-Effect Earnings	1.89	1.89	1.89	1.89	1.89
Total Increase in Direct Earnings	**$198,781,128**	**$375,096,947**	**$306,671,489**	**$880,549,564**	**$51,212,521**

Source: State Input-Output Model (approved July 2011), and The Hallstrom Group/CBRE

WCT will have nominal impacts on the socio-economic aspects of Wailuku-Kahului that relate to real property issues. Property values in the study area are largely driven by external, cyclical economic factors and cumulative mass, not any single new project.

The envisioned subject project homes are, for the most part, to be moderately priced; within the range for other new single family product and multifamily units in the study area. They will have a diversity of scale and style that will be generally consistent with Central Maui residential development and the other proposed master planned projects on the island.

The project will fit in well with the emerging and proposed mixed-uses in the Honoapiilani Highway corridor. The residential component of

the project is designed to house any in-migration to Maui as a direct result of WCT or its operating components, and meet the County's affordability and workforce housing requirements.

PUBLIC FISCAL COSTS AND BENEFITS ASSOCIATED WITH THE PROJECT

The master summary table from the modeling process is presented in Exhibit IV, Table 1 through 3.

We have analyzed the public fiscal impacts considering only the non-resident component of WCT, both in regards to tax benefits flowing to the State and County of Hawaii and the cost of providing government services to them on a per capita basis.

The exception is for the full-time resident real property taxes, as their new home at WCT will mean increased real property assessments and taxes, with their previous homes still having a tax load that would be paid by a subsequent owner. The tax impacts of on-going maintenance/renovation costs of their new homes are also included in the model.

From a household income and discretionary spending perspective, the resident population is assumed to live on Maui prior to their residing at WCT and is therefore already contributing their State GET and Income taxes, so these are excluded from the model. They are merely moving their home from one location to the other on the island and their public fiscal footprint will remain generally unchanged apart from the additions to the County's real property tax base.

Maui County and the State of Hawaii will receive millions of dollars in tax receipts from the construction and stabilized "operation" of WCT from numerous revenue sources.

For the County, the primary tax source will be from Real Property Taxes paid by the owners of the various privately-owned WCT residential and commercial components.

The potential property tax receipts were estimated by applying current prevailing tax rates against the projected market value of the finished inventory which was calculated as shown below (total construction costs, plus allocated infrastructure costs and underlying land value, plus developer's profit).

Quantification of Assessed Values for Components of Proposed Waikapu Country Town
In Constant 2015 Dollars

Commercial		*Single Family (1)*		*Multifamily*	
Total Gross Floor Area in SF	169,597	Total Homes to be Built	1,050	Total Units to be Built	383
Cost to Build per SF	337	Avg Home Size in SF	1,618	Avg Unit Size in SF	804
Total Cost to Build	$57,154,189	Cost to Build per SF	175	Cost to Build per SF	175
Plus Land/Infra. Allocation	$21,199,625	Total Cost to Build	$283,150	Total Cost to Build	$198,000
Plus Developer's Profit	$6,268,305	Plus Infrastructure Allocation	$150,131	Plus Infrastructure Allocation	$70,698
Total Commercial Value	**$84,622,119**	Plus Land Allocation	$85,000	Plus Land Allocation	$25,000
Value per Square Foot	$498.96	Plus Other Costs & Profit	$49,856	Plus Other Costs & Profit	$24,610
		Total Average Home Value	**$568,137**	**Total Average Unit Value**	**$318,308**

(1) Includes 970 urban homes averaging 1,473 square feet and 80 rural homes averaging 3,375 square feet. Overall single family average of 1,618 square feet.

Note: Ohana units are estimated to have an average size of 575 square feet, based on County code allowances with an average construction cost of $100,600. The other cost items are assumed to already be accounted for in the primary residence on the lot.

Source: The Hallstrom Group/CBRE

It was assumed the average assessed value for a finished single family home (combined urban and rural houses) would be $568,137, that multifamily units would have an average assessment of $318,308, and that commercial holdings were assessed at a total (land and improvements) averaging $499 per square foot. The developer-envisioned overall price/assessed value range for single family homes would be from about $350,000 to about $1.8 million, and for multifamily units about $220,000 to $420,000.

Appropriate deductions were made for homeowner exemptions, assumed to be $200,000 within the model; with all resident households receiving the exemption. Based on market study data it is estimated that 85 percent of the WCT residential units would be owned by Maui residents and that about 60 percent would be owner/occupied. This results in 51 percent of the total number of units being eligible for the exemption and "homeowner" assessment rate status, and 49 percent not being eligible.

The total net assessed value and real property taxes of WCT inventory, land and improvements, before and after homeowner's exemptions, would be as follows upon build-out:

COUNTY OF MAUI REAL PROPERTY TAX ASSESSMENTS AND PAYMENTS
All Amounts Expressed in Constant 2015 Dollars

Development Period	Development, Sales & Stabilization Period			Totals During Build-Out Period	Stabilized Annually After Build-out
	2016 to 2020	2021 to 2025	2026 to 2030		
1. COUNTY REAL PROPERTY TAXES					
Assessed Value					
Commercial	$21,155,530	$76,159,907	$84,622,119		$84,622,119
Single Family Residential - Homeowners (After Exemptions)	$65,149,205	$169,162,633	$197,137,364		$197,137,364
Single Family Residential - Non-Homeowners	$96,600,334	$250,826,804	$292,306,487		$292,306,487
Multifamily Residential - Homeowners (After Exemptions)	$20,695,618	$23,109,102	$23,109,102		$23,109,102
Multifamily Residential - Non-Homeowner	$53,498,026	$59,736,862	$59,736,862		$59,736,862
Ohana Units (No Exemptions, No Land Value)	$0	$7,343,800	$14,687,600		$14,687,600
Total Assessed Value	**$257,098,713**	**$578,995,308**	**$656,911,933**		**$656,911,933**
Real Property Taxes					
Commercial	$139,626	$502,655	$558,506		$558,506
Single Family Residential - Homeowners (After Exemptions)	$179,160	$465,197	$542,128		$542,128
Single Family Residential - Non-Full Time Residents and Rentals	$521,642	$1,354,465	$1,578,455		$1,578,455
Multifamily Residential - Homeowners (After Exemptions)	$56,913	$63,550	$63,550		$63,550
Multifamily Residential - Non-Full Time Residents and Rentals	$320,988	$358,421	$358,421		$358,421
Ohana Units (60% on homeowners properties, 40% on rental properties)	$0	$15,863	$31,725		$31,725
Total Annual Property Taxes (End of Period)	**$1,218,330**	**$2,760,151**	**$3,132,785**		
Total Real Property Taxes During Period	**$3,045,824**	**$9,946,202**	**$14,732,341**	**$27,724,367**	**$3,132,785**

We estimate the County will receive some $27.7 million in real property tax receipts during the 15-year build-out/projection period from 2016 through 2030, and annual collections of $3.1 million on a stabilized basis thereafter.

Real Property Taxes (RPT) are forecast to generate about 64.6 percent of total Maui County General Fund revenues in the Mayor's proposed Fiscal Year 2016 budget, with secondary taxes and fees the forming the remainder. It is logical to assume the WCT development and business activities will generate secondary taxes in proportion to RPT as does the overall Maui community.

The secondary Maui County receipts are equal to 55 percent of the RPT total (35.4% divided by 64.6%).

Application of this ratio to the WCT property tax sum results in a cumulative total estimated County tax collection from the subject of $42.9 million during the initial 15-year projection period, and $4.8 million annually on a stabilized basis.

Additionally the County will receive a minimum of $5.0 million in impact fees for parks, water service and wastewater service, or circa $3,489 per unit on average. Further fees may be imposed. These fees push the total County collections (primary taxes, secondary taxes and

impact fees) to $47.9 million during the development-to-stabilization period.

COUNTY OF MAUI GROSS PUBLIC TAX REVENUES FROM WAIKPAU COUNTY TOWN
All Amounts Expressed in Constant 2015 Dollars

Development Period	Development, Sales & Stabilization Period 2016 to 2020	2021 to 2025	2026 to 2030	Totals During Build-Out Period	Stabilized Annually After Build-out
INCLUDES ONLY THOSE REVENUES AND COSTS WHICH ARE "NEW" TO MAUI					
TOTAL GROSS PUBLIC REVENUES					
To County of Maui (Rea; Property Taxes)	$3,045,824	$9,946,202	$14,732,341	$27,724,367	$3,132,785
Adjustment for Other Proportional Taxes	1.55	1.55	1.55	1.55	1.55
Adjusted Maui County Revenues	$4,718,512	$15,408,400	$22,822,962	$42,949,874	$4,853,230
Plus Impact Fees (2)	$5,000,000	$0	$0	$5,000,000	
Total County of Maui Receipts	$9,718,512	$15,408,400	$22,822,962	$47,949,874	$4,853,230

The State of Hawaii will receive an estimated $28.9 million in new primary receipts from State Income Taxes from worker wages and profits from operating businesses based on average statewide corporate and personal payments rates of 4.4 percent and 5.1 percent, respectively, applied against the economic model forecasts.

The State will also receive some $43.7 million in Gross Excise Tax during build-out and $1.9 million annually on a stabilized basis.

STATE OF HAWAII DIRECT TAX REVENUES FROM WAIKAPU COUNTY TOWN
All Amounts Expressed in Constant 2015 Dollars

Development Period	Development, Sales & Stabilization Period 2016 to 2020	2021 to 2025	2026 to 2030	Totals During Build-Out Period	Stabilized Annually After Build-out
INCLUDES ONLY THOSE TAXES WHICH ARE "NEW" TO MAUI AS RESULT OF THE PROJECT					
2. STATE INCOME TAXES					
Taxable Personal Income	$105,175,200	$198,463,993	$162,260,047	$465,899,240	$27,096,572
Taxable Corporate Profits	$37,461,253	$54,748,982	$23,914,355	$116,124,591	$4,813,619
Personal Taxes Paid	$5,363,935	$10,121,664	$8,275,262	$23,760,861	$1,381,925
Corporate Taxes Paid	$1,648,295	$2,408,955	$1,052,232	$5,109,482	$211,799
TOTAL STATE INCOME TAXES	$7,012,230	$12,530,619	$9,327,494	$28,870,343	$1,593,724
3. STATE GROSS EXCISE TAX					
Taxable Transactions					
Construction Contracts	$260,033,788	$329,018,679	$55,252,085	$644,304,552	
Worker Disposable Income Purchases	$52,587,600	$99,231,997	$81,130,024	$232,949,620	$13,548,286
"New" Maui Spending Project Impact	$7,043,487	$57,909,115	$107,860,422	$172,813,024	$32,090,792
Total Taxable Transactions	$319,664,875	$486,159,791	$244,242,530	$1,050,067,196	$45,639,078
TOTAL STATE EXCISE TAX	$13,319,476	$20,256,820	$10,176,854	$43,753,150	$1,901,643

In recent fiscal years, Income Tax and GET have generated about 80 percent of total State revenues, and secondary taxes and fees the remainder. We anticipate WCT activity will result in similar ratios of secondary taxes flowing from the project relative to the primary sources quantified.

The secondary State receipts are equal to 25 percent of the Income Tax and GET totals (20% divided by 80%).

Application of this ratio to the WCT income tax and GET sums results in a cumulative total estimated new tax collection monies from the subject of $90.1 million during the initial 15-year forecasting period, and $4.4 million annually on a stabilized basis.

Additionally the State will receive a minimum of $4.6 million in Department of Education school impact fees, an average of $3,210 per housing unit. Further fees may be imposed. These fees push the total State collections (primary taxes, secondary taxes and impact fees) to $95.4 million during the development period.

STATE OF HAWAII GROSS PUBLIC TAX REVENUES FROM WAIKPAU COUNTY TOWN
All Amounts Expressed in Constant 2015 Dollars

	Development, Sales & Stabilization Period				
Development Period	2016 to 2020	2021 to 2025	2026 to 2030	Totals During Build-Out Period	Stabilized Annually After Build-out
INCLUDES ONLY THOSE REVENUES AND COSTS WHICH ARE "NEW" TO MAUI					
To State (Items #2 & #3)	$20,331,707	$32,787,439	$19,504,348	$72,623,493	$3,495,368
Adjustment for Other Proportional Taxes (3)	1.25	1.25	1.25	1.25	1.25
Adjusted State Revenues	$25,414,633	$40,984,299	$24,380,434	$90,779,366	$4,369,210
Plus Impact Fees (2)	$4,600,028	$0	$0	$4,600,028	
Total State of Hawaii Receipts	$30,014,661	$40,984,299	$24,380,434	$95,379,394	$4,369,210

The new/additional per capita cost for the County and State associated with the new, part time (second home) resident population component at WCT was calculated as follows based on the 2015-16 proposed mayoral fiscal year budgets for each as shown.

CALCULATION OF PER CAPITA GOVERNMENTAL COSTS FOR FISCAL-YEAR 2015-16	
Total County Budget (Operating and Capital)	**$790,578,100**
Divided by Total County De Facto Population (Residents & Tourists)	208,185
County Per Capita Fiscal Year Expense	**$3,797**
Total State Budget (Operating and Capital)	**$14,279,500,000**
Divided by Total State De Facto Population (Residents & Tourists)	1,631,302
State Per Capita Fiscal Year Expense	**$8,753**

The total governmental costs on a periodic basis for WCT for the development period and as stabilized are on the following chart.

COUNTY OF MAUI AND STATE OF HAWAII NEW PER CAPITA COSTS FROM WAIKAPU COUNTY TOWN
All Amounts Expressed in Constant 2015 Dollars

Development Period	Development, Sales & Stabilization Period 2016 to 2020	2021 to 2025	2026 to 2030	Totals During Build-Out Period	Stabilized Annually After Build-out
INCLUDES ONLY THOSE REVENUES AND COSTS WHICH ARE "NEW" TO MAUI					
PUBLIC COSTS (Expenses)					
By County of Maui	$711,956	$1,982,654	$2,821,422	$5,516,032	$620,290
By State of Hawaii	$1,641,105	$4,570,148	$6,503,563	$12,714,816	$1,429,808
TOTAL PUBLIC COSTS	$2,353,061	$6,552,802	$9,324,986	$18,230,849	$2,050,098

The total new added operating and capital costs to the County of Maui will amount to $5.5 million during the build-out period and stabilize at $620,090 annually. The total new added per capita costs to the State of Hawaii budget will be $12.7 million during the build-out period and $1.4 million per year thereafter.

As shown below, both the County and the State will be provided with a net positive benefit (or "profit") from WCT in each development period and on an annual stabilized basis.

The County will realize a new net benefit of $42.4 million during build-out and a stabilized level of $4.3 annually thereafter. The State will receive $82.7 million in net benefits during build-out and $2.9 million per year on a stabilized basis.

COUNTY OF MAUI AND STATE OF HAWAII NEW NET BENEFITS (TAXES LESS COSTS) FROM WAIKAPU COUNTY TOWN
All Amounts Expressed in Constant 2015 Dollars

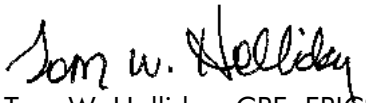
Development Period	Development, Sales & Stabilization Period 2016 to 2020	2021 to 2025	2026 to 2030	Totals During Build-Out Period	Stabilized Annually After Build-out
INCLUDES ONLY THOSE REVENUES AND COSTS WHICH ARE "NEW" TO MAUI					
TOTAL NET PUBLIC BENEFITS					
To County of Maui	$9,006,556	$13,425,746	$20,001,540	$42,433,842	$4,232,940
To State of Hawaii	$28,373,556	$36,414,151	$17,876,871	$82,664,578	$2,939,401
AGGREGATE NET BENEFITS	$37,380,112	$49,839,896	$37,878,411	$125,098,420	$7,172,342

CERTIFICATION

I certify that to the best of my knowledge and belief:

- The statements of fact contained in this report are true and correct.
- The reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are my personal, impartial, and unbiased professional analyses, opinions, and conclusions.
- I have no present or prospective interest in the property that is the subject of this report, and no personal interest with respect to the parties involved.
- The Hallstrom Group | CBRE, Inc. has not performed appraisal/consulting services, or services in any other capacity, regarding the property that is the subject of this report within the three-year period immediately preceding acceptance of this assignment.
- I have performed no services, as an appraiser or in any other capacity, regarding the property that is the subject of this report within the three-year period immediately preceding acceptance of this assignment.
- I have no bias with respect to the property that is/are the subject of this report or to the parties involved with this assignment.
- My engagement in this assignment was not contingent upon developing or reporting predetermined results, a requested minimum valuation, specific valuation, or the approval of a loan.
- My compensation for completing this assignment is not contingent upon the development or reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this appraisal.
- The analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the Uniform Standards of Professional Appraisal Practice.
- I have made a personal inspection of the property that is the subject of this report.

- No one provided significant real property appraisal assistance to the person signing this certification.
- The reported analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute.
- The use of this report is subject to the requirements of the Appraisal Institute relating to review by its duly authorized representatives.



Tom W. Holliday, CRE, FRICS

/as

ADDENDA

Addendum A

RESIDENTIAL MARKET STUDY TABLES

EXHIBIT I - TABLE 1

PROJECTED SUBJECT RESIDENTIAL UNITS ABSORPTION
Assuming 1,433 Residential Units
With Sales Starting in 2017

Year		Construction, Sale and Absorption Timing	Absorbed Residential Units (Pre-Sold/Reserved)
Calendar	Development		
2016	1	Infrastructure Emplacement Commences	
2017	2	Infrastructure Completed, Verttical Construction & Pre-Sales Begin	150
2018	3	Initial Buildings Completed and Occupied	120
2019	4	Vertical Construction, Absorption and Sales On-Going	130
2020	5	Construction, Absorption and Sales On-Going	140
2021	6	Construction, Absorption and Sales On-Going	150
2022	7	Construction, Absorption and Sales On-Going	150
2023	8	Construction, Absorption and Sales On-Going	150
2024	9	Construction, Absorption and Sales On-Going	150
2025	10	Construction, Absorption and Sales On-Going	150
2026	11	Residential Component Completed	143
	Totals		**1,433**
2021 to 2030		**Construction of Ohana Units Assumed to Occur with Maximum Build-Out**	**146**

Source: The Hallstrom Group/CBRE

EXHIBIT I - TABLE 2

QUANTIFICATION OF HOUSING UNIT DEMAND FOR THE WAILUKU-KAHULUI STUDY AREA 2015 TO 2035

	2015	2020	2025	2030	2035	Additional Units Required by 2035
Scenario One: Minimum Based on Adjusted Planning Department Baseline Population Forecasts (2)						
Resident Population	57,618	62,642	67,909	73,269	78,764	
Average Household Size (2)	3.42	3.35	3.28	3.21	3.14	
Total Resident Units Required	16,847	18,699	20,704	22,825	25,084	
Vacancy Allowance (3 % of resident unit demand)	505	561	621	685	753	
Non-Resident Purchaser Allowance (3) (12% of resident unit demand)	2,022	2,244	2,484	2,739	3,010	
TOTAL MARKET UNIT DEMAND	**19,374**	**21,504**	**23,810**	**26,249**	**28,847**	**9,647**
Scenario Two: Maximum Based on Planning Department Historical "High" Population Forecasts (Unadjusted)						
Resident Population	57,618	68,010	76,850	86,679	97,080	
Average Household Size (2)	3.42	3.34	3.26	3.18	3.10	
Total Resident Units Required	16,847	20,362	23,574	27,258	31,316	
Vacancy Allowance (3% of resident unit demand)	505	611	707	818	939	
Non-Resident Purchaser Allowance (3) (12% of resident unit demand)	2,022	2,443	2,829	3,271	3,758	
TOTAL MARKET UNIT DEMAND	**19,374**	**23,417**	**27,110**	**31,346**	**36,014**	**16,814**

CONCLUDED HOUSING UNIT DEMAND RANGE

	2015	2016-2020	2021-2025	2026-2030	2031-2035	Totals
MINIMUM DEMAND						
Periodic	174	2,130	2,305	2,439	2,598	**9,647**
Cumulative	174	2,304	4,610	7,049	9,647	
Average Annual Demand	N/A	426	461	488	520	
MAXIMUM DEMAND						
Periodic	174	4,042	3,693	4,237	4,668	**16,814**
Cumulative	174	4,217	7,910	12,146	16,814	
Average Annual Demand	N/A	808	739	847	934	
MID-POINT DEMAND						
Periodic	174	3,086	2,999	3,338	3,633	**13,230**
Cumulative	174	3,260	6,260	9,598	13,230	
Average Annual Demand	N/A	617	600	668	727	

Note: The 2006 Socio-Economic Forecast "Baseline" Model projects a demand for 6,978 additional housing units in Wailuku-Kahului region between 2015 a
Our "Adjusted Baseline" calculations (Scenario One) quantify demand for the same period at 6,875 additional units. Their "High" trend model proje
result in demand for circa 11,500 additional housing units in the study area between 2015 and 2030. Our high model projections show demand fo

(1) According to the 2010 US Census, there were 54,433 residents in the Primary Study Area (Kahului, Wailuku, Waihee-Waiehu, and Waikapu CDPs, Spreke
Figure escalated to mid-year 2015 at compounded annual growth rate of 1.5 percent.
(2) Adjusted from 2006 projections upwards by 2.9 percent based on figures from the 2010 census. Forecasts for 2010 were at 51,331 persons 2.9, percent
(2) Census reported average household size for Primary Study Area in 2010 was between 3.46 persons (computed) and 3.49 persons (based on survey).
(3) There were 17,760 total "housing units" in the Primary Study Area in 2010 according to the Census. We estimate the current unit count is now 19,200.

Source: US Census, County of Maui Planning Dept "Socio-Economic Forecast: Report", Various and The Hallstrom Group/CBRE

EXHIBIT I - TABLE 3

2010 CENSUS FIGURES FOR THE WAILUKU-KAHULUI PLANNING AREA

Census Designated Place	Resident Population	Total Housing Units	Number of Households (1)	Average Household Size (2) Computed	Average Household Size (2) Survey	Homeownership Rate	Non-Resident Ownership (3)		Multi-Family Units as % of Inventory
Kahului	26,337	7,773	6,721	3.92	3.65	56.7%	13.5%		28.2%
Wailuku	15,313	6,250	5,326	2.88	2.92	63.8%	14.8%		28.7%
Waihee-Waiehu	8,841	2,459	2,517	3.51	4.06	81.6%	3.0%	*	9.2%
Waikapu	2,965	909	879	3.37	3.37	78.0%	3.3%		0.0%
CDP Total	**53,456**	**17,391**	**15,443**	**3.46**	**3.49**	**63.9%**	**12.0%**		**24.2%**

(*) Estimated.

(1) Average during six-year period 2007-012. This causes a slight disconnect in regards to the Waihee-Waiehu CDP figure.

(2) "Computed" calculated by dividing resident population total by number of households. "Survey" are based on answers given to US Census.

(3) Percentage of total housing units not used by resident households. Does not include short-term/vacation/transient rentals

Source: 2010 US Census, and The Hallstrom Group/CBRE

EXHIBIT I - TABLE 4

ESTIMATE OF HOUSING PRICE AFFORDABILITY FOR MAUI RESIDENTS IN 2015
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui , Hawaii
Assuming Family of Four, 4.0 Percent Mortgage Interest Rate

1. Based on HUD/Maui County Criteria for Three-Bedroom Single Family House

Grouping Household Income as a Percent of County Median	Low Income 80% or less	Below-Moderate to Moderate Income 81% to 120%	Above-Moderate to Gap Group Income 121% to 160%
Gross Household Monthly Income, Using Maximum for Category (1)	$5,007	$7,510	$10,013
Amount Available for Debt Service (2)	$1,502	$2,253	$3,004
Maximum Mortgage Amount (3)	$314,611	$471,916	$629,222
Down payment at 5% of Sales Price	$16,558	$24,838	$33,117
Total Affordable Purchase Price, Maximum for Category	**$331,169**	**$496,754**	**$662,339**
Indicated Affordable Price Range for Category (Rounded)	**Up to $331,000**	**$331,000 to $497,000**	**$497,000 to $662,000**
County Pricing Guidelines for Other Unit Sizes and Types for 2015 (3)			
Single Family			
One Bedroom House	$231,840	$347,760	$463,610
Two Bedroom House	$281,520	$422,280	$552,955
Three Bedroom House	**$331,200**	**$496,800**	**$662,300**
Four Bedroom House	$380,880	$571,320	$761,645
Multi-Family			
One Bedroom Unit	$280,670	$312,970	$417,270
Two Bedroom Unit	$253,385	$380,035	$506,685
Three Bedroom Unit	$298,100	$447,100	$596,100
Four Bedroom Unit	$342,815	$514,165	$685,515

2. Based on Conventional Financing Criteria

Grouping	Low Income	Below-Moderate to Moderate Income	Above-Moderate to Gap Group Income
Gross Household Monthly Income	$5,007	$7,510	$10,013
Maximum Allowable Housing Expense (4)	$1,402	$2,103	$2,804
Maximum Mortgage Amount (5)	$293,665	$440,497	$587,329
Down payment at 20% of Sales Price (6)	$73,416	$110,124	$146,832
Total Affordable Purchase Price	**$367,081**	**$550,621**	**$734,161**
Indicated Affordable Price Range for Category (Rounded)	**Up to $367,000**	**$367,000 to $551,000**	**$551,000 to $734,000**

3.96% annual average mortgage interest rate for last 12 months Freddie Mac Primary Mortgage Market Survey (June 2014 through May 2015).

Note: Total Purchase Price estimate excludes any points associated with financing.

(1) Utilizing US HUD 2015 median household income estimate for Island of Maui of $75,100 annually for family of four.
(2) Based on Maui County mortgage affordability criteria at 30% of gross income, apart from any reserves.
(3) Assuming 4.0% annual interest and 30 year mortgage with 5% down payment, no discount points.
(4) Conventional financing with maximum monthly mortgage payment at 28% of gross income, apart from any reserves.
(5) Assuming 4.0% annual interest and 30 year mortgage, with 20% down payment.
(6) Conventional financing standard.

Source: Maui County Dept. of Housing and Human Concerns, and The Hallstrom Group/CBRE

EXHIBIT I - TABLE 5

2015 MONTHLY AFFORDABLE RENT GUIDELINES FOR MAUI COUNTY
BY UNIT SIZE AND PERCENTAGE OF MEDIAN FAMILY INCOME
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii

Percent of Median Income	Unit Size By Number of Bedrooms					
	Studio	1 BR	2 BR	3BR	4 BR	5 BR
10%	$132	$141	$169	$195	$218	$240
20%	$263	$282	$338	$391	$436	$481
30%	$394	$422	$507	$586	$653	$721
40%	$526	$563	$676	$781	$871	$961
50%	$657	$704	$845	$976	$1,089	$1,202
60%	$789	$845	$1,014	$1,172	$1,307	$1,442
70%	$920	$986	$1,183	$1,367	$1,525	$1,682
80%	$1,052	$1,127	$1,521	$1,757	$1,960	$2,163
90%	$1,183	$1,267	$1,521	$1,757	$1,960	$2,163
100%	$1,314	$1,408	$1,690	$1,953	$2,178	$2,403
110%	$1,446	$1,549	$1,859	$2,148	$2,396	$2,644
120%	$1,577	$1,690	$2,028	$2,343	$2,614	$2,884
130%	$1,709	$1,831	$2,197	$2,538	$2,831	$3,124
140%	$1,840	$1,971	$2,366	$2,734	$3,049	$3,364

Note: Affordable Rents are beased on 30% of gross monthly income. Includes untilities.

Source: Housing Division, Department of Housing and Human Concerns, County of Maui

EXHIBIT I - TABLE 6

STRIATED PROJECTIONS OF HOUSING UNIT DEMAND
BY SELLING PRICE IN THE WAILUKU-KAHULUI TUDYAREA 2014 TO 2035
Expressed in Constant 2015 Dollars

Period	Periodic Demand 2015	2016 to 2020	2021 to 2025	2026 to 2030	2031 to 2035	Total Demand 2014-2035
1. Minimum Demand Forecasts						
Less Than $330,000 (1)	**52**	**639**	**692**	**732**	**779**	**2,894**
Percent of Total Demand	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
$330,000 to $660,000 (2)	**78**	**958**	**1,037**	**1,098**	**1,169**	**4,341**
Percent of Total Demand	45.00%	45.00%	45.00%	45.00%	45.00%	45.00%
$660,000 to $1,000,000	**35**	**426**	**461**	**488**	**520**	**1,929**
Percent of Total Demand	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Over $1,000,000	**9**	**106**	**115**	**122**	**130**	**482**
Percent of Total Demand	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Total Market Demand	**174**	**2,130**	**2,305**	**2,439**	**2,598**	**9,647**
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
2. Maximum Demand Forecasts						
Less Than $330,000 (1)	**52**	**1,213**	**1,108**	**1,271**	**1,400**	**5,044**
Percent of Total Demand	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
$330,000 to $660,000 (2)	**78**	**1,819**	**1,662**	**1,906**	**2,100**	**7,566**
Percent of Total Demand	45.00%	45.00%	45.00%	45.00%	45.00%	45.00%
$660,000 to $1,000,000	**35**	**808**	**739**	**847**	**934**	**3,363**
Percent of Total Demand	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Over $1,000,000	**9**	**202**	**185**	**212**	**233**	**841**
Percent of Total Demand	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Total Market Demand	**174**	**4,042**	**3,693**	**4,237**	**4,668**	**16,814**
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

(1) This price is considered "affordable" for households earning 80% of the median county household income ("Low Income").
(2) This price is considered "affordable" for households earning from 81% to 160% of county median (includes "Below Moderate" to "Gap Income" categories).

Source: Maui County, DBEDT, MLS and The Hallstrom Group/CBRE

EXHIBIT I - TABLE 7

DIVISION OF PROJECTED DEMAND BY UNIT TYPE
FOR HOUSING UNITS IN WAILUKU-KAHULUI STUDY AREA 2015 TO 2035

	Periodic Demand (1)					Total
	2015	2016 to 2020	2021 to 2025	2026 to 2030	2031 to 2035	Demand 2015-2035
1. Using Minimum Demand Projections						
Single Family Homes	110	1,044	1,037	1,073	1,117	4,381
Percent of Total	63%	49%	45%	44%	43%	45%
Single Family Lots	21	234	231	220	208	913
Percent of Total	12%	11%	10%	9%	8%	9%
Multifamily Units	44	852	1,037	1,147	1,273	4,352
Percent of Total	25%	40%	45%	47%	49%	45%
Total	**174**	**2,130**	**2,305**	**2,439**	**2,598**	**9,647**
	100%	100%	100%	100%	100%	100%
2. Using Maximum Projections						
Single Family Homes	110	1,981	1,662	1,864	2,007	7,624
Percent of Total	63%	49%	45%	44%	43%	45%
Single Family Lots	21	445	369	381	373	1,590
Percent of Total	12%	11%	10%	9%	8%	9%
Multifamily Units	44	1,617	1,662	1,991	2,287	7,601
Percent of Total	25%	40%	45%	47%	49%	45%
Total	**174**	**4,042**	**3,693**	**4,237**	**4,668**	**16,814**
	100%	100%	100%	100%	100%	100%
Mid-Point						
Single Family Homes	110	1,512	1,350	1,469	1,562	**6,002**
Single Family Lots	21	339	300	300	291	**1,251**
Multifamily Units	44	1,234	1,350	1,569	1,780	**5,976**
Total	**174**	**3,086**	**2,999**	**3,338**	**3,633**	**13,230**

Source: The Hallstrom Group/CBRE

EXHBIT I - TABLE 8

DIVISION OF PROJECTED DEMAND BETWEEN ONWER-OCCUPANTS AND RENTALS FOR HOUSING UNITS IN KAHULUI-WAILUKU STUDY AREA 2015 TO 2035
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii

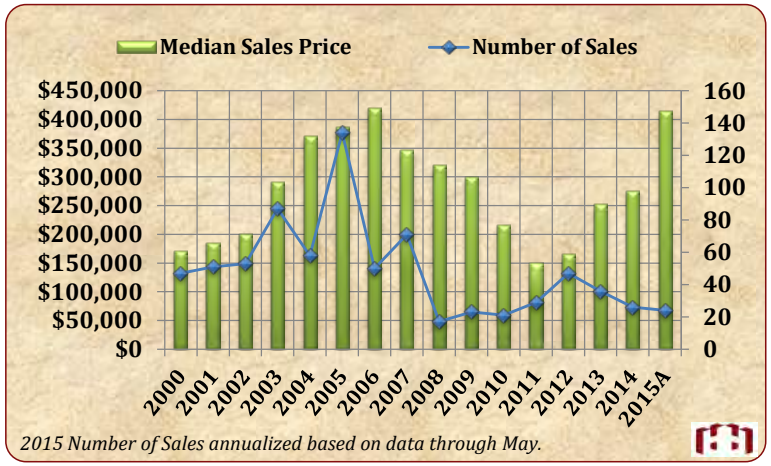
	Periodic Demand (1)					Total Demand 2015-2035
	2015	2016 to 2020	2021 to 2025	2026 to 2030	2031 to 2035	
1. Using Minimum Demand Projections						
Owner-Occupied Units	112	1,320	1,383	1,415	1,455	5,685
Percent of Total	64%	62%	60%	58%	56%	59%
Renter-Occupied Units	63	809	922	1,025	1,143	3,962
Percent of Total	36%	38%	40%	42%	44%	41%
Total	**174**	**2,130**	**2,305**	**2,439**	**2,598**	**9,647**
	100%	100%	100%	100%	100%	100%
2. Using Maximum Projections						
Owner-Occupied Units	112	2,506	2,216	2,457	2,614	9,905
Percent of Total	64%	62%	60%	58%	56%	59%
Renter-Occupied Units	63	1,536	1,477	1,779	2,054	6,909
Percent of Total	36%	38%	40%	42%	44%	41%
Total	**174**	**4,042**	**3,693**	**4,237**	**4,668**	**16,814**
	100%	100%	100%	100%	100%	100%
Mid-Point						
Owner-Occupied Units	112	1,913	1,800	1,936	2,034	**7,795**
Renter-Occupied Units	63	1,173	1,200	1,402	1,598	**5,435**
Total	**174**	**3,086**	**2,999**	**3,338**	**3,633**	**13,230**

Note: The 2010 Census identified owner-occupants as comprising 64 percent of the market and rental-occupied units at 36 percent of the Wailuku-Kahului study area.

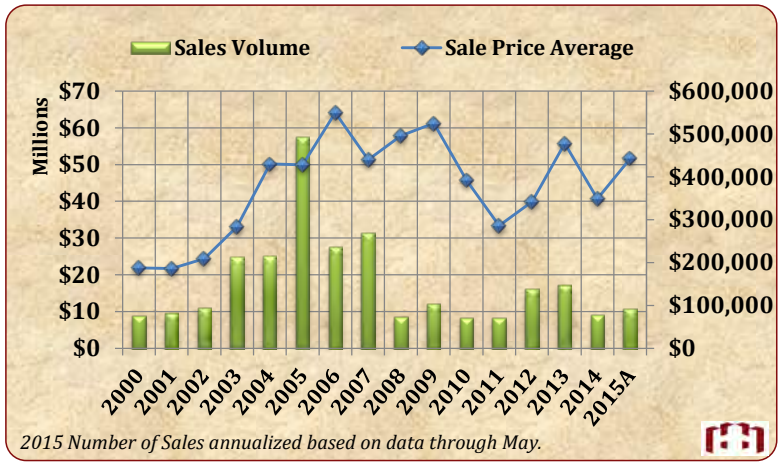
Source: The Hallstrom Group/CBRE

EXHIBIT I - TABLE 9

LAND SALES IN CENTRAL MAUI BROKERED THROUGH THE MAUI MULTIPLE LISTING SERVICE
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii



2015 Number of Sales annualized based on data through May.



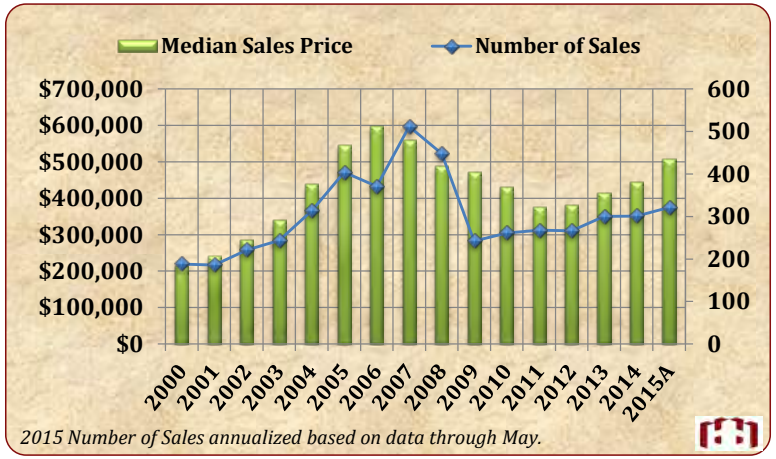
2015 Number of Sales annualized based on data through May.

Year	Median	Average	Sales	Volume
2000	$170,000	$188,007	47	$8,836,310
2001	$185,500	$186,294	51	$9,501,000
2002	$199,900	$209,441	53	$11,100,398
2003	$290,900	$283,555	87	$24,699,326
2004	$371,000	$430,079	58	$24,944,574
2005	$387,000	$428,145	134	$57,371,378
2006	$420,000	$549,210	50	$27,460,487
2007	$346,500	$440,005	71	$31,240,390
2008	$320,000	$496,017	17	$8,432,290
2009	$300,000	$524,555	23	$12,064,770
2010	$215,000	$392,153	21	$8,235,220
2011	$150,000	$286,046	29	$8,295,324
2012	$165,000	$342,209	47	$16,083,817
2013	$252,000	$478,000	36	$17,208,005
2014	$275,500	$349,069	26	$9,075,805
2015A	$415,000	$442,874	24	$10,628,978

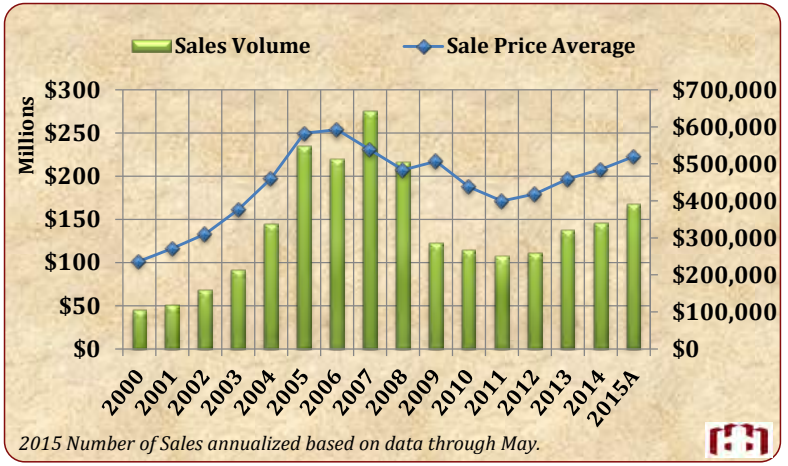
2015 Number of Sales and Volume annualized based on data through May.
Source: Maui Board of Realtors, Compiled by the Hallstrom Group | CBRE

EXHIBIT I - TABLE 10

SINGLE FAMILY HOME SALES IN CENTRAL MAUI BROKERED THROUGH THE MAUI MULTIPLE LISTING SERVICE
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii



2015 Number of Sales annualized based on data through May.



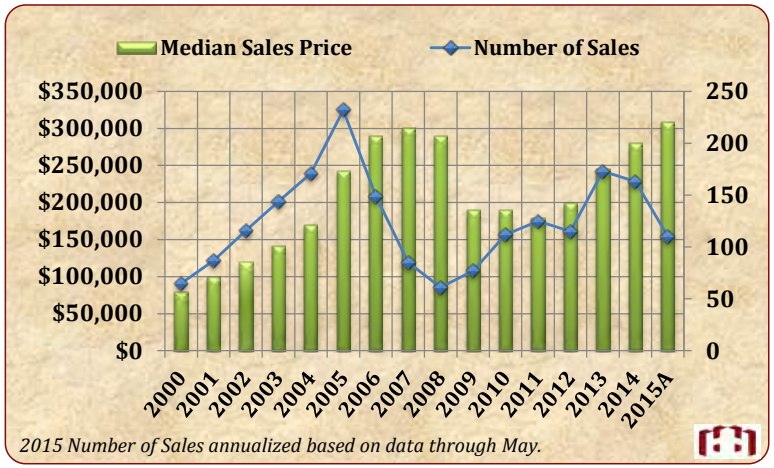
2015 Number of Sales annualized based on data through May.

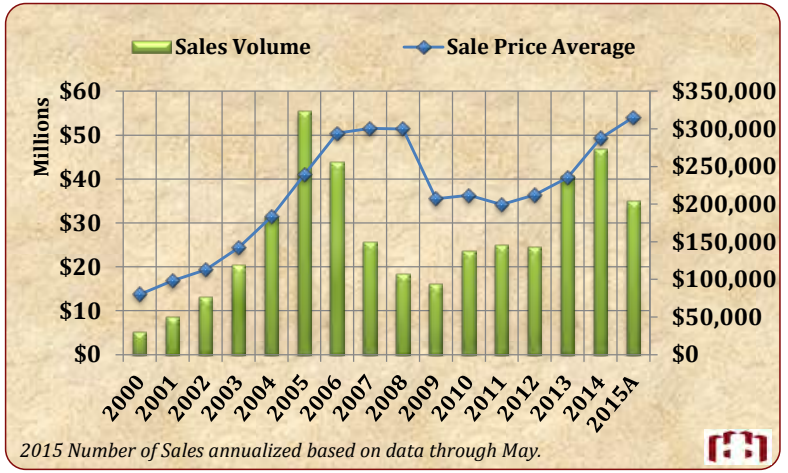
Year	Median	Average	Sales	Volume
2000	$214,000	$237,337	188	$44,619,393
2001	$242,250	$271,730	186	$50,541,755
2002	$286,000	$310,950	221	$68,719,852
2003	$340,000	$376,397	244	$91,840,766
2004	$438,500	$460,701	314	$144,659,988
2005	$544,920	$582,766	404	$235,437,495
2006	$597,240	$592,022	371	$219,640,103
2007	$558,941	$538,048	512	$275,480,632
2008	$490,000	$483,792	448	$216,738,595
2009	$471,250	$506,872	242	$122,662,933
2010	$430,000	$438,035	261	$114,327,236
2011	$375,000	$399,351	268	$107,025,982
2012	$380,000	$418,214	266	$111,244,954
2013	$415,630	$459,001	300	$137,700,416
2014	$445,000	$485,245	301	$146,058,613
2015A	$507,286	$519,985	322	$167,227,284

2015 Number of Sales and Volume annualized based on data through May.
Source: Maui Board of Realtors, Compiled by the Hallstrom Group | CBRE

EXHIBIT I - TABLE 11

CONDOMINIUM UNIT SALES IN CENTRAL MAUI BROKERED THROUGH THE MAUI MULTIPLE LISTING SERVICE
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii





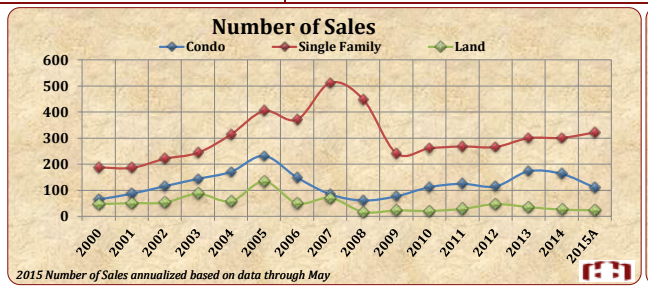
Year	Median	Average	Sales	Volume
2000	$79,250	$80,136	65	$5,208,872
2001	$99,000	$98,074	87	$8,532,400
2002	$120,000	$112,556	116	$13,056,508
2003	$141,000	$142,014	144	$20,450,000
2004	$170,000	$183,236	171	$31,333,350
2005	$242,875	$238,932	232	$55,432,274
2006	$290,000	$294,206	149	$43,836,645
2007	$300,000	$300,705	85	$25,559,910
2008	$290,000	$300,007	61	$18,300,425
2009	$190,000	$207,210	77	$15,955,165
2010	$189,500	$211,593	112	$23,698,377
2011	$179,000	$199,448	125	$24,930,946
2012	$199,000	$212,068	115	$24,387,815
2013	$245,000	$235,352	173	$40,715,950
2014	$280,000	$287,607	163	$46,880,000
2015A	$308,750	$315,655	110	$34,848,360

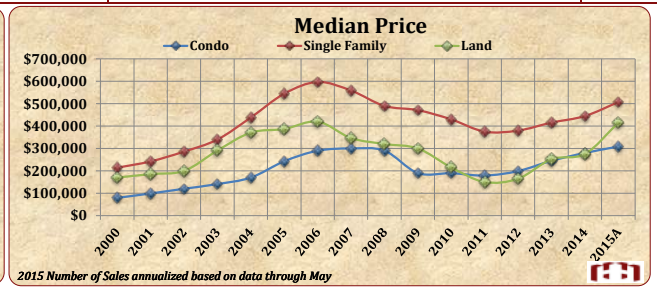
2015 Number of Sales and Volume annualized based on data through May.
Source: Maui Board of Realtors, Compiled by the Hallstrom Group | CBRE

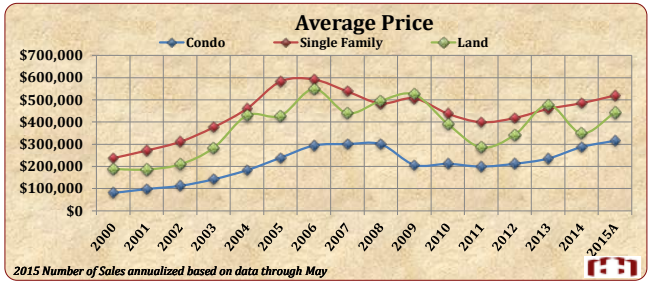
EXHIBIT I - TABLE 12

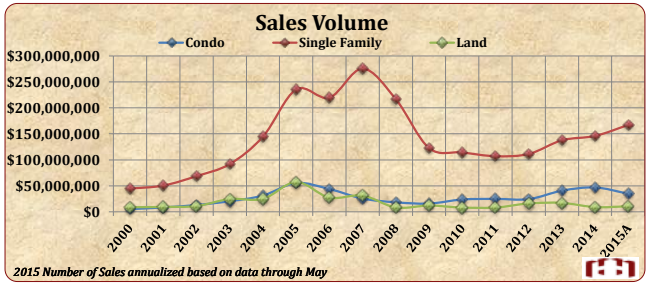
COMBINED LAND, SINGLE FAMILY HOME AND CONDOMINIUM UNIT SALES INDICATORS FROM THE MAUI MULTIPLE LISTING SERVICE
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii

	Number of Sales			Median Price			Average Price			Sales Volume		
	Condo	Single Family	Land	Condo	Single Family	Land	Condo	Single Family	Land	Condo	Single Family	Land
2000	65	188	47	$79,250	$214,000	$170,000	$80,136	$237,337	$188,007	$5,208,872	$44,619,393	$8,836,310
2001	87	186	51	$99,000	$242,250	$185,500	$98,074	$271,730	$186,294	$8,532,400	$50,541,755	$9,501,000
2002	116	221	53	$120,000	$286,000	$199,900	$112,556	$310,950	$209,441	$13,056,508	$68,719,852	$11,100,398
2003	144	244	87	$141,000	$340,000	$290,900	$142,014	$376,397	$283,555	$20,450,000	$91,840,766	$24,699,326
2004	171	314	58	$170,000	$438,500	$371,000	$183,236	$460,701	$430,079	$31,333,350	$144,659,988	$24,944,574
2005	232	404	134	$242,875	$544,920	$387,000	$238,932	$582,766	$428,145	$55,432,274	$235,437,495	$57,371,378
2006	149	371	50	$290,000	$597,240	$420,000	$294,206	$592,022	$549,210	$43,836,645	$219,640,103	$27,460,487
2007	85	512	71	$300,000	$558,941	$346,500	$300,705	$538,048	$440,005	$25,559,910	$275,480,632	$31,240,390
2008	61	448	17	$290,000	$490,000	$320,000	$300,007	$483,792	$496,017	$18,300,425	$216,738,595	$8,432,290
2009	77	242	23	$190,000	$471,250	$300,000	$207,210	$506,872	$524,555	$15,955,165	$122,662,933	$12,064,770
2010	112	261	21	$189,500	$430,000	$215,000	$211,593	$438,035	$392,153	$23,698,377	$114,327,236	$8,235,220
2011	125	268	29	$179,000	$375,000	$150,000	$199,448	$399,351	$286,046	$24,930,946	$107,025,982	$8,295,324
2012	115	266	47	$199,000	$380,000	$165,000	$212,068	$418,214	$342,209	$24,387,815	$111,244,954	$16,083,817
2013	173	300	36	$245,000	$415,630	$252,000	$235,352	$459,001	$478,000	$40,715,950	$137,700,416	$17,208,005
2014	163	301	26	$280,000	$445,000	$275,500	$287,607	$485,245	$349,069	$46,880,000	$146,058,613	$9,075,805
2015A	110	322	24	$308,750	$507,286	$415,000	$315,655	$519,985	$442,874	$34,848,360	$167,227,284	$10,628,978









Source: Maui Board of Realtors, Compiled by the Hallstrom Group | CBRE

EXHIBIT I - TABLE 13

CENTRAL MAUI PLANNED AND PROPOSED DEVELOPMENT PROJECTS

"COMMITTED (ENTITLED)" PROJECTS

	Single Family	Multi Family	Time Share Hotel
Aina 0 Kane Condos	0	100	0
Hale Mua	466	0	0
Imi Ikena Affordable Rentals	0	28	0
Kahawai Condos	0	16	0
Kahului Town Center Redevelopment	0	442	0
Kai Hoill AG Lots	17	0	0
Kehalani (C-12)	150	0	0
Kehalani (C-13)	0	77	0
Kehalani (C-14)	80	0	0
Kehalani (C-18)	0	83	0
Kehalani (C-19)	76	0	0
Kehalani (C-3)	30	0	0
Kehalani (C-6)	0	80	0
Kehalani (C-7)	35	0	0
Kehalani (C-8)	0	84	0
Kehalani (C-9)	90	0	0
Kehalani Ho'olea Terrace	0	112	0
Maui Lani Lot 4	0	238	0
Maui Lani Sandhills -Commercial	16	0	0
Maui Lani The Fairways	50	0	0
Maui Lani The Parkways	225	0	0
Maui Lani Traditions	153	0	0
Maui Lani Village	79	0	0
Maui Beach Hotel Addition	0	0	136
Mission Street Affordable Apts	0	10	0
Pi'ihana Project District 2	95	440	0
Waikapu Gardens II	56	0	0
Subtotal	**1,618**	**1,710**	**136**

"MIP AND CP (PARTLY ENTITLED)" PROJECTS

	Single Family	Multi Family	Time Share Hotel
Habitat For Humanity Condos	0	40	0
Ka Lima 0 Maui Affordable Housing	0	16	0
Maui Lani Homes 1	240	0	0
Maui Lani Lot 7B	120	0	0
Maui Lani MF7 Condos	0	68	0
Waikapu Mauka Country Town	**228**	**195**	**0**
Waikapu Mauka Rural Lots	304	0	0
Subtotal	**892**	**319**	**0**

"MIP ONLY" PROJECTS

Pu'unani Residences	150	450	0
Wai'ale Affordable Homes	0	300	0
Waiale	1,127	1,127	0
Waikapu Makai Village	**468**	**513**	**0**
Waikapu Rural Village	26	0	0
Subtotal	**1,771**	**2,390**	**0**

	Proposed/Planned Units	
	Number	% of Total
Including Subject		
Single Family	**4,281**	**49.2%**
Multi Family	**4,419**	**50.8%**
Total	**8,700**	**100.00%**
Excluding Subject		
Single Family	**3,585**	**49.1%**
Multi Family	**3,711**	**50.9%**
Total	**7,296**	**100.00%**

Projects identified as "Planned/Committed" have the appropriate conforming Community Plan and zoning entitlements, are approved agricultural subdivisions, are approved 201G/H projects, or are Department of Hawaiian Homelands (DHHL) projects. Projects identified as "Planned/Designated" have urban or rural Community Plan designations but not the conforming zoning entitlements to proceed. Projects identified as "Proposed" are currently lacking urban or rural Community Plan designations. Projects identified as "Recently Completed" include those where the subdivision process is complete, total build-out of the project has been reached or nearly reached, and real property is being actively marketed. Further, these projects remain "Recently Completed" until other map layers show the completed project.

Proposed subject units shaded and in bold.

Source: County of Maui Planning Department, and The Hallstrom Group | CBRE

EXHIBIT I - TABLE 14

PROJECTION OF POTENTIAL SUBJECT UNIT ABSORPTION USING THE RESIDUAL METHOD BASED ON TOTAL DEMAND FOR RESIDENTIAL UNITS IN THE WAILUKU-KAHULUI STUDY AREA
Based on Proposed Units Within the Proposed Directed Growth Boundary for Wailuku-Kahului, Using Mid-Point Demand Estimates

Segment	TOTAL UNITS PROPOSED Excluding Subject	Sales Period 2015	2016-2020	2021-2025	2026-2030	2031-2035	Total
Single Family (1)							
Identified Supply (2)	3,585	100	1,000	1,000	1,000	485	3,585
Market Share Percentage of Total Supply		57%	50%	50%	50%	43%	49%
Regional SF Lot/Home Demand (mid-point)	**7,254**	**100**	**1,852**	**1,650**	**1,769**	**1,853**	**7,223**
Shortage or (Excess) Supply	**3,669**	**0**	**852**	**650**	**769**	**1,368**	**3,638**
Potential Residual Subject SF Demand							
at 90% Capture Rate	3,302	0	766	585	692	1,231	3,274
at 80% Capture Rate	2,935	0	681	520	615	1,094	2,910
Multi Family							
Identified Supply (2)	3,711	74	1,000	1,000	1,000	637	3,711
Market Share Percentage of Total Supply		43%	50%	50%	50%	57%	51%
Regional MF Unit Demand (mid-point)	**5,976**	**74**	**1,234**	**1,350**	**1,569**	**1,780**	**6,007**
Shortage or (Excess) Supply	**2,265**	**0**	**234**	**350**	**569**	**1,143**	**2,296**
Potential Residual Subject MF Demand							
at 90% Capture Rate	2,039	0	211	315	512	1,029	2,066
at 80% Capture Rate	1,812	0	188	280	455	914	1,837
Total Single and Multi Family							
Identified Supply	7,296	174	2,000	2,000	2,000	1,122	7,296
Market Share Percentage of Total Supply		100%	100%	100%	100%	100%	100%
Regional Total Unit Demand (mid-point)	**13,230**	**174**	**3,086**	**2,999**	**3,338**	**3,633**	**13,230**
Shortage or (Excess) Supply	**5,934**	**0**	**1,086**	**999**	**1,338**	**2,511**	**5,934**
Potential Residual Subject Demand							
at 90% Capture Rate	5,341	0	977	899	1,204	2,260	5,340
at 80% Capture Rate	4,747	0	869	799	1,070	2,009	4,747

(1) Includes lots and finished homes.
(2) Assumes 100 percent of all planned/proposed units are constructed during projection period.

Source: Maui County, Developers/Agents, & The Hallstrom Group, Inc.

EXHIBIT I - TABLE 15

SUMMARY OF SUBJECT PROJECTED DEMAND LEVELS
USING THE MARKET SHARES METHOD
Assuming Pre-Sales Commence in 2017

Scenario One: Using Minimum Demand Assumptions

Sales Year		Total Regional	Effective Subject	Indicated Total Subject
Date	Period	Demand	Share	Absorption (1)
2017	1	426	20.00%	85
2018	2	426	18.00%	77
2019	3	426	19.00%	81
2020	4	426	20.00%	85
2021	5	461	20.00%	92
2022	6	461	20.00%	92
2023	7	461	20.00%	92
2024	8	461	20.00%	92
2025	9	461	20.00%	92
2026	10	488	20.00%	98
2027	11	488	20.00%	98
2028	12	488	20.00%	98
2029	13	488	20.00%	98
2030	14	488	20.00%	98
2031	15	520	20.00%	104
2032	16	520	10.00%	52
Totals		**7,488**	**19.14%**	**1,433**

Scenario Two: Using Maximum Demand Assumptions

Sales Year		Total Regional	Effective Subject	Indicated Total Subject
Date	Period	Demand	Share	Absorption (1)
2017	1	808	22.00%	178
2018	2	808	20.00%	162
2019	3	808	21.00%	170
2020	4	808	22.00%	178
2021	5	739	22.00%	162
2022	6	739	22.00%	162
2023	7	739	22.00%	162
2024	8	739	22.00%	162
2025	9	739	13.00%	96
Totals		**6,927**	**20.69%**	**1,433**

ANALYSIS MID-POINT			
12.05 Years	**7,207**	**19.88%**	**1,433**

(1) Excludes potential Ohana units.

Source: The Hallstrom Group/CBRE

Addendum B

COMMERCIAL MARKET STUDY TABLES

EXHIBIT II - TABLE 1

SUMMARY OF EXISITING COMMERCIAL SPACE DEVELOPMENT IN HAWAII AND AMOUNT PER CAPITA
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii
As of End of First Quarter 2015, Major Islands Only

County	C &C of Honolulu	Maui	Kauai	Hawaii	State Totals
Resident Population	1,001,706	154,020	71,885	200,016	1,427,626
De Facto Population	1,097,734	208,185	95,420	229,964	1,631,302
Gross Leaseable Area in Major Centers in Sq. Ft. (1)	19,995,007	4,069,738	1,267,749	3,234,939	28,567,432
Other Gross Leaseable Area in Sq. Ft. (2)	3,683,500	543,150	200,200	653,125	5,079,975
Total Estimated Commercial GLA (Square Feet)	**23,678,507**	**4,612,888**	**1,467,949**	**3,888,064**	**33,647,407**
2. Per Capita Spatial Allowance (Square Feet per Person)					
Per Resident Population Member	23.6	29.9	20.4	19.4	23.6
Per De Facto Population Member	21.6	22.2	15.4	16.9	20.6
3. General Market Operating Overview					**State Average**
Vacancy Rate	4.9%	9.5%	10.3%	4.8%	5.8%
Estimated Vacant Square Feet of GLA	1,160,247	438,224	151,199	186,627	1,936,297
Weighted Avg. Monthly Base per Square Foot Rents (3)					
Low	$2.73	$2.96	$2.95	$2.42	$3.62
High	$14.37	$4.51	$4.64	$4.41	$8.16
Average Monthly per Square Foot Operating Expenses (3)	$2.41	$1.22	$0.98	$1.30	$1.90
Space Absorbed in 2014 (Full-Year)	**(79,901)**	**(13,309)**	**7,435**	**(5,367)**	**(91,142)**
Space Absorbed in 1st Qtr. 2015	**(832)**	**(16,022)**	**5,253**	**23,611**	**12,010**

(1) Complexes with about 50,000 square feet and up.
(2) Includes smaller projects, freestanding buildings and hotels. Does not include space within mixed-use and multi-tenant buildings located in Light Industrial parks.
(3) Based on recent leases. Historic leases may be outside of stated range.

Source: State DBEDT and The Hallstrom Group | CBRE

EXHIBIT II - TABLE 2

SUMMARY OF NEIGHBORHOOD COMMERCIAL SPACE DEMAND
CREATED BY WAIKAPU COUNTRY TOWN BY BUILD-OUT AND STABILIZATION
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii

1. Stabilized Subject Population		
De Facto Population		4,085
Full Time Eqivalent On-Site Workers		597
2. Project Resident Per Capita Demand for Commercial Space (in Gross Square Feet per Person)		
Total for All Commercial Needs (1)		30.0
"Neighborhood Retail" Space Demand as Percent of Total		55%
Total Per Capita "Neighborhood Retail" Commercial Space Demand in Square Feet		16.5
Allowance for "Service Commercial/Medical" Space (40% of Neighborhood demand)		6.6
Allowance for "Support/Other/Destination Commercial" Space (20% of Neighborhood demand)		3.3
Total Per Capita Floor Space Demand for Resident-Oriented/Neighborhood Commercial Space		26.4
Capture Rate of In-Project Resident Neighborhood Demand		90.0%
Total Floor Space Demand for Resident-Oriented/Neighborhood Commercial Space		97,060
3. In-Project Worker Per Capita Demand for Commercial Space (in Gross Square Feet per Person)		
Estimated Percent of Workers not Residing in Project		50.0%
Non-Resident Workers Patronizing Subject Commercial Businesses		299
Total Per Capita Floor Space Demand by Workers for Neighborhood Commercial Space (2)		6.6
Total Floor Space Demand by Workers for Neighborhood Commercial Space		1,970
3. Indicated Subject Commercial Floor Space Demand		
From Subject Project Population		99,030
Patronage From Other Sources	**% of Community Demand**	
Nearby Population in Non-Subject Projects	15%	14,854
Guests/Passer-Bys and Others	25%	24,757
Total Estimated Gross Floor Space Demand at Stabilization		**138,642**

(1) Based on mid-point per person spatial demand in 2030.
(2) Based on capture rate of 25 percent of per capita resident demand in square feet.

Source: The Hallstrom Group/CBRE

Addendum C

ECONOMIC IMPACT ANALYSIS TABLES

EXHIBIT III -TABLE 1

SUMMARY COMPARISON OF MAJOR ECONOMIC IMPACTS
AND PUBLIC FISCAL COSTS/BENEFITS
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii
All Amounts Expressed in Constant, Uninflated 2015 Dollars

Analysis Item	Cumulative During Projection Period 2016-2030	Stabilized Annually Thereafter
Direct Capital Investment	$644,304,552	
Local Contractor's Profits	$64,430,455	
Local Supplier's Profits	$25,772,182	
Worker Years of Jobs	8,946	746
Employee Wages	$465,899,240	$27,096,572
Resident Population		3,921
Full-Time Resident Household Income	$1,334,322,822	$156,629,499
De Facto Population Expenditures (On & Off Site)	$675,920,535	$78,314,749
Total New Operating Gross Receipts	$172,813,024	$32,090,792
Total New Maui "Base" Economic Impact	$817,117,576	$32,090,792
ACCOUNTS FOR NEW TAX REVENUES AND EXPENDITURES ONLY		
County of Maui Gross Tax and Fee Receipts	$47,949,874	$4,853,230
State of Hawaii Gross Tax and Fee Receipts	$95,379,394	$4,369,210
County of Maui Costs of Services (per capita basis)	$5,516,032	$620,290
State Costs of Services (per capita basis)	$12,714,816	$1,429,808
County of Maui Net Benefits or (Loss)	$42,433,842	$4,232,940
State Net Benefits or (Loss)	$82,664,578	$2,939,401

Source: The Hallstrom Group/CBRE

EXHIBIT III -TABLE 2

PROPOSED DEVELOPMENT SCHEDULE AND ESTIMATED CONSTRUCTION COSTS
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii
All Amounts Expressed in Constant 2015 Dollars, Includes Ohana Units

	Development, Sales & Stabilization Period			Totals During Build-Out
	2016 to 2020	2021 to 2026	2026 to 2030	
Infrastructure Emplacement	$79,569,400	$119,687,500		**$199,256,900**
Commercial Construction (1)	$14,297,338	$37,173,079	$5,718,935	**$57,189,352**
Residential Construction (2, 3)	$166,167,050	$172,158,100	$49,533,150	**$387,858,300**
TOTAL PERIODIC CONSTRUCTION COSTS	**$260,033,788**	**$329,018,679**	**$55,252,085**	**$644,304,552**
Contractor Profits	$26,003,379	$32,901,868	$5,525,209	**$64,430,455**
Supplier Profits	$10,401,352	$13,160,747	$2,210,083	**$25,772,182**

(1) Includes 169,597 square feet of retail, restaurant, service and office/other components. Estimated average direct development cost of $337 per sq ft.
(2) Estimated average direct development cost of $175 per square foot for single family homes, multifamily units and ohana units.

(3) Assuming average size for 970 urban homes of 1,473 square feet and 80 rural homes of 3,375 square feet, with overall average of 1,618 square feet. Average multifamily unit size of 804 square feet and average ohana unit size of 575 square feet.

Source: The Hallstrom Group/CBRE

EXHIBIT III - TABLE 3

ESTIMATED YEARLY FULL-TIME EQUIVALENT EMPLOYMENT POSITIONS CREATED BY DEVELOPMENT
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii

	Development, Sales & Stabilization Period			Totals During Build-Out	
Construction Employment (1)	**2016 to 2020**	**2021 to 2025**	**2026 to 2030**		
Infrastructure Emplacement	199	299		**498**	
Commercial Construction	64	165	25	**254**	
Residential Units (includes Ohana Units)	739	765	220	**1,724**	
Total Periodic Construction Jobs	**1,001**	**1,230**	**246**	**2,476**	
On-Going Business Employment					**Stabilized Annually**
Commercial Worker Years (2)	199	1,528	2,524	**4,251**	
Total FTE Jobs in Place at End of Period	133	478	531		**531**
Maintenance & Common Element (3)	23	141	266	**429**	
Total FTE Jobs in Place at End of Period	16	41	66		**66**
Total Periodic On-Going Business Jobs	**223**	**1,668**	**2,790**	**4,681**	
Total FTE Jobs in Place at End of Period	**148**	**519**	**597**		**597**
Off-Site Employment (4)	306	724	759	**1,789**	
Total FTE Jobs in Place at End of Period	37	130	149		**149**
TOTAL PERIODIC WORKER YEARS	**1,530**	**3,622**	**3,794**	**8,946**	
TOTAL END-OF-PERIOD PERMANENT JOBCOUNT	**186**	**649**	**746**		**746**

(1) Infrastructure construction employment estimated at 1 worker-year for every $400,000 in costs. Vertical construction (all types) employment estimated at 1 worker-year for every $225,000 in costs. Includes all direct employment associated with construction, on and off-site.

(2) Employment estimated at 1 full-time-equivalent worker for every 320 square feet of gross floor area. First stores opening in 2018.

(3) Includes project common element administration, security and maintenance staff of 10 jobs, apartment staffs, and single family home services.

(4) Estimated at one cumulative off-site employment position for every four on site positions.

Source: Hallstrom Group/CBRE

EXHIBIT III - TABLE 4

ESTIMATED YEARLY EMPLOYEE WAGES CREATED BY DEVELOPMENT
Market Study of the Waikapu Country Town
Waikapu, Maui, Hawaii
All Amounts Expressed in Constant 2015 Dollars

	Development, Sales & Stabilization Period			Totals During Build-Out	
Construction Wages (1)	**2016 to 2020**	**2021 to 2025**	**2026 to 2030**		
Infrastructure Emplacement	$16,149,087	$24,291,296		**$40,440,383**	
Commercial Construction	$5,158,632	$13,412,443	$2,063,453	**$20,634,528**	
Residential Units (including Ohana Units)	$59,954,844	$62,116,479	$17,872,089	**$139,943,412**	
Total Periodic Construction Wages	**$81,262,563**	**$99,820,218**	**$19,935,542**	**$201,018,323**	
On-Going Business Wages					**Annually**
Commercial (2)	$7,110,145	$54,511,110	$90,061,834	**$151,683,088**	**$17,298,261**
Maintenance & Common Element (4)	$1,193,924	$7,168,647	$13,546,447	**$21,909,019**	**$2,183,168**
Total Periodic On-Going Business Wages	**$8,304,069**	**$61,679,757**	**$103,608,281**	**$173,592,107**	**$19,481,429**
Off-Site Employment Wages (5)	$15,608,568	$36,964,018	$38,716,225	**$91,288,810**	**$7,615,143**
TOTAL PERIODIC WAGES	**$105,175,200**	**$198,463,993**	**$162,260,047**	**$465,899,240**	**$27,096,572**

(1) Average annual wage for full-time-equivalent construction worker (all trades) at $81,182 ($39.03/hour X 2,080 hours).

(2) Average annual wage for full-time-equivalent retail trade& restaurant workers at $32,552 ($15.65/hour).

(3) Average annual wage for full-time-equivalent industrial worker estimated at $40,893 ($19.66/hour) based on average wage for manufacturing, trade, wholesale workers.

(2) Estimated average annual wage for full-time-equivalent maintenance and security workers at $33,200 ($16/hour).

(5) Average annual wage for full-time-equivalent general worker at $51,022 ($24.53/hour), the average wage for all "Total Private Workers" in the state.

Wages taken from State of Hawaii "Hawaii Workforce Infonet" "Publications and Tables > Hours and Earnings > Production Worker" through June 2015. Hourly wage figure is average over first half of year.

Source: Hallstrom Group/CBRE

ESTIMATED RESIDENT POPULATION, HOUSEHOLD INCOME AND DISCRETIONARY EXPENDITURES
Market Study of the Waikapu Country Town
Waikapu, Maui, Hawaii
All Amounts Expressed in Constant 2015 Dollars

	Development, Sales & Stabilization Period			
	2016 to 2020	2021 to 2025	2026 to 2030	Totals
Number of Units Occupied End-Of-Period	**690**	**1,284**	**1,433**	
Single Family Homes	**347**	**901**	**1,050**	
Percent of Total Units	50%	70%	73%	
Multifamily Units	**343**	**383**	**383**	
Percent of Total Units	50%	30%	27%	
Ohana Units	0	73	146	
Single Family Homes Population - Full-Time Residents (1)	944	2,452	2,856	
Single Family Homes Population - Part-Time Residents (1)	34	88	126	
Multifamily Homes Population - Full-Time Residents (2)	758	846	846	
Multiamily Homes Population - Part-Time Residents (2)	41	46	37	
Ohana Units (All Full-Time Residents) (3)	0	110	219	
				Average Household Size
Total Full-Time Resident Population	**1,702**	**3,408**	**3,921**	**2.87**
Total Part-Time Resident Population	**75**	**134**	**163**	
Total De Facto Population	**1,777**	**3,542**	**4,085**	
				During Build-Out
RESIDENT HOUSEHOLD INCOME (4)				
Annually (at end of period)	**$66,133,060**	**$135,643,367**	**$156,629,499**	
Periodic	**$99,199,590**	**$504,441,068**	**$730,682,164**	**$1,334,322,822**
			Stabilized	**$156,629,499**
TOTAL DE FACTO POPULATION EXPENDITURES (5)				
Annually (at end of period)	**$35,256,311**	**$67,821,684**	**$78,314,749**	
Periodic	**$52,884,467**	**$257,694,986**	**$365,341,082**	**$675,920,535**
			Stabilized	**$78,314,749**
TOTAL "NEW" MAUI SPENDING BY PART-TIME RESIDENTS				
Annually (at end of period)	**$2,189,781**	**$3,908,318**	**$4,769,601**	
Periodic	**$3,284,672**	**$15,245,247**	**$21,694,797**	**$40,224,716**
			Stabilized	**$4,769,601**

(1) Average household size of 3.2 persons.
(2) Average household size of 2.6 persons.
(3) Average household size of 1.5 persons.
(4) Single Family households at 175% of Maui household income average, multifamily households at 125% of Maui average. Ohana at 80% of Maui average.
(5) For full-time residents assumes 15% of gross income for taxes, 30% for housing costs and 5% for utlitiles. Leaving 50% of gross income as net disposable.
For non-full time residents estimated disposable income at $80 per day (50% above average daily per resident spending of $53).

Source: The Hallstrom Group/CBRE

EXHIBIT III - TABLE 6

PROJECTED ON-SITE OPERATING ECONOMIC ACTIVITY
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii
All Amounts Expressed in Constant 2015 Dollars

	Development, Sales & Stabilization Period				
	2016 to 2020	2021 to 2025	2026 to 2030	Totals During Build-Out	Stabilized Annually
Commercial Businesses (1)	$38,159,325	$292,554,825	$419,752,575	**$750,466,725**	**$101,758,200**
Non-Project Resident Patronage %	55.00%	56.00%	58.00%	**56.33%**	**42.00%**
Outside Project Patronage Expenditures	$17,171,696	$128,724,123	$176,296,082	**$327,703,803**	**$59,019,756**
"New" Maui Spending as % of Expenditures	13.0%	26.0%	39.0%	**26.0%**	**39.0%**
"New" Maui Spending as a Result of Project	**$2,232,321**	**$33,468,272**	**$68,755,472**	**$85,202,989**	**$23,017,705**
New Spending as % of Total Sales	**5.9%**	**11.4%**	**16.4%**	**11.4%**	**22.6%**
Maintenance & Common Element (4)	$1,526,495	$9,195,596	$17,410,153	**$28,132,244**	**$4,303,486**
In-Project Resident Population Patronage %	100%	100%	100%	**100%**	**100%**
Outside Project Patronage Expenditures	$0	$0	$0	**$0**	**$0**
Total Economic Activity					
"New" Maui Spending as a Result of Project	$2,232,321	$33,468,272	$68,755,472	**$104,456,064**	**$23,017,705**
Maintenance & Common Element Expenditures	$1,526,495	$9,195,596	$17,410,153	**$28,132,244**	**$4,303,486**
"New" Maui Spending by Part-Time Project Residents	$3,284,672	$15,245,247	$21,694,797	**$40,224,716**	**$4,769,601**
TOTAL PERIODIC "NEW MAUI" PROJECT GROSS REVENUES	**$7,043,487**	**$57,909,115**	**$107,860,422**	**$172,813,024**	**$32,090,792**

(1) Estimated based on average annual sales of $600 per square foot.
(4) Estimated at $3,000 per residential unit per year (ohana units included in base property) and $2 per square foot of total leaseable area per year.

Source: Hallstrom Group/CBRE

EXHIBIT III - TABLE 7

SUMMARY OF ECONOMIC IMPACTS ASSOCIATED WITH DEVELIOPMENT
Market Study of the Waikapu Country Twon
Waikapu, Maui, Hawaii
All Amounts Expressed in Constant 2014 Dollars

Development, Sales & Stabilization Period

	2016 to 2020	2021 to 2025	2026 to 2030	Totals During Build-Out	Stabilized Annually
Construction Activity					
Construction Wages	$81,262,563	$99,820,218	$19,935,542	**$201,018,323**	
Contractor Profits	$26,003,379	$32,901,868	$5,525,209	**$64,430,455**	
Supplier Profits	$10,401,352	$13,160,747	$2,210,083	**$25,772,182**	
Other Construction Costs	$142,366,494	$183,135,845	$27,581,252	**$353,083,591**	
Total Construction Impact	**$260,033,788**	**$329,018,679**	**$55,252,085**	**$644,304,552**	
Total "New Maui" Speding Project Impact	**$7,043,487**	**$57,909,115**	**$107,860,422**	**$172,813,024**	**$32,090,792**
TOTAL BASE ECONOMIC IMPACT	**$267,077,275**	**$386,927,794**	**$163,112,507**	**$817,117,576**	**$32,090,792**

Source: Hallstrom Group/CBRE

EXHIBIT III-TABLE 8

ESTIMATES OF TOTAL ECONOMIC IMPACT FROM SUBJECT CONSTRUCTION
USING STATE INPUT-OUTPUT MODEL "TYPE II" MULTIPLIERS
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui,, Hawaii
All Amounts Expressed in Constant 2014 Dollars

	Development, Sales & Stabilization Period			
Year	**2016 to 2020**	**2021 to 2025**	**2026 to 2030**	**Totals**
Construction Costs	**$260,033,788**	**$329,018,679**	**$55,252,085**	**$644,304,552**
1. Economic Output Multiplier	2.12	2.12	2.12	2.12
Total State Economic Output	**$551,271,631**	**$697,519,599**	**$117,134,421**	**$1,365,925,650**
2. Earnings Multiplier	0.61	0.61	0.61	0.61
Total Increase in State Earnings	**$158,620,611**	**$200,701,394**	**$33,703,772**	**$393,025,777**
3. State Tax Multipliers	0.12	0.12	0.12	0.12
Total Increase in State Taxes	**$31,204,055**	**$39,482,241**	**$6,630,250**	**$77,316,546**
4. Total Job Multipliers	13.83	13.83	13.83	13.83
Total State Jobs Created	**3,596.3**	**4,550.3**	**764.1**	**8,910.7**
Construction Employment	**1,001**	**1,230**	**246**	**2,476**
5. Direct-Effect Job Multipliers	2.68	2.68	2.68	2.68
Total Direct Jobs Created	**2,682.6**	**3,295.3**	**658.1**	**6,636.0**
Construction Wages	**$81,262,563**	**$99,820,218**	**$19,935,542**	**$201,018,323**
6. Direct-Effect Earnings	2.02	2.02	2.02	2.02
Total Increase in Direct Earnings	**$164,150,378**	**$201,636,841**	**$40,269,794**	**$406,057,013**

Source: State Input-Output Model (approved July 2011), and The Hallstrom Group/CBRE

EXHIBIT III - TABLE 9

ESTIMATES OF TOTAL ECONOMIC IMPACT FROM SUBJECT OPERATIONS
USING STATE INPUT-OUTPUT MODEL "TYPE II" MULTIPLIERS
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii
All Amounts Expressed in Constant 2014 Dollars

	Development, Sales & Stabilization Period				Stabilized
Year	**2016 to 2020**	**2021 to 2025**	**2026 to 2030**	**Totals**	**Annually**
Operating Revenues	**$7,043,487**	**$57,909,115**	**$107,860,422**	**$165,769,537**	**$32,090,792**
1. Economic Output Multiplier	2.09	2.09	2.09	2.09	2.09
Total State Economic Output	**$14,720,889**	**$121,030,051**	**$225,428,281**	**$346,458,332**	**$67,069,755**
2. Earnings Multiplier	0.66	0.66	0.66	0.66	0.66
Total Increase in State Earnings	**$4,648,702**	**$38,220,016**	**$71,187,878**	**$109,407,894**	**$21,179,923**
3. State Tax Multipliers	0.16	0.16	0.16	0.16	0.16
Total Increase in State Taxes	**$1,126,958**	**$9,265,458**	**$17,257,667**	**$26,523,126**	**$5,134,527**
4. Total Job Multipliers	19.00	19.00	19.00	19.00	19.00
Total State Jobs Created	**133.8**	**1,100.3**	**2,049.3**	**3,149.6**	**609.7**
Operating Employment	**223**	**1,668**	**2,790**	**4,681**	**597**
5. Direct-Effect Job Multipliers	2.05	2.05	2.05	2.05	2.05
Total Direct Jobs Created	**456.5**	**3,420.0**	**5,718.8**	**9,595.3**	**1,223.9**
Operating Wages	**$105,175,200**	**$198,463,993**	**$162,260,047**	**$465,899,240**	**$27,096,572**
6. Direct-Effect Earnings	1.89	1.89	1.89	1.89	1.89
Total Increase in Direct Earnings	**$198,781,128**	**$375,096,947**	**$306,671,489**	**$880,549,564**	**$51,212,521**

Source: State Input-Output Model (approved July 2011), and The Hallstrom Group/CBRE

Addendum D

PUBLIC FISCAL BENEFITS ASSESSMENT TABLES

EXHIBIT IV - TABLE 1

PUBLIC COST AND BENEFITS ASSESSMENT ASSOCIATED WITH THE WAIKAPU COUNTY TOWN
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii
All Amounts Expressed in Constant 2015 Dollars

Development Period	Development, Sales & Stabilization Period: 2016 to 2020	2021 to 2025	2026 to 2030	Totals During Build-Out Period	Stabilized Annually After Build-out
PUBLIC BENEFITS (Revenues)					
1. COUNTY REAL PROPERTY TAXES					
Assessed Value					
Commercial	$21,155,530	$76,159,907	$84,622,119		$84,622,119
Single Family Residential - Homeowners (After Exemptions)	$65,149,205	$169,162,633	$197,137,364		$197,137,364
Single Family Residential - Non-Homeowners	$96,600,334	$250,826,804	$292,306,487		$292,306,487
Multifamily Residential - Homeowners (After Exemptions)	$20,695,618	$23,109,102	$23,109,102		$23,109,102
Multifamily Residential - Non-Homeowner	$53,498,026	$59,736,862	$59,736,862		$59,736,862
Ohana Units (No Exemptions, No Land Value)	$0	$7,343,800	$14,687,600		$14,687,600
Total Assessed Value	**$257,098,713**	**$578,995,308**	**$656,911,933**		**$656,911,933**
Real Property Taxes					
Commercial	$139,626	$502,655	$558,506		$558,506
Single Family Residential - Homeowners (After Exemptions)	$179,160	$465,197	$542,128		$542,128
Single Family Residential - Non-Full Time Residents and Rentals	$521,642	$1,354,465	$1,578,455		$1,578,455
Multifamily Residential - Homeowners (After Exemptions)	$56,913	$63,550	$63,550		$63,550
Multifamily Residential - Non-Full Time Residents and Rentals	$320,988	$358,421	$358,421		$358,421
Ohana Units (60% on homeowners properties, 40% on rental properties)	$0	$15,863	$31,725		$31,725
Total Annual Property Taxes (End of Period)	**$1,218,330**	**$2,760,151**	**$3,132,785**		
Total Real Property Taxes During Period	**$3,045,824**	**$9,946,202**	**$14,732,341**	**$27,724,367**	**$3,132,785**
INCLUDES ONLY THOSE TAXES WHICH ARE "NEW" TO MAUI AS RESULT OF THE PROJECT					
2. STATE INCOME TAXES					
Taxable Personal Income	$105,175,200	$198,463,993	$162,260,047	$465,899,240	**$27,096,572**
Taxable Corporate Profits	$37,461,253	$54,748,982	$23,914,355	$116,124,591	**$4,813,619**
Personal Taxes Paid	$5,363,935	$10,121,664	$8,275,262	$23,760,861	**$1,381,925**
Corporate Taxes Paid	$1,648,295	$2,408,955	$1,052,232	$5,109,482	**$211,799**
TOTAL STATE INCOME TAXES	**$7,012,230**	**$12,530,619**	**$9,327,494**	**$28,870,343**	**$1,593,724**
3. STATE GROSS EXCISE TAX					
Taxable Transactions					
Construction Contracts	$260,033,788	$329,018,679	$55,252,085	$644,304,552	
Worker Disposable Income Purchases	$52,587,600	$99,231,997	$81,130,024	$232,949,620	$13,548,286
"New" Maui Spending Project Impact	$7,043,487	$57,909,115	$107,860,422	$172,813,024	$32,090,792
Total Taxable Transactions	**$319,664,875**	**$486,159,791**	**$244,242,530**	**$1,050,067,196**	**$45,639,078**
TOTAL STATE EXCISE TAX	**$13,319,476**	**$20,256,820**	**$10,176,854**	**$43,753,150**	**$1,901,643**
INCLUDES ONLY THOSE REVENUES AND COSTS WHICH ARE "NEW" TO MAUI					
TOTAL GROSS PUBLIC REVENUES					
To County of Maui (Item #1)	**$3,045,824**	**$9,946,202**	**$14,732,341**	**$27,724,367**	**$3,132,785**
Adjustment for Other Proportional Taxes	**1.55**	**1.55**	**1.55**	**1.55**	**1.55**
Adjusted Maui County Revenues	**$4,718,512**	**$15,408,400**	**$22,822,962**	**$42,949,874**	**$4,853,230**
Plus Impact Fees (2)	**$5,000,000**	**$0**	**$0**	**$5,000,000**	
Total County of Maui Receipts	**$9,718,512**	**$15,408,400**	**$22,822,962**	**$47,949,874**	**$4,853,230**
To State (Items #2 & #3)	**$20,331,707**	**$32,787,439**	**$19,504,348**	**$72,623,493**	**$3,495,368**
Adjustment for Other Proportional Taxes (3)	**1.25**	**1.25**	**1.25**	**1.25**	**1.25**
Adjusted State Revenues	**$25,414,633**	**$40,984,299**	**$24,380,434**	**$90,779,366**	**$4,369,210**
Plus Impact Fees (2)	**$4,600,028**	**$0**	**$0**	**$4,600,028**	
Total State of Hawaii Receipts	**$30,014,661**	**$40,984,299**	**$24,380,434**	**$95,379,394**	**$4,369,210**
AGGREGATE TAX REVENUES	**$34,733,174**	**$56,392,698**	**$47,203,396**	**$138,329,268**	**$9,222,440**
PUBLIC COSTS (Expenses)					
By County of Maui	**$711,956**	**$1,982,654**	**$2,821,422**	**$5,516,032**	**$620,290**
By State of Hawaii	**$1,641,105**	**$4,570,148**	**$6,503,563**	**$12,714,816**	**$1,429,808**
TOTAL PUBLIC COSTS	**$2,353,061**	**$6,552,802**	**$9,324,986**	**$18,230,849**	**$2,050,098**
TOTAL NET PUBLIC BENEFITS					
To County of Maui	**$9,006,556**	**$13,425,746**	**$20,001,540**	**$42,433,842**	**$4,232,940**
To State of Hawaii	**$28,373,556**	**$36,414,151**	**$17,876,871**	**$82,664,578**	**$2,939,401**
AGGREGATE NET BENEFITS	**$37,380,112**	**$49,839,896**	**$37,878,411**	**$125,098,420**	**$7,172,342**

(1) Real property taxes comprise 64.6 percent of General Fund in the proposed Maui County FY 2016 budget. Economic activity generates other revenue items of 35.4 percent or additional 55 percent above real property taxes.

(2) For parks, water/wastewater service, schools and other items. Additional impact fees may be assessed.

(3) In recent fiscal years, Gross Excise and Income Taxes have averaged about 80 percent of total State revenues; other revenue items 20 percent, or 25 percent above income and gross excise taxes.

Source: The Hallstrom Group/CBRE

EXHIBIT IV - TABLE 2

PUBLIC BENEFITS ASSESSMENT ASSOCIATED WITH THE WAIKAPU COUNTY TOWN
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii
All Amounts Expressed in Constant 2015 Dollars

	Development, Sales & Stabilization Period				
Development Period	**2016 to 2020**	**2021 to 2025**	**2026 to 2030**	**Totals During Build-Out Period**	**Stabilized Annually After Build-out**
PUBLIC BENEFITS (Revenues)					
1. COUNTY REAL PROPERTY TAXES					
Assessed Value					
Commercial	$21,155,530	$76,159,907	$84,622,119		$84,622,119
Single Family Residential - Homeowners (After Exemptions)	$65,149,205	$169,162,633	$197,137,364		$197,137,364
Single Family Residential - Non-Homeowners	$96,600,334	$250,826,804	$292,306,487		$292,306,487
Multifamily Residential - Homeowners (After Exemptions)	$20,695,618	$23,109,102	$23,109,102		$23,109,102
Multifamily Residential - Non-Homeowner	$53,498,026	$59,736,862	$59,736,862		$59,736,862
Ohana Units (No Exemptions, No Land Value)	$0	$7,343,800	$14,687,600		$14,687,600
Total Assessed Value	**$257,098,713**	**$578,995,308**	**$656,911,933**		**$656,911,933**
Real Property Taxes					
Commercial	$139,626	$502,655	$558,506		$558,506
Single Family Residential - Homeowners (After Exemptions)	$179,160	$465,197	$542,128		$542,128
Single Family Residential - Non-Full Time Residents and Rentals	$521,642	$1,354,465	$1,578,455		$1,578,455
Multifamily Residential - Homeowners (After Exemptions)	$56,913	$63,550	$63,550		$63,550
Multifamily Residential - Non-Full Time Residents and Rentals	$320,988	$358,421	$358,421		$358,421
Ohana Units (60% on homeowners properties, 40% on rental properties)	$0	$15,863	$31,725		$31,725
Total Annual Property Taxes (End of Period)	**$1,218,330**	**$2,760,151**	**$3,132,785**		
Total Real Property Taxes During Period	**$3,045,824**	**$9,946,202**	**$14,732,341**	**$27,724,367**	**$3,132,785**
INCLUDES ONLY THOSE TAXES WHICH ARE "NEW" TO MAUI AS RESULT OF THE PROJECT					
2. STATE INCOME TAXES					
Taxable Personal Income	$105,175,200	$198,463,993	$162,260,047	$465,899,240	**$27,096,572**
Taxable Corporate Profits	$37,461,253	$54,748,982	$23,914,355	$116,124,591	**$4,813,619**
Personal Taxes Paid	$5,363,935	$10,121,664	$8,275,262	$23,760,861	**$1,381,925**
Corporate Taxes Paid	$1,648,295	$2,408,955	$1,052,232	$5,109,482	**$211,799**
TOTAL STATE INCOME TAXES	**$7,012,230**	**$12,530,619**	**$9,327,494**	**$28,870,343**	**$1,593,724**
3. STATE GROSS EXCISE TAX					
Taxable Transactions					
Construction Contracts	$260,033,788	$329,018,679	$55,252,085	$644,304,552	
Worker Disposable Income Purchases	$52,587,600	$99,231,997	$81,130,024	$232,949,620	$13,548,286
"New" Maui Spending Project Impact	$7,043,487	$57,909,115	$107,860,422	$172,813,024	$32,090,792
Total Taxable Transactions	**$319,664,875**	**$486,159,791**	**$244,242,530**	**$1,050,067,196**	**$45,639,078**
TOTAL STATE EXCISE TAX	**$13,319,476**	**$20,256,820**	**$10,176,854**	**$43,753,150**	**$1,901,643**

Source: The Hallstrom Group/CBRE

EXHIBIT IV - TABLE 3

PUBLIC COSTS AND CORRELATION ASSESSMENT ASSOCIATED WITH THE WAIKAPU COUNTY TOWN
Market Study of the Proposed Waikapu Country Town
Waikapu, Maui, Hawaii
All Amounts Expressed in Constant 2015 Dollars

Development Period	Development, Sales & Stabilization Period			Totals During Build-Out Period	Stabilized Annually After Build-out
	2016 to 2020	2021 to 2025	2026 to 2030		
	INCLUDES ONLY THOSE REVENUES AND COSTS WHICH ARE "NEW" TO MAUI				
TOTAL GROSS PUBLIC REVENUES					
To County of Maui (Real Property Tax)	$3,045,824	$9,946,202	$14,732,341	$27,724,367	$3,132,785
Adjustment for Other Proportional Taxes (1)	1.55	1.55	1.55	1.55	1.55
Adjusted Maui County Revenues	$4,718,512	$15,408,400	$22,822,962	$42,949,874	$4,853,230
Plus Impact Fees (2)	$5,000,000	$0	$0	$5,000,000	
Total County of Maui Receipts	$9,718,512	$15,408,400	$22,822,962	$47,949,874	$4,853,230
To State (INCOME AND GET)	$20,331,707	$32,787,439	$19,504,348	$72,623,493	$3,495,368
Adjustment for Other Proportional Taxes (3)	1.25	1.25	1.25	1.25	1.25
Adjusted State Revenues	$25,414,633	$40,984,299	$24,380,434	$90,779,366	$4,369,210
Plus Impact Fees (2)	$4,600,028	$0	$0	$4,600,028	
Total State of Hawaii Receipts	$30,014,661	$40,984,299	$24,380,434	$95,379,394	$4,369,210
AGGREGATE TAX REVENUES	$34,733,174	$56,392,698	$47,203,396	$138,329,268	$9,222,440
PUBLIC COSTS (Expenses)					
By County of Maui	$711,956	$1,982,654	$2,821,422	$5,516,032	$620,290
By State of Hawaii	$1,641,105	$4,570,148	$6,503,563	$12,714,816	$1,429,808
TOTAL PUBLIC COSTS	$2,353,061	$6,552,802	$9,324,986	$18,230,849	$2,050,098
TOTAL NET PUBLIC BENEFITS					
To County of Maui	$9,006,556	$13,425,746	$20,001,540	$42,433,842	$4,232,940
To State of Hawaii	$28,373,556	$36,414,151	$17,876,871	$82,664,578	$2,939,401
AGGREGATE NET BENEFITS	$37,380,112	$49,839,896	$37,878,411	$125,098,420	$7,172,342

(1) Real property taxes comprise 64.6 percent of General Fund in the proposed Maui County FY 2016 budget. Economic activity generates other revenue items of 35.4 percent or additional 55 percent above real property taxes.

(2) For parks, water/wastewater service, schools and other items. Additional impact fees may be assessed.

(3) In recent fiscal years, Gross Excise and Income Taxes have averaged about 80 percent of total State revenues; other revenue items 20 percent, or 25 percent above income and gross excise taxes.

Source: The Hallstrom Group/CBRE

Addendum E

QUALIFICATIONS

PROFESSIONAL QUALIFICATIONS OF THOMAS W. HOLLIDAY, CRE, FRICS

Business Affiliation

Senior Appraiser	The Hallstrom Group | CBRE, Inc. Valuation & Advisory Services Honolulu, Hawaii (2015 – Present)
Senior Analyst/ Supervisor	The Hallstrom Group, Inc. Honolulu, Hawaii (1980 – 2014)
Former Staff Appraiser	Davis-Baker Appraisal Co. Avalon, Santa Catalina Island, California

National Designation and Membership

- CRE Designation (2015) - The Counselors of Real Estate
- FRICS Designation (2016)–Royal Institution of Chartered Surveyors

Education

- California State University, Fullerton (Communications/Journalism)
- SREA Course 201- Principles of Income Property Appraising
- Expert witness testimony before State of Hawaii Land Use Commission and various state and county boards and agencies since 1983.
- Numerous professional seminars and clinics.
- Contributing author to Hawaii Real Estate Investor, Honolulu Star Bulletin

On January 1, 1991, the American Institute of Real Estate Appraisers (AIREA) and the Society of Real Estate Appraisers (SREA) consolidated, forming the Appraisal Institute (AI).

Recent Neighbor Island Assignments

- Market Study, Economic Impact Analyses and Public Costs/ Benefits (Fiscal Impact) Assessments

  Maui
  -- Maui Research & Tech Park (Mixed-Use Community)
  -- Maui Lani (Mixed-Use Community)
  -- Honuaula (Mixed-Use Community)
  -- Makena Beach Resort
  -- Maui Business Park, Phase II (Industrial/Commercial)
  -- Kapalua Mauka (Master Planned Community)
  -- Hailiimaile (Mixed-Use Master Planned Community)
  -- Pulelehua (Master Planned Community)
  -- Westin Kaanapali Ocean Villas Expansion (Resort/ Timeshare)
  -- Upcountry Town Center (Mixed-Use Project)

  Big Island
  -- Kamakana Villages (Mixed-Use Residential Development)
  -- W.H. Shipman Ltd, Master Plan (Various Urban Uses)
  -- Nani Kahuku Aina (Mixed-Use Resort Community
  -- Kona Kai Ola (Mixed-Use Resort Community)
  -- Waikoloa Highlands (Residential)
  -- Waikoloa Heights (Mixed-Use Residential Development)

Kauai
-- Hanalei Plantation Resort (Resort/Residential)
-- Kukuiula (Resort/Residential)
-- Waipono/Puhi (Mixed-Use Planned Development)
-- Eleele Commercial Expansion (Commercial)
-- Village at Poipu (Resort/Residential)
-- Ocean Bay Plantation (Resort/Residential)

- Major Neighbor Island Valuation Assignments

  -- Mauna Lani Bay Hotel
  -- Courtyard Kahului Airport Hotel
  -- Maui Oceanfront Days Inn
  -- Holiday Inn Express – Kona Hotel (proposed)
  -- Keauhou Beach Hotel
  -- Courtyard King Kamehameha Kona Beach Hotel
  -- Aloha Beach Resort
  -- Coco Palms Resort
  -- Grand Hyatt Kauai
  -- Islander on the Beach
  -- Waimea Plantation Cottages
  -- Coconut Beach Resort
  -- Sheraton Maui Hotel
  -- Outrigger Wailea Resort Hotel
  -- Maui Lu Hotel
  -- Coconut Grove Condominiums
  -- Palauea Bay Holdings
  -- Wailea Ranch
  -- Maui Coast Hotel
  -- Westin Maui Hotel
  -- Maui Marriott Hotel
  -- Waihee Beach
  -- Kapalua Bay Hotel and The Shops at Kapalua

Email Address TWH@HallstromGroup.com | Tom.Holliday@cbre.com

APPENDIX B

BOTANICAL AND FAUNAL SURVEYS

BIOLOGICAL RESOURCES SURVEY

for the

WAIKAPU COUNTRY TOWN PROJECT

WAIKAPU, WAILUKU DISTRICT, MAUI

by

Robert W. Hobdy
Environmental Consultant
Kokomo, Maui
February 2013

Prepared for: Waikapu Properties LLC

BIOLOGICAL RESOURCES SURVEY
WAIKAPU COUNTRY TOWN PROJECT
Waikapū, Maui, Hawaii

INTRODUCTION

The Waikapū Country Town Project lies on approximately 520 acres of land on the southeast slopes of the West Maui mountains just south of Waikapū Stream and the village of Waikapū (see Figure 1). The project area straddles the Honoapi′ilani Highway and includes the Maui Tropical Plantation facilities and surrounding agriculture and pasture lands, TMKs (2) 3-6-02:003 por., (2) 3-6-04:003 and 006 por. and (2) 3-6-05:007.

SITE DESCRIPTION

The project area includes about 70 acres that comprise the facilities of the Maui Tropical Plantation. This is surrounded by 50 acres of vegetable farm. On the slopes above this are 150 acres of cattle pasture, and below the highway are 240 acres in sugar cane production. Elevations range from 250 feet at the lower end up to 800 feet at the top of the pastures. Soils are all deep, well-drained alluvial soils which are classified in the Wailuku Silty Clay, Iao Clay and Pulehu Cobbly Clay Loam soil series (Foote et al, 1972). The vegetation consists of a great variety of ornamental plant species on the grounds of the Maui Tropical Plantation, a diversity of vegetable crop plants, pasture grasses and dense fields of sugar cane. Annual rainfall ranges from 25 inches in the lower end up to 30 inches at the top (Armstrong, 1983).

SURVEY OBJECTIVES

This report summarizes the findings of a flora and fauna survey of the proposed Waikapū Country Town Project which was conducted during February 2013. The objectives of the survey were to:

1. Document what plant and animal species occur on the property or may likely occur in the existing habitat.

2. Document the status and abundance of each species.

3. Determine the presence or likely occurrence of any native flora and fauna, particularly any that are Federally listed as Threatened or Endangered. If such occur, identify what features of the habitat may be essential for these species.

4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora and fauna in this part of the island.

BOTANICAL SURVEY REPORT

SURVEY METHODS

A walk-through botanical survey method was used to cover all of the diverse habitats represented across the entire project area. The riparian strip along Waikapū Stream was examined more intensively because of its special habitat. Specifically excluded from this survey were the ornamental plants in the Maui Tropical Plantation landscape and the numerous crop plants in the farm area.

DESCRIPTION OF THE VEGETATION

The vegetation, excluding the purely ornamental plants and vegetable crop species, was still quite diverse. A total of 130 plant species were recorded during the survey. Seven species were found to be common within the project area: buffelgrass (*Cenchrus ciliaris*), Guinea grass (*Megathyrsus maximus*), sugar cane (*Saccharum officinarum*), smooth rattlepod (*Crotalaria pallida*), cheeseweed (*Malva parviflora*), ʻuhaloa (*Waltheria indica*) and Java plum (*Syzygium cumini*). These species are found naturally in Hawaii as well as throughout the tropics nearly worldwide and are common.

Just 3 native species were found on the 520 acre project area: ʻuhaloa, koali awahia (*Ipomoea indica*) and popolo (*Solanum americanum*). These species are found naturally in Hawaii as well as throughout the tropics nearly worldwide and are common.

Four plant species found during the survey were introduced over a thousand years ago by Polynesian voyagers: kukui (*Aleurites moluccana*), niu (*Cocos nucifera*), hau (*Talipariti tileaceum*) and ʻihiʻai (*Oxalis corniculata*).

The remaining 123 species were non-native plants including some useful forage grasses, but many are considered to be agricultural or roadside weeds.

The largest portions of this project area are agricultural fields in sugar cane production or are cattle pastures. The narrow Waikapū Stream corridor is another distinctive forested habitat type. The remainder of the project includes the highly manipulated ornamental landscapes of the Maui Tropical Plantation grounds and the ever-changing farm fields, the plant species of which were not deemed important to the purposes of this study and were not included in the plant inventory.

DISCUSSION AND RECOMMENDATION

The vegetation along the project corridor is dominated by non-native species. Only three common indigenous species were found. No federally listed Endangered or Threatened plant species (USFWS, 2012) were found, nor do any plants proposed as candidates for such status occur on the property.

Waikapū Stream is a sensitive environment that needs to be carefully managed, although it is not a special plant habitat in that it has no Endangered or Threatened plants living in or around it. The stream is diverted for agricultural irrigation that contributes to it being periodically dry. Were it not diverted it would almost certainly be a perennial running stream with increased possibilities of harboring native species. As it is now no native plants were found within this riparian channel.

No wetlands occur on the site. Streams are technically not wetlands by federal definition. The remainder of the project area consists of dry upland habitat.

As a result of the above findings it is determined that there is little of botanical concern and that the proposed project is not expected to have a significant negative impact on the botanical resources in this part of Maui. No recommendations with regard to plants are deemed appropriate or necessary.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within each of four groups: Ferns, Conifers, Monocots and Dicots. Taxonomy and nomenclature are in accordance with Wagner et al. (1999).

For each species, the following information is provided:

1. Scientific name with author citation.

2. Common English or Hawaiian name.

3. Bio-geographical status. The following symbols are used:

   endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.

   indigenous = native to the Hawaiian Islands and also to one or more other geographical area(s).

   Polynesian = all those plants brought to Hawaii during the course of Polynesian migrations.

   non-native = all those plants brought to the islands intentionally or accidentally after western contact.

4. Abundance of each species within the project area:

   abundant = forming a major part of the vegetation within the project area.

   common = widely scattered throughout the area or locally abundant within a portion of it.

   uncommon = scattered sparsely throughout the area or occurring in a few small patches.

   rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
FERNS			
NEPHROLEPIDACEAE (Sword Fern Family)			
Nephrolepis brownii (Desv.) Hovencamp & Miyamoto	Asian sword fern	non-native	rare
THELYPTERIDACEAE (Marsh Fern Family)			
Christella parasitica (L.) H. Lev.	----------	non-native	rare
CONIFERS			
ARAUCARIACEAE (Araucaria Family)			
Araucaria columnaris (Forst.) J.D. Hooker	Cook pine	non-native	rare
MONOCOTS			
ALOEACEAE (Aloe Family)			
Aloe vera (L.) N.L. Burm	aloe	non-native	rare
ARECACEAE (Palm Family)			
Cocos nucifera L.	coconut	Polynesian	rare
Dypsis lutescens (Wendl.) Beentjie & Dransfield	golden-fruited palm	non-native	rare
ASPARAGACEAE (Asparagus Family)			
Furcraea foetida (L.) Haw.	Mauritius hemp	non-native	rare
Asparagus plumosus J.G. Baker	climbing asparagus fern	non-native	rare
COMMELINACEAE (Dayflower Family)			
Commelina diffusa N.L. Burm.	honohono	non-native	rare
CYPERACEAE (Sedge Family)			
Cyperus involucratus Rottb.	umbrella sedge	non-native	rare
Cyperus rotundus L.	nutsedge	non-native	uncommon
Eleocharis radicans (Poir.) Kunth	pīpīwai	non-native	rare
Kyllinga brevifolia Rottb.	kilio'opu	non-native	rare
POACEAE (Grass Family)			
Bothriochloa pertusa (L.) A. Camus	pitted beardgrass	non-native	rare
Cenchrus ciliaris L.	buffelgrass	non-native	common
Cenchrus echinatus L.	common sandbur	non-native	rare
Cenchrus purpureus (Schumach.) Morrone	Napier grass	non-native	rare
Chloris barbata (L.) Sw.	swollen fingergrass	non-native	uncommon
Coix lacryma-jobi L.	Job's tears	non-native	rare
Cynodon dactylon (L.) Pers.	Bermuda grass	non-native	rare
Digitaria insularis (L.) Mez ex Ekman	sourgrass	non-native	rare
Digitaria violascens Link	kukae pua'a	non-native	rare
Eleusine indica (L.) Gaertn.	wiregrass	non-native	rare
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	non-native	rare
Megathyrsus maximus (Jacq.) Simon & Jacobs	Guinea grass	non-native	common
Melinis repens (Willd.) Zizka	Natal redtop	non-native	uncommon
Paspalum conjugatum Bergius	Hilo grass	non-native	uncommon
Saccharum officinarum L.	sugar cane	non-native	common
Setaria verticillata (L.) P. Beauv.	bristly foxtail	non-native	rare
Sorghum halapense (L.) Pers.	Johnson grass	non-native	uncommon
Urochloa subquadripara (Trin.) R.D. Webster	----------	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
DICOTS			
ACANTHACEAE (Acanthus Family)			
Asystasia gangetica (L.) T.Anderson	Chinese violet	non-native	rare
Justicia betonica L.	white shrimp plant	non-native	uncommon
Thunbergia fragrans Roxb.	sweet clock-vine	non-native	rare
AMARANTHACEAE (Amaranth Family)			
Alternanthera pungens Kunth	khaki weed	non-native	rare
Amaranthus spinosus L.	spiny amaranth	non-native	uncommon
Atriplex suberecta Verd.	saltbush	non-native	rare
Chenopodium carinatum R. Br.	keeled goosefoot	non-native	rare
Chenopodium murale L.	'āheahea	non-native	rare
ANACARDIACEAE (Mango Family)			
Mangifera indica L.	mango	non-native	uncommon
Schinus terebinthifolius Raddi	Christmas berry	non-native	rare
APIACEAE (Parsley Family)			
Centella asiatica (L.) Urb.	Asiatic pennywort	non-native	rare
Ciclospermum leptophyllum (Pers.) Sprague	fir-leaved celery	non-native	rare
APOYCYNACEAE (Dogbane Family)			
Asclepias physocarpa (E. Mey.) Schlect.	baloon plant	non-native	rare
Calotropis procera (Aiton) Aiton	small crown flower	non-native	rare
ARALIACEAE (Panax Family)			
Schefflera actinophylla (Endl.) Harms	octopus tree	non-native	rare
ASTERACEAE (Sunflower Family)			
Bidens pilosa L.	Spanish needle	non-native	uncommon
Calyptocarpus vialis Less.	----------	non-native	rare
Conyza bonariensis (L.) Cronq.	hairy horseweed	non-native	uncommon
Crassocephalum crepidioides (Benth.) S. Moore	redflower ragleaf	non-native	rare
Emilia fosbergii Nicolson	red pualele	non-native	uncommon
Emilia sonchifolia (L.) DC.	violet pualele	non-native	rare
Flaveria trinervia (Spreng.) C. Mohr	clustered yellowtops	non-native	rare
Lactuca sativa L.	prickly lettuce	non-native	rare
Pluchea carolinensis (Jacq.) G. Don	sourbush	non-native	uncommon
Senecio madagascariensis Poir.	fireweed	non-native	rare
Sonchus oleraceus L.	pualele	non-native	uncommon
Synedrella nodiflora (L.) Gaertn.	nodeweed	non-native	rare
Tridax procumbens L.	coat buttons	non-native	uncommon
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	non-native	uncommon
Xanthium strumarium L.	kīkānia	non-native	rare
BASELLACEAE (Basella Family)			
Anredera cordifolia (Ten.) Steenis	Madeira vine	non-native	rare
BIGNONIACEAE (Bignonia Family)			
Spathodea campanulata P. Beauv.	African tulip tree	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
BORAGINACEAE (Borage Family)			
Carmona retusa (Vahl) Masam.	Fukien tea	non-native	rare
Heliotropium aplexicaule Vahl	summer heliotrope	non-native	rare
Heliotropium procumbens Mill.	fourspike heliotrope	non-native	rare
BRASSICACEAE (Mustard Family)			
Lepidium virginicum L.	pepperwort	non-native	rare
CACTACEAE (Cactus Family)			
Hylocereus undatus (Haw.) Britton & Rose	night-blooming cereus	non-native	rare
CASUARINACEAE (She-oak Family)			
Casuarina equisetifolia L.	common ironwood	non-native	uncommon
CLEOMACEAE (Cleome Family)			
Cleome gynandra L.	wild spider flower	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
Ipomoea indica (J. Burm.) Merr.	koali 'awahia	indigenous	rare
Ipomoea triloba L.	little bell	non-native	uncommon
Merremia aegyptia (L.) Urb.	hairy merremia	non-native	rare
CUCURBITACEAE (Gourd Family)			
Momordica charantia L.	bitter melon	non-native	uncommon
EUPHORBIACEAE (Spurge Family)			
Aleurites moluccana (L.) Willd.	kukui	Polynesian	rare
Euphorbia heterophylla L.	kaliko	non-native	rare
Euphorbia hirta L.	hairy spurge	non-native	rare
Euphorbia hypericifolia L.	graceful spurge	non-native	rare
Euphorbia prostrata Aiton	prostrate spurge	non-native	rare
Macaranga tanarius (L.) Mull. Arg.	parasol leaf tree	non-native	uncommon
Ricinus communis L.	Castor bean	non-native	uncommon
FABACEAE (Pea Family)			
Alysicarpus vaginalis (L.) DC.	alyce clover	non-native	rare
Canavalia cathartica Thouars	maunaloa	non-native	rare
Chamaecrista nictitans (L.) Moench	partridge pea	non-native	uncommon
Crotalaria incana L.	fuzzy rattlepod	non-native	uncommon
Crotalaria pallida Aiton	smooth rattlepod	non-native	common
Crotalaria retusa L.	rattlepod	non-native	rare
Desmanthus pernambucanus (L.) Thellung	slender mimosa	non-native	uncommon
Desmodium tortuosum (Sw.) DC.	Florida beggarweed	non-native	rare
Enterolobium cyclocarpum (Jacq.) Griesbach	elephant earpod	non-native	rare
Indigofera hendecaphylla Jacq.	creeping indigo	non-native	uncommon
Indigofera suffruticosa Mill.	inikō	non-native	uncommon
Leucaena leucocephala (Lam.) de Wit	koa haole	non-native	uncommon
Macroptilium atropurpureum (DC.) Urb.	siratro	non-native	uncommon
Mimosa pudica L.	hilahila	non-native	rare
Neonotonia wightii (Wight & Arnott) Lackey	glycine	non-native	uncommon
Pithecellobium dulce (Roxb.) Benth.	'ōpiuma	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	non-native	rare
Samanea saman (Jacq.) Merr.	monkeypod	non-native	rare
Tamarindus indica L.	tamarind	non-native	rare
LAMIACEAE (Mint Family)			
Hyptis pectinanta (L.) Poit.	comb hyptis	non-native	rare
Leonotis nepetifolia (L.) R. Br.	lion's ear	non-native	uncommon
MALVACEAE (Mallow Family)			
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	non-native	uncommon
Malva parviflora L.	cheeseweed	non-native	common
Malvastrum coromandelianum (L.) Garcke	false mallow	non-native	uncommon
Sida rhombifolia L.	Cuban jute	non-native	uncommon
Talipariti tileaceum Fryxell	hau	Polynesian	rare
Waltheria indica L.	'uhaloa	indigenous	common
MELIACEAE (Mahogany Family)			
Melia azedarach L.	pride-of-India	non-native	rare
MORACEAE (Mulberry Family)			
Ficus microcarpa L. fil.	Chinese banyan	non-native	rare
MYRTACEAE (Myrtle Family)		non-native	
Corymbia citriodora (Hook.) Hill & Johnson	lemon gum	non-native	rare
Eucalyptus robusta Sm.	swamp mahogany	non-native	uncommon
Psidium cattleianum Sabine	strawberry guava	non-native	uncommon
Psidium guajava L.	common guava	non-native	rare
Syzygium cumini (L.) Skeels	Java plum	non-native	common
NYCATAGINACEAE (Four-o'clock Family)			
Boerhavia coccinia Mill.	scarlet spiderling	non-native	uncommon
Mirabilis jalapa L.	four-o'clock	non-native	rare
ONAGRACEAE (Evening Primrose Family)			
Ludwigia octovalvis (Jacq.) Raven	primrose willow	non-native	rare
OXALIDACEAE (Wood Sorrel Family)			
Oxalis corniculata L.	'ihi'ai	Polynesian	uncommon
PAPAVERACEAE (Poppy Family)			
Argemone mexicana L.	Mexican poppy	non-native	rare
PORTULACACEAE (Purslane Family)			
Portulaca oleracea L.	pigweed	non-native	rare
SOLANACEAE (Nighshade Family)			
Datura stramonium L.	jimson weed	non-native	rare
Nicandra physalodes (L.) Gaertn.	apple-of-Peru	non-native	uncommon
Nicotiana glauca R.C. Graham	tree tobacco	non-native	rare
Solanum americanum Mill.	pōpolo	indigenous	rare
Solanum lycopersicum L.	cherry tomato	non-native	rare
Solanum seaforthianum Andr.	Brazilian nightshade	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
VERBENACEAE (Verbena Family)			
Lantana camara L.	lantana	non-native	rare
Stachytarpheta cayennensis (Rich.) Vahl	nettle-leaved vervain	non-native	rare
ZYGOPHYLLACEAE (Creosote Bush Family)			
Tribulus terrestris L.	puncture vine	non-native	rare

FAUNA SURVEY REPORT

SURVEY METHODS

A walk-through survey method was conducted in conjunction with the botanical survey. All parts of the project area were covered. Field observations were made with the aid of binoculars and by listening to vocalizations. Notes were made on species abundance, activities and location as well as observations of trails, tracks scat and signs of feeding. In addition an evening visit was made to the area to record crepuscular activities and vocalizations and to see if there was any evidence of occurrence of the Hawaiian hoary bat (*Lasiurus cinereus semotus*) in the area.

RESULTS

MAMMALS

Four species of non-native mammals were observed during four site visits to the project area. These included: cattle (*Bos Taurus*), small Indian mongoose (*Herpestes javanicus auropunctata*), domestic cat (*Felis sylvestris catus*) and domestic dog (*Canis lupus familiaris*). Taxonomy and nomenclature follow Tomich (1986).

Other non-native mammals one might expect to utilize this area include: rats (*Rattus* spp.), mice (*Mus domesticus*) and axis deer (*Axis axis*). Rats and mice feed on seeds, fruits, eggs and succulent vegetation and are in turn preyed upon by cats and mongoose. Axis deer are expanding their range into this area and small herds are occasionally seen during the evenings.

A special effort was made to look for the native Hawaiian hoary bat by making an evening survey to four sites in the project area: one near the top of the project, one in the middle and two along the Waikapū Stream corridor. When present in an area these bats can be easily identified as they forage for insects, their distinctive flight patterns clearly visible in the glow of twilight. No evidence of such activity was observed though visibility was excellent. In addition a bat detecting device (Bat Box IIID) was used, set to the frequency of 27,000 to 28,000 hertz which is the typical range within which these bats are known to use for echolocation. No activity was detected using this device.

BIRDS

There was a good diversity of birdlife present on this large project area. Twenty one species were observed during four site visits. This included 20 non-native birds and one migratory bird, the Pacific golden-plover (*Pluvialis fulva*). Four species were common throughout the project area: zebra dove (*Geopelia striata*), common myna (*Acridotheres tristis*), spotted dove (*Streptopelia chinensis*) and chestnut mannikin (*Lonchura malacca*). The remaining 17 species were uncommon or rare of occurrence. Taxonomy and nomenclature follow American Ornithologists' Union (2011).

A few other bird species might be expected in this area and at different times of year. These include the northern mockingbird (*Mimus polyglottos*), the orange-cheeked waxbill (*Estrilda melpoda*) and the barn owl (*Tyto alba*). The indigenous black-crowned night-heron (*Nycticorax nycticorax hoactli*) can occasionally be seen along the stream fishing and roosting in trees when the stream is running. The habitat is also unsuitable for Hawaii's native forest birds that are presently restricted to good quality native forests at higher elevations beyond the range of mosquitoes and the avian diseases they carry and transmit.

INSECTS

Insect life was moderate in numbers of species as well as in total numbers of individuals. Sixteen insect species were recorded during the survey representing six Orders. Taxonomy and nomenclature follow Nishida et al (1992). Most common were: the dung fly (*Musca sorbens*), the Sonoran carpenter bee (*Xylocopa sonorina*), the long-tailed blue butterfly (*Lampides boeticus*) and the globe skimmer dragonfly *(Pantala flavescens*). Native species recorded included: the indigenous globe skimmer dragonfly, the indigenous green darner dragonfly (*Anax junius*) and the endemic and Endangered Blackburn's sphinx moth (*Manduca blackburni*) of which two eggs were seen on leaves of its preferred host plant, the tree tobacco (*Nicotiana glauca*).

AMPHIBIANS

One amphibian, the green frog (*Rana clamitans*), was observed in the pond at the Maui Tropical Plantation.

REPTILES

Two gecko species, the house gecko (*Hemidactylus frenatus*) and the mourning gecko (*Lepidodactylus lugubris*) were observed during the evening survey.

MOLLUSKS

One mollusk, the giant East African snail (*Achatina fulica*) was seen in various parts of the project area.

CONCLUSIONS AND RECOMMENDATIONS

The project area encompasses a variety of highly altered areas which have been the focus of large scale agriculture for over 100 years. Only the narrow Waikapū Stream channel shows some resemblance of its original character.

All of the mammals recorded are common non-native species of no particular concern. None of the Endangered native bats were detected during the survey. However, theses bats do occur in many parts of Maui and are known to be highly mobile both on a daily (nightly) basis and seasonally. They have been observed from sea level to high elevations. Their movements appear to coincide with surges in insect activities and are thus likely to be tied to food availability for the bats.

Birdlife here, as well, is dominated by widespread introduced species that merit no special environmental protections. The habitat is unsuitable for Hawaii's native forest birds that are presently restricted to native habitats at higher elevations, beyond the range of mosquitoes that are carriers of lethal avian diseases for which these native birds have almost no resistance.

One indigenous waterbird, the auku′u or black-crowned night-heron, while not seen during the survey, often can be found in Waikapū Stream's forested channel when the water is running. They feed on mollusks, crustaceans and small fish. These birds are relatively common throughout Hawaii as well as in the Western USA and Mexico and carry no special protected federal status under the Endangered Species Act.

While no protected seabirds were found on the property, the 'ua'u and 'a'o are known to overfly the area at dawn and dusk to their burrows high in the mountains between the months of March and November. In late fall young birds fledge from their burrows to take their first tentative flights out to sea. These inexperienced birds are easily confused and distracted by bright lights and often crash to the ground where they are particularly vulnerable to being run over by vehicles or killed by predators. It is recommended that any significant outdoor lighting such as street lights or flood lights that are incorporated into the project design be shielded to direct the light downward so that it is not visible from above.

Three native insects were recorded during the survey. The indigenous dragonflies, the globe skimmer and the green darner are both widespread and common both in Hawaii and elsewhere, and are of no particular conservation concern. The Blackburn's sphinx moth, however, is an Endangered species and is of special concern. Just two individuals of its preferred host plants, the tree tobacco, were found on the northern end of the sugar cane fields at the base of a stockpiled sand pile. These two plants were carefully examined for eggs, larvae or signs of feeding. One plant was found to have two mature eggs on separate leaves. The eggs had turned brown, indicating they were ready to hatch out young larvae. Tree tobacco plants are not native to Hawaii, but fall under the protection of the Endangered Species Act (1973) during the period of their association with the Endangered Blackburn's sphinx moth. It is recommended that this occurrence be reported to the U.S. Fish and Wildlife Service so that the required protections and management actions can be clarified.

The occurrences of the non-native amphibians, reptiles and mollusks are of no particular interest or concern.

ANIMAL SPECIES LIST

Following is a checklist of the animal species inventoried during the field work. Animal species are arranged in descending abundance within six groups: Mammals, Birds, Insects, Amphibians, Reptiles and Mollusks. For each species the following information is provided:

1. Common name

2. Scientific name

3. Bio-geographical status. The following symbols are used:

   endemic = native only to Hawaii; not naturally occurring anywhere else in the world.

   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).

   non-native = all those animals brought to Hawaii intentionally or accidentally after western contact.

   migratory = spending a portion of the year in Hawaii and a portion elsewhere. In Hawaii the migratory birds are usually in the over wintering/non-breeding phase of their life cycle.

4. Abundance of each species within the project area:

   abundant = many flocks or individuals seen throughout the area at all times of day.

   common = a few flocks or well scattered individuals throughout the area.

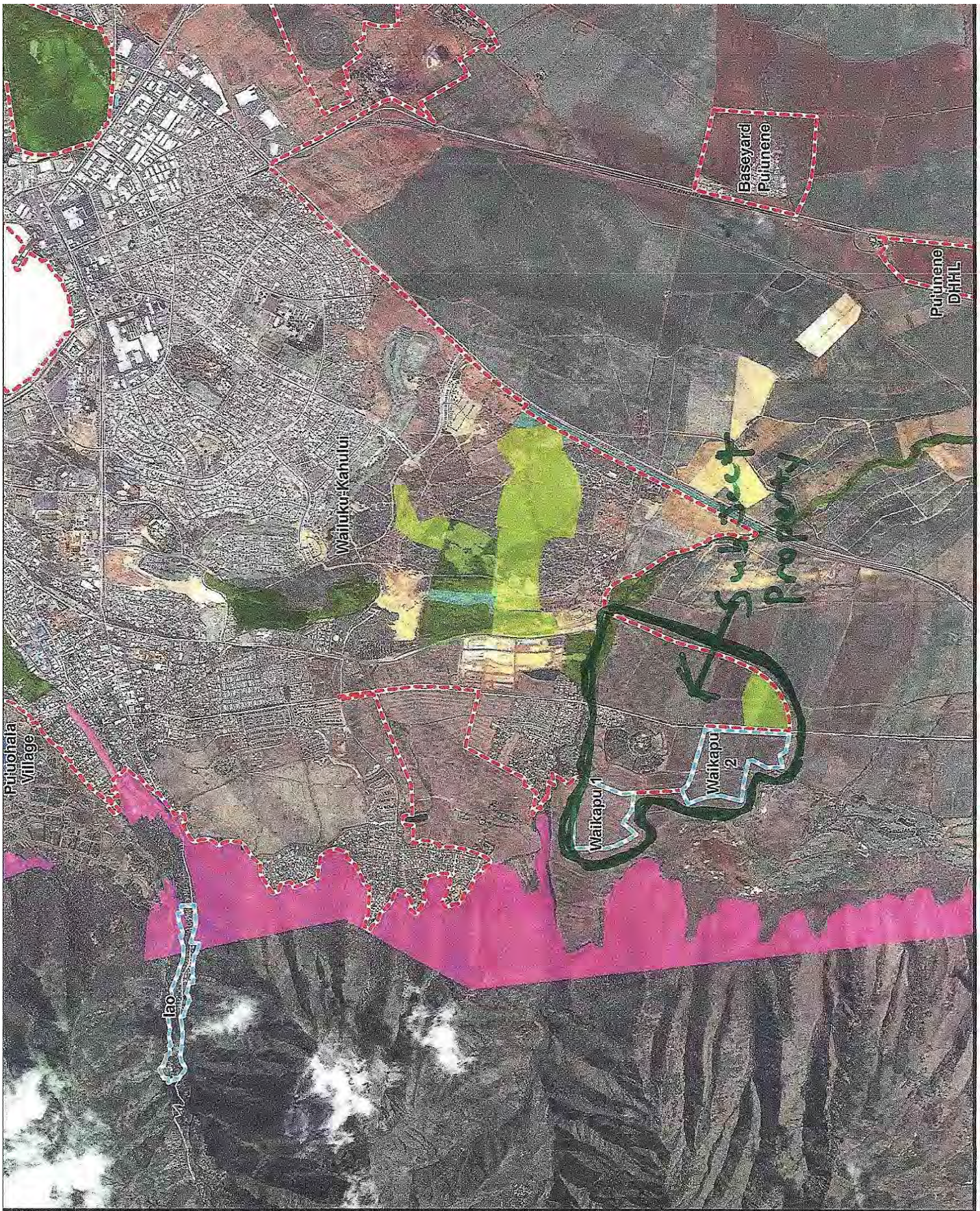
   uncommon = only one flock or several individuals seen within the project area.

   rare = only one or two seen within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
MAMMALS			
Bos taurus L.	cattle	non-native	common
Herpestes javanicus auropunctatus Hodgson	small Asian mongoose	non-native	uncommon
Felis sylvestris catus L.	domestic cat	non-native	rare
Canis lupus familiaris L.	domestic dog	non-native	rare
BIRDS			
Geopelia striata L.	zebra dove	non-native	common
Acridotheres tristis L.	common myna	non-native	common
Streptopelia chinensis Scopoli	spotted dove	non-native	common
Lonchura malacca L.	chestnut mannikin	non-native	common
Padda oryzivora L.	Java sparrow	non-native	uncommon
Passer domesticus L.	house sparrow	non-native	uncommon
Francolinus pondicerianus Gmelin	gray francolin	non-native	uncommon
Carpodacus mexicanus Muller	house finch	non-native	uncommon
Cardinalis cardinalis L.	northern cardinal	non-native	uncommon
Aratinga mitrata Tschudi	mitred conure	non-native	uncommon
Gallus gallus L.	chicken	non-native	uncommon
Lonchura punctulata L.	nutmeg mannikin	non-native	rare
Bubulcus ibis L.	cattle egret	non-native	rare
Columba livia Gmelin	rock pigeon	non-native	rare
Francolinus francolinus L.	black francolin	non-native	rare
Zosterops japonicus Temminck & Schlegel	Japanese white-eye	non-native	rare
Phasianus colchicus L.	Chinese ring-necked pheasant	non-native	rare
Lonchura cantans Gmelin	African silverbill	non-native	rare
Paroaria coronata Miller	red-crested cardinal	non-native	rare
Pluvialis fulva Gmelin	Pacific golden-plover	migratory	rare
Zenaida macroura L.	mourning dove	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
INSECTS			
Order ARANAE - true spiders			
ARANEIDAE (Orb Weaver Spider Family)			
Gasteracantha mammosa Koch	Asian spiny-backed spider	non-native	rare
Order DIPTERA - flies			
CALLIPHORIDAE (Blow Fly Family)			
Rhinia testacea Robineau - Desvoidy	----------	non-native	rare
MUSCIDAE (House Fly Family)			
Musca domestica L.	house fly	non-native	rare
Musca sorbens Wiedemann	dung fly	non-native	common
SYRPHIDAE (Hoverfly Family)			
Simosyrphus grandicornis Macquart	Australian hoverfly	non-native	rare
Order HETEROPTERA - true bugs			
APHIDIDAE (Aphid Fmaily)			
Aphis craccivora Koch	cow pea aphid	non-native	rare
Order HYMENOPTERA - bees, wasps & ants			
APIDAE (Honey Bee Family)			
Apis mellifera L.	honey bee	non-native	uncommon
Xylocopa sonorina Smith	Sonoran carpenter bee	non-native	common
FORMICIDAE (Ant Family)			
Pheidole megacephala Fabricius	big-headed ant	non-native	uncommon
Order LEPIDOPTERA - butterflies & moths			
LYCAENIDAE (Gossamer-winged Butterfly Family)			
Lampides boeticus L.	long-tail blue butterfly	non-native	common
PAPILIONIDAE (Swallowtail Butterfly Family)			
Papilio xutha L.	Asian swallowtail	non-native	rare
PIERIDAE (White & Sulphur Butterfly Family)			
Phoebis agarithe Boisduval	large orange sulphur butterfly	non-native	rare
Pieris rapae L.	cabbage butterfly	non-native	uncommon
SPHINGIDAE (Sphinx Moth Family)			
Manduca blackburni Butler	Blackburn's sphinx moth	endemic	rare
Order Odonata - dragonflies & damselflies			
AESHNIDAE (Hawker Dragonfly Family)			
Anax junius Drury	green darner	indigenous	uncommon
LIBELLULIDAE (Skipper Dragonfly Family)			
Pantala flavescens Fabricius	globe skimmer	indigenous	common

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
AMPHIBIANS			
Rana clamitans Latreille	green frog	non-native	rare
REPTILES			
Hemidactylus frenatus Schlegel	house gecko	non-native	rare
Lepidodactylus lugubris Dumeril & Bibron	mourning gecko	non-native	rare
MOLLUSKS			
Achatina fulica Ferussac	giant east African snail	non-native	uncommon



Planning Department Directed Growth Map - 17 November 2010 C3 Long Range Planning Division - Deptartment of Planning - County of Maui

Figure 2 – Entrance to the Maui Tropical Plantation facilities

Figure 3 – An open field alongside the Maui Tropical Plantation

Figure 4 Entrance to the commercial farm


Figure 5 Rows of vegetables in the commercial farm.

Figure 6 – View of the pasture lands in the upper part of the project area.

Figure 7 A portion of fenced pasture land with grazing cattle.

Figure 8 Sugar cane fields in the lower portion of the project area.

Figure 9 A lateral view of the narrow, forested Waikapū stream where it passes through agricultural lands.

Figure 10 Densely forested rocky river bed of Waikapū stream.

Figure 11 A densely grassy section of Waikapu stream with running water following a rain event.

Figure 12 A tree tobacco plant (*Nicotiana glauca*), the preferred host plant for the Blackburn's sphinx moth (*Manduca blackburni*), an Endangered species.

Figure 13 A close up of a tree tobacco leaf with a mature egg of an Endangered Blackburn's sphinx moth.

Literature Cited

American Ornithologists' Union 2011. Check-list of North American Birds. 7th edition. American Ornithologists' Union. Washington D.C.

Armstrong, R. W. (ed.) 1983. Atlas of Hawaii. (2nd. ed.) University of Hawaii Press.

Foote, D.E. , E.L. Hill, S. Nakamura, and F. Stephens. 1972. Soil survey of the islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii. U.S. Dept. of Agriculture, Soil Conservation Service. Washington, D.C.

Nishida, G.M., G.A. Samuelson, J.S. Strazanac, K.S. Kami. 1992. Hawaiian Terestrial Arthropod Checklist. Hawaii Biological Survey. Honolulu.

Tomich, P.Q. 1986. Mammals in Hawaii. Bishop Museum Press, Honolulu.

U.S. Fish and Wildlife Service. 2012. Endangered and threatened wildlife and Plants. Listings and Occurrences for Hawaii. www.fws.gov/endangered

U.S. Fish and Wildlife Service. 2000. Endangered and threatened wildlife and plants: determination of endangered status for Blackburn's sphinx moth from Hawaii. Federal Register 65(21): 4770-4779.

Wagner, W. L., D.R. Herbst, and S. H. Sohmer. 1999. Manual of the flowering plants of Hawai'i. University of Hawai'i Press and Bishop Museum Press. Honolulu.

APPENDIX C

Air Quality Study

AIR QUALITY STUDY

FOR THE PROPOSED

WAIKAPU COUNTRY TOWN PROJECT

WAIKAPU, MAUI, HAWAII

Prepared for:

Waikapu Partners, LLC

December 2016

B.D. NEAL & ASSOCIATES

Applied Meteorology • Air Quality • Computer Science

P.O. BOX 1808 • KAILUA-KONA, HAWAII 96745 • TELPHONE (808) 329-1627 • FAX (808) 325-6739
EMAIL: bdneal@bdneal.com

CONTENTS

Section		Page
1.0	Summary	1
2.0	Introduction	4
3.0	Ambient Air Quality Standards	5
4.0	Regional and Local Climatology	6
5.0	Present Air Quality	9
6.0	Short-Term Impacts of Project	12
7.0	Long-Term Impacts of Project	14
	7.1 Roadway Traffic	14
	7.2 Wastewater Treatment Facility	22
8.0	Conclusions and Recommendations	23
References		26

FIGURES

Figure	
1	Project Location Map

TABLES

Table	
1	Summary of State of Hawaii and National Ambient Air Quality Standards
2	Air Pollution Emissions Inventory for Island of Maui, 1993
3	Annual Summaries of Ambient Air Quality Measurements for Monitoring Stations Nearest Waikapu Country Town Project
4	Estimated Worst-Case 1-Hour Carbon Monoxide Concentrations Along Roadways Near Waikapu Country Town Project
5	Estimated Worst-Case 8-Hour Carbon Monoxide Concentrations Along Roadways Near Waikapu Country Town Project

1.0 SUMMARY

Waikapu Partners, LLC is proposing the Waikapu Country Town Project in Waikapu on the island of Maui. The proposed 1,562-acre project will consist of approximately 170,000 square feet of commercial space, 1579 residential units, a private wastewater treatment facility, an elementary school and 33 acres of park/open space. The project is planned to be built in two phases beginning in 2017 with completion during 2026. This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed facilities and suggests mitigative measures to reduce any potential air quality impacts where possible and appropriate.

Both federal and state standards have been established to maintain ambient air quality. At the present time, seven parameters are regulated including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. Hawaii air quality standards are comparable to the national standards except those for nitrogen dioxide and carbon monoxide which are more stringent than the national standards.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the project area is very much affected by its elevation near sea level and by nearby mountains. The predominant trade winds tend to be channeled through the area by the mountains to the east and west. Temperatures in the project area are generally very consistent and warm with average daily temperatures ranging from about 68°F to 81°F. Rainfall in the

project area is only moderate with an average of about 26 inches per year.

Except for periodic impacts from volcanic emissions (vog) and possibly occasional localized impacts from traffic congestion and local agricultural sources, the present air quality of the project area is believed to be relatively good. There is very little air quality monitoring data from the Department of Health for the project area, but the limited data that are available suggest that concentrations are generally within state and national air quality standards.

If the proposed project is given the necessary approvals to proceed, there may be some short- and/or long-term impacts on air quality that may occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust could occur during the project construction phases. To a lesser extent, exhaust emissions from stationary and mobile construction equipment, from the minor disruption of traffic, and from workers' vehicles may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the property line. Hence, an effective dust control plan must be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures to consider include limiting the area that is disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule

will also reduce dust emissions. Exhaust emissions can be mitigated by moving construction equipment and workers to and from the project site during off-peak traffic hours.

To assess the potential long-term impact of emissions from project-related motor vehicle traffic operating on roadways in the project area after construction is completed, a computerized air quality modeling study was undertaken. The air quality modeling study estimated current worst-case concentrations of carbon monoxide at intersections in the project vicinity and predicted future levels both with and without the proposed project. During worst-case conditions, model results indicated that present 1-hour and 8-hour worst-case carbon monoxide concentrations are well within both the state and the national ambient air quality standards. In the year 2026 without the project, worst-case carbon monoxide concentrations were predicted to decrease (improve) despite an increase in traffic, and concentrations would remain well within standards. This is because emissions from the increase in traffic will be more than offset by the retirement of older, more-polluting vehicles over time. With the project in the year 2026 and with proposed roadway improvements, estimated worst-case carbon monoxide concentrations indicated only minimal or no impact compared to the without project case. Concentrations would remain well within standards. Due to the negligible impact the project is expected to have, implementing mitigation measures for long-term traffic-related air quality impacts is unnecessary and unwarranted.

The project wastewater treatment facility will be designed and operated to keep any emissions of odorous gases at the facility

boundary below the odor threshold. Thus, offsite odor nuisance is not expected to be an issue.

2.0 INTRODUCTION

Waikapu Partners, LLC is proposing the Waikapu Country Town Project in Waikapu on the island of Maui (see Figure 1 for project location). The project site is located along Honoapiilani Highway in the Waikapu community in central Maui. The project will be developed in two phases, with the first phase scheduled to begin in 2017 and be completed in 2021 and the second phase to begin in 2022 and be done in 2026. The first phase will include approximately 170,000 square feet of commercial and employment uses as well as 731 residential units, an elementary school and 27 acres of park and open space. Phase 2 will include 848 residential units and approximately 6 acres of park and open space. A private wastewater treatment facility will be provided to treat and reuse project wastewater. Primary access to the development would be provided via Honoapiilani Highway and Waiale Road, via the planned southward extension of Waiale Road known as the Waiale Bypass.

The purpose of this study is to describe existing air quality in the project area and to assess the potential short- and long-term direct and indirect air quality impacts that could result from construction and use of the proposed facilities as planned. Measures to mitigate project impacts are suggested where possible and appropriate.

3.0 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, national and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide. National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one

or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and state standards allow a specified number of exceedances each year.

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit.

The national AAQS are reviewed periodically, and multiple revisions have occurred over the past 30 years. In general, the national AAQS have become more stringent with the passage of time and as more information and evidence become available concerning the detrimental effects of air pollution. Changes to the Hawaii AAQS over the past several years have tended to follow revisions to the national AAQS, making several of the Hawaii AAQS the same as the national AAQS.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

Regional and local climatology significantly affect the air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout most of the state, significant differences in these parameters may occur from one location to another. Most differences in regional

and local climates within the state are caused by the mountainous topography.

The topography of Maui is dominated by the great volcanic masses of Haleakala (10,023 feet) and the West Maui Mountains (5,788 feet). The island consists entirely of the slopes of these mountains and of a connecting isthmus. Haleakala is still considered to be an active volcano and last erupted about 1790. The project site is located near sea level in the central isthmus area between Haleakala and the West Maui Mountains.

Maui lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. Because the project area is located on the isthmus between Haleakala and the West Maui Mountains, the predominant trade wind flow tends to be channeled through the area from north to south by the terrain to the east and west. Local winds such as land/sea breezes and/or upslope/downslope winds also influence the wind pattern for the area when the trade winds are weak or absent. During winter, occasional strong winds from the south or southwest occur in association with the passage of winter storm systems.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depends to a large

degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade winds tend to have the least temperature variation, while inland and leeward areas often have the most. The project site's lower elevation and near-windward location results in relatively even temperatures compared with many other parts of the island. Average daily minimum and maximum temperatures at nearby Wailuku are 68°F and 81°F, respectively [1]. Temperatures at the project site can be expected to be similar to this.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is often measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 is the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In the Waikapu area, stability classes 5 or 6 typically occur during the nighttime or early morning hours when temperature inversions form due to radiational cooling or to drainage flow from the nearby mountains. Stability classes 1 through 4 occur during the daytime, depending mainly on the amount of cloud cover and incoming solar radiation and the prevailing wind conditions.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can

become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land. Mixing heights in Hawaii typically are above 3,000 feet (1,000 meters).

Rainfall can have a beneficial effect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The climate of the project area is moderately dry due to the low elevation. Historical records from Wailuku show that this area of Maui averages about 26 inches of precipitation per year with the summer months being the driest [1].

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from vehicular, industrial, natural and/or agricultural sources. Table 2 presents an air pollutant emission summary for the island of Maui for calendar year 1993. This is the most recent year for which an island-wide emission inventory is available. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, most of the manmade

particulate and sulfur oxides emissions on Maui originate from point sources, such as power plants and other fuel-burning industries. Nitrogen oxides emissions are roughly equally divided between point sources and area sources (mostly motor vehicle traffic). The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic and sugar cane burning), while hydrocarbons are emitted mainly from point sources. Emissions today are probably higher than those shown in the table, but the proportional relationships are likely about the same.

The largest sources of air pollution in the immediate project area are most likely agricultural operations and automobile traffic using local roadways. Emissions from these sources consist primarily of particulate, carbon monoxide and nitrogen oxides. Nearby sugarcane planting and harvesting operations sometimes result in significant emissions of smoke and dust that can impact the area. Industrial sources in the project vicinity include Kahului Power Plant, which is located about 2 miles to the north, and Puunene Sugar Mill, which is situated about 2 miles to the east. These are older facilities that emit mostly sulfur dioxide, nitrogen oxides and particulate. Volcanic emissions from distant natural sources on the Big Island also affect the air quality at times during kona wind conditions. By the time the volcanic emissions reach the project area, they consist mostly of fine particulate sulfate.

The State Department of Health operates a network of air quality monitoring stations at various locations around the state, but only very limited data are available for Maui Island. The only air quality data for the island of Maui consists of particulate measurements collected at Kihei, which is about 7 miles to the

south. Table 3 summarizes the data from the Kihei monitoring station. The annual second-highest 24-hour PM-10 particulate concentration (which is most relevant to the air quality standard) was 60 $\mu g/m^3$ in 2008. The average annual concentration was 20 $\mu g/m^3$. Prior to 2008, occasional exceedances of the state PM-10 standard have been recorded. These were generally due to either agricultural tilling operations or brush fires in the area. Monitoring of PM-10 at the Kihei monitoring station was discontinued in 2009.

As indicated in Table 3, PM-2.5 particulate is also monitored at the Kihei monitoring station. Annual 24-hour 98^{th} percentile PM-2.5 particulate concentrations (which are most relevant to the air quality standards) ranged from 13 to 16 $\mu g/m^3$ between 2008 and 2012. Average annual concentrations ranged from 4 to 6 $\mu g/m^3$. No values above 35 $\mu g/m^3$ (which relates to the national standard) were recorded during this period.

Given the limited air pollution sources in the area, it is likely that air pollution concentrations are near natural background levels most of the time, except possibly for locations adjacent to agricultural operations or near traffic-congested intersections. Present concentrations of carbon monoxide in the project area are estimated later in this study based on computer modeling of motor vehicle emissions.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur due to project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement and soil excavation activities; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project site, from a temporary increase in local traffic caused by commuting construction workers, and from the disruption of normal traffic flow caused by roadway lane closures.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with site clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately. This is because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [2] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions at the project site could be somewhere near that level, depending on the amount of rainfall that occurs. In any case, State of Hawaii Air Pollution Control Regulations [3] prohibit visible emissions of fugitive dust from construction

activities at the property line. Thus, an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could become airborne. Haul trucks tracking dirt onto paved streets from unpaved areas is often a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving of parking areas and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the annual standard for nitrogen dioxide is not likely to be violated by short-term construction equipment emissions. Also, the new short-term (1-hour) standard for nitrogen dioxide is based on a three-year average; thus it is unlikely that relatively short-term construction emissions would exceed the standard. Carbon monoxide emissions from diesel

engines are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

Project construction activities could obstruct the normal flow of traffic for short periods of times such that overall vehicular emissions in the project area could temporarily increase. The only means to alleviate this problem will be to attempt to keep roadways open during peak traffic hours and to move heavy construction equipment and workers to and from construction areas during periods of low traffic volume. Thus, most potential short-term air quality impacts from project construction can be mitigated.

7.0 LONG-TERM IMPACTS OF PROJECT

7.1 Roadway Traffic

After construction is completed, use of the proposed facilities may result in increased motor vehicle traffic in the project area, potentially causing long-term impacts on ambient air quality. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide. They also emit nitrogen oxides and other contaminates.

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly compared to a few years ago. In 1990, the President signed into law the Clean Air Act Amendments. This legislation required further emission reductions, which have been phased in since 1994. More recently, additional restrictions were

signed into law during the Clinton administration, and these began to take effect during the next decade. The added restrictions on emissions from new motor vehicles will lower average emissions each year as more and more older vehicles leave the state's roadways.

To evaluate the potential long-term ambient air quality impact of motor vehicle traffic using the proposed new roadway facilities, computerized emission and atmospheric dispersion models can be used to estimate ambient carbon monoxide concentrations along roadways within the project area. Carbon monoxide is selected for modeling because it is both the most stable and the most abundant of the pollutants generated by motor vehicles. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem that can be addressed locally to some extent, whereas nitrogen oxides air pollution most often is a regional issue that cannot be addressed by a single project.

For this project, three scenarios were selected for the carbon monoxide modeling study: (1) year 2013 with present conditions, (2) year 2026 without the project, and (3) year 2026 with the project. To begin the modeling study of the three scenarios, critical receptor areas in the vicinity of the project were identified for analysis. Generally speaking, roadway intersections are the primary concern because of traffic congestion and because of the increase in vehicular emissions associated with traffic queuing. For this study, four of the key intersections identified in the traffic study [4] were selected for air quality analysis. These included the following intersections:

- Honoapiilani Highway at Kuikahi Drive
- Waiale Road at Maui Lani Parkway
- South Kamehameha Avenue at Maui Lani Parkway
- Kuihelani Highway at Maui Lani Parkway.

The traffic study indicated that the selected intersections generally had higher traffic volumes and/or more congestion. The traffic study describes the existing and projected future traffic conditions and laneage configurations of the study intersections in detail. In performing the air quality impact analysis, it was assumed that all recommended traffic mitigation measures would be implemented.

The main objective of the modeling study was to estimate maximum 1-hour average carbon monoxide concentrations for each of the three scenarios studied. To evaluate the significance of the estimated concentrations, a comparison of the predicted values for each scenario can be made. Comparison of the estimated values to the national and state AAQS was also used to provide another measure of significance.

Maximum carbon monoxide concentrations typically coincide with peak traffic periods. The traffic impact assessment report evaluated morning and afternoon peak traffic periods. These same periods were evaluated in the air quality impact assessment.

Vehicular carbon monoxide emissions for each year studied were calculated using EPA's Motor Vehicle Emission Simulator (MOVES) computer model [5]. MOVES was configured for a project-level

analysis specifically for Hawaii. Assumptions included an urban, unrestricted road type, default fuel supply and fuel formulation, default vehicle age distribution and ambient temperature of 68 F. MOVES emission factors were generated both for idling and for moving traffic.

After computing vehicular carbon monoxide emissions through the use of MOVES, these data were then input to an atmospheric dispersion model. EPA air quality modeling guidelines [6] currently recommend that the computer model CAL3QHC [7] be used to assess carbon monoxide concentrations at roadway intersections, or in areas where its use has previously been established, CALINE4 [8] may be used. Until a few years ago, CALINE4 was used extensively in Hawaii to assess air quality impacts at roadway intersections. In December 1997, the California Department of Transportation recommended that the intersection mode of CALINE4 no longer be used because it was thought the model had become outdated. Studies have shown that CALINE4 may tend to over-predict maximum concentrations in some situations. Therefore, CAL3QHC was used for the subject analysis.

CAL3QHC was developed for the U.S. EPA to simulate vehicular movement, vehicle queuing and atmospheric dispersion of vehicular emissions near roadway intersections. It is designed to predict 1-hour average pollutant concentrations near roadway intersections based on input traffic and emission data, roadway/receptor geometry and meteorological conditions.

Input peak-hour traffic data were obtained from the traffic study cited previously. This included vehicle approach volumes, saturation capacity estimates, intersection laneage and signal timings. All emission factors that were input to CAL3QHC for free-flow traffic on roadways were obtained from MOVES based on assumed free-flow vehicle speeds corresponding to the posted or design speed limits.

Model roadways were set up to reflect roadway geometry, physical dimensions and operating characteristics. Concentrations predicted by air quality models generally are not considered valid within the roadway-mixing zone. The roadway-mixing zone is usually taken to include 3 meters on either side of the traveled portion of the roadway and the turbulent area within 10 meters of a cross street. Model receptor sites were thus located at the edges of the mixing zones near all intersections that were studied for all three scenarios. This acknowledges that pedestrian sidewalks already exist or may exist in the future in these locations. All receptor heights were placed at 1.8 meters above ground to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" results. One of the key meteorological inputs is atmospheric stability category. For these analyses, atmospheric stability category 6 was assumed for the morning cases, while atmospheric stability category 4 was assumed for the afternoon cases. These are the most conservative stability categories that are generally used for estimating worst-case pollutant dispersion within suburban areas for these periods. A surface roughness length of 100 cm and a mixing height of 1000 meters were used in all cases. Worst-case wind conditions were

defined as a wind speed of 1 meter per second with a wind direction resulting in the highest predicted concentration. Concentration estimates were calculated at wind directions of every 5 degrees.

Existing background concentrations of carbon monoxide in the project vicinity are believed to be at low levels. Thus, background contributions of carbon monoxide from sources or roadways not directly considered in the analysis were accounted for by adding a background concentration of 0.5 ppm to all predicted concentrations for 2013. Although increased traffic is expected to occur within the project area within the next few years with or without the project, background carbon monoxide concentrations may not change significantly since individual emissions from motor vehicles are forecast to decrease with time. Hence, a background value of 0.5 ppm was assumed to persist for the future scenarios studied.

Predicted Worst-Case 1-Hour Concentrations

Table 4 summarizes the final results of the modeling study in the form of the estimated worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations. These results can be compared directly to the state and the national AAQS. Estimated worst-case carbon monoxide concentrations are presented in the table for three scenarios: year 2013 with existing traffic, year 2026 without the project and year 2026 with the project. The locations of these estimated worst-case 1-hour concentrations all occurred at or very near the indicated intersections.

As indicated in the table, the highest estimated 1-hour concentration within the project vicinity for the present (2013) case was 1.8 ppm. This was projected to occur during the morning peak traffic hour at three of the four intersections studied. Predicted worst-case 1-hour concentrations at all locations studied for the 2013 scenario were well within both the national AAQS of 35 ppm and the state standard of 9 ppm.

In the year 2026 without the proposed project, the highest worst-case 1-hour carbon monoxide concentrations in the project area were predicted to reach a maximum of 1.1 ppm during the morning peak traffic hour. Compared to the existing case, predicted concentrations for the year 2026 without the project decreased (improved) at all locations, and worst-case concentrations remained well within the state and national standards. This suggests that emissions from higher traffic volumes and increased traffic congestion in the future will be more than offset by the retirement of older, more-polluting vehicles over time.

Predicted 1-hour worst-case concentrations for the 2026 with project scenario remained nearly unchanged at the study intersections. Forecast worst-case concentrations at all locations studied remained well within the state and federal standards.

Predicted Worst-Case 8-Hour Concentrations

Worst-case 8-hour carbon monoxide concentrations were estimated by multiplying the worst-case 1-hour values by a persistence factor of 0.5. This accounts for two factors: (1) traffic volumes

averaged over eight hours are lower than peak 1-hour values, and (2) meteorological conditions are more variable (and hence more favorable for dispersion) over an 8-hour period than they are for a single hour. Based on monitoring data, 1-hour to 8-hour persistence factors for most locations generally vary from 0.4 to 0.8 with 0.6 being the most typical. One study based on modeling [9] concluded that 1-hour to 8-hour persistence factors could typically be expected to range from 0.4 to 0.5. EPA guidelines [10] recommend using a value of 0.7 unless a locally derived persistence factor is available. Recent monitoring data for locations on Oahu reported by the Department of Health [11] suggest that this factor may range between about 0.2 and 0.6 depending on location and traffic variability. Considering the location of the project and the traffic pattern for the area, a 1-hour to 8-hour persistence factor of 0.5 will likely yield reasonable estimates of worst-case 8-hour concentrations.

The resulting estimated worst-case 8-hour concentrations are indicated in Table 5. For the 2013 scenario, the estimated worst-case 8-hour carbon monoxide concentrations for the four locations studied ranged from 0.7 to 0.9 ppm. The estimated worst-case concentrations for the existing case were well within both the state standard of 4.4 ppm and the national limit of 9 ppm.

For the year 2026 without project scenario, predicted worst-case concentrations ranged between 0.4 and 0.6 ppm, decreasing (improving) compared to the existing scenario. All predicted concentrations were within the standards.

For the 2026 with project scenario, worst-case concentrations remained nearly unchanged compared to the without project case, indicating minimal project impact. All predicted 8-hour concentrations for this scenario were well within both the national and the state AAQS.

Conservativeness of Estimates

The results of this study reflect several assumptions that were made concerning both traffic movement and worst-case meteorological conditions. One such assumption concerning worst-case meteorological conditions is that a wind speed of 1 meter per second with a steady direction for 1 hour will occur. A steady wind of 1 meter per second blowing from a single direction for an hour is extremely unlikely and may occur only once a year or less. With wind speeds of 2 meters per second, for example, computed carbon monoxide concentrations would be only about half the values given above. The 8-hour estimates are also conservative in that it is unlikely that anyone would occupy the assumed receptor sites (within 3 m of the roadways) for a period of 8 hours.

7.2 Wastewater Treatment Facility

The Waikapu Country Town Project will include a private wastewater treatment facility to treat and reuse project wastewater. The facility will be designed and operated in compliance with the State of Hawaii, Department of Health Administrative Rules. The average dry-weather flow is expected to reach 645,335 gallons per day with the peak flow about double this. It is anticipated that the effluent produced by the facility will be used primarily for irrigation within the project area.

Insofar as air quality is concerned, the primary issue with wastewater treatment facilities is the potential for offsite odor nuisance, typically from hydrogen sulfide (H2S) emissions. As indicated in Table 1, the Hawaii Department of Health has established a standard for H2S of 0.025 ppm for a one-hour average. While this standard may provide protection from detrimental health effects of H2S, it does not guard against odor nuisance. The odor threshold for sensitive individuals is generally taken to be about 0.005 ppm. Thus, the Waikapu Country Town Project and the developer of the associated wastewater treatment facility, Mana Water, have made a commitment to limit the concentration of H2S at the facility boundary to 0.005 ppm [12]. This should effectively preclude the occurrence of offsite odor nuisance from the facility.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Although very little ambient air quality data are available to characterize existing conditions, it is likely that state and federal ambient air quality standards are currently being met in the project area. Occasional air quality degradation may occur due to dust and smoke emissions from nearby sugarcane operations.

Project-related short-term impacts on air quality may occur from the emission of fugitive dust during construction phases. Uncontrolled fugitive dust emissions from construction activities could amount to about 1.2 tons per acre per month, depending on rainfall. To control dust, active work areas and any temporary unpaved work roads should be watered at least twice daily on days

without rainfall. Use of wind screens and/or limiting the area that is disturbed at any given time will also help to contain fugitive dust emissions. Wind erosion of inactive areas of the site that have been disturbed could be controlled by mulching or by the use of chemical soil stabilizers. Dirt-hauling trucks should be covered when traveling on roadways to prevent windage. A routine road cleaning and/or tire washing program will also help to reduce fugitive dust emissions that may occur as a result of trucks tracking dirt onto paved roadways in the project area. Establishment of landscaping early in the construction schedule will also help to control dust.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment and/or commuting construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours.

After the proposed project is completed, any long-term impacts on air quality in the project area due to emissions from project-related motor vehicle traffic should be negligible. Worst-case concentrations of carbon monoxide should remain within both the state and the national ambient air quality standards. Implementing any air quality mitigation measures for long-term traffic-related impacts is unnecessary and unwarranted.

The project wastewater treatment facility will be designed and operated to keep any emissions of odorous gases at the facility boundary below the odor threshold. Thus, offsite odor nuisance is not expected to be an issue.

REFERENCES

1. "Climatic Summary of the United States, Supplement for 1951 through 1960, Hawaii and Pacific", U.S. Department of Commerce, Weather Bureau, Washington, D.C., 1965.

2. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition, AP-42, U.S. Environmental Protection Agency, Research Triangle Park, NC, January 1995.

3. State of Hawaii. Hawaii Administrative Rules, Chapter 11-60, Air Pollution Control.

4. Fehr & Peers, Waikapu Country Town Transportation Impact Analysis Report, December 2014.

5. User Guide for Motor Vehicle Emission Simulator, MOVES2010b, U.S. Environmental Protection Agency, Office of Transportation and Air Quality, Assessment and Standards Division, Ann Arbor, Michigan, June 2012, EPA-420-B-12-001b.

6. Guideline on Air Quality Models (Revised), Including Supplements A and B, EPA-450/2-78-027R, U.S. Environmental Protection Agency, Research Triangle Park, NC, July 1986.

7. User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections, U.S. Environmental Protection Agency, November 1992.

8. CALINE4 - A Dispersion Model for Predicting Air Pollutant Concentrations Near Roadways, FHWA/CA/TL-84/15, California State Department of Transportation, November 1984 with June 1989 Revisions.

9. "Persistence Factors for Mobile Source (Roadway) Carbon Monoxide Modeling", C. David Cooper, Journal of the Air & Waste Management Association, Volume 39, Number 5, May 1989.

10. Guideline for Modeling Carbon Monoxide from Roadway Intersections, U.S. Environmental Protection Agency, EPA-454/R-92-005, November 1992.

11. Annual Summaries, Hawaii Air Quality Data, 2006-2010, State of Hawaii Department of Health.

12. Mana Water, Water Reclamation and Education Facility, Water Reclamation and Reuse Report, Waikapu Country Town, October 2016.

Figure 1 - Project Location

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	$\mu g/m^3$	Annual	–	–	50
		24 Hours	150[a]	150[a]	150[b]
Particulate Matter (<2.5 microns)	$\mu g/m^3$	Annual	15[c]	15[c]	–
		24 Hours	35[d]	35[d]	–
Sulfur Dioxide	ppm	Annual	–	–	0.03
		24 Hours	–	–	0.14[b]
		3 Hours	–	0.5[b]	0.5[b]
		1 Hour	0.075[e]	–	–
Nitrogen Dioxide	ppm	Annual	0.053	0.053	0.04
		1 Hour	0.100[f]	–	–
Carbon Monoxide	ppm	8 Hours	9[b]	–	4.4[b]
		1 Hour	35[b]	–	9[b]
Ozone	ppm	8 Hours	0.075[g]	0.075[g]	0.08[g]
Lead	$\mu g/m^3$	3 Months	0.15[h]	0.15[h]	–
		Quarter	1.5[i]	1.5[i]	1.5[i]
Hydrogen Sulfide	ppm	1 Hour	–	–	0.025[b]

[a] Not to be exceeded more than once per year on average over three years.
[b] Not to be exceeded more than once per year.
[c] Three-year average of the weighted annual arithmetic mean.
[d] 98th percentile value of the 24-hour concentrations averaged over three years.
[e] Three-year average of annual fourth-highest daily 1-hour maximum.
[f] 98th percentile value of the daily 1-hour maximum averaged over three years.
[g] Three-year average of annual fourth-highest daily 8-hour maximum.
[h] Rolling 3-month average.
[i] Quarterly average.

Table 2

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF MAUI, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	63,275	7,030	70,305
Sulfur Oxides	6,419	nil	6,419
Nitrogen Oxides	7,312	8,618	15,930
Carbon Monoxide	4,612	20,050	24,662
Hydrocarbons	1,991	234	2,225

Source: Final Report, “Review, Revise and Update of the Hawaii Emissions Inventory Systems for the State of Hawaii”, prepared for Hawaii Department of Health by J.L. Shoemaker & Associates, Inc., 1996

Table 3

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST WAIKAPU COUNTRY TOWN PROJECT

Parameter / Location	2008	2009	2010	2011	2012
Particulate (PM-10) / Kihei					
24-Hour Averaging Period:					
No. of Samples	331	–	–	–	–
Highest Concentration ($\mu g/m^3$)	78	–	-	–	–
2nd Highest Concentration ($\mu g/m^3$)	60	–	–	–	–
No. of State AAQS Exceedances	0	–	-	–	–
Annual Average Concentration ($\mu g/m^3$)	20	–	–	–	–
Particulate (PM-2.5) / Kihei					
24-Hour Averaging Period:					
No. of Samples	58	358	332	301	337
Highest Concentration ($\mu g/m^3$)	16	26	24	15	18
98th Percentile Concentration ($\mu g/m^3$)	15	16	14	13	14
No. of values greater than 35 $\mu g/m^3$	0	0	0	0	0
Annual Average Concentration ($\mu g/m^3$)	6	4	5	6	6

Source: State of Hawaii Department of Health, "Annual Summaries, Hawaii Air Quality Data, 2008 – 2012"

Table 4

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR WAIKAPU COUNTRY TOWN PROJECT (parts per million)

Roadway Intersection	Year/Scenario					
	2013/Present		2026/Without Project		2026/With Project	
	AM	PM	AM	PM	AM	PM
Honoapiilani Highway at Kuikahi Drive	1.8	1.1	0.9	0.7	0.9	0.7
Waiale Road at Maui Lani Parkway	1.8	1.2	1.1	0.8	1.1	0.9
S. Kamehameha Ave at Maui Lani Parkway	1.8	1.3	1.1	0.8	1.0	0.8
Kuihelani Highway at Maui Lani Parkway	1.4	1.2	1.1	0.8	1.0	0.9

Hawaii State AAQS: 9
National AAQS: 35

Table 5

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR WAIKAPU COUNTRY TOWN PROJECT (parts per million)

Roadway Intersection	Year/Scenario		
	2013/Present	2026/Without Project	2026/With Project
Honoapiilani Highway at Kuikahi Drive	0.9	0.4	0.4
Waiale Road at Maui Lani Parkway	0.9	0.6	0.6
S. Kamehameha Ave at Maui Lani Parkway	0.9	0.6	0.5
Kuihelani Highway at Maui Lani Parkway	0.7	0.6	0.5

Hawaii State AAQS: 4.4
National AAQS: 9

APPENDIX D

Noise Assessment Report

D. L. ADAMS ASSOCIATES
acoustics | performing arts | technology

970 N. Kalaheo Ave.
Suite A311
Kailua, HI 96734
www.dlaa.com
808.254.3318

Environmental Noise Assessment Report
Waikapu Country Town
Waikapu, Island of Maui, Hawaii

November 2016

Prepared by:
D.L. Adams Associates, Ltd.
970 N. Kalaheo Avenue, Suite A-311
Kailua, Hawaii 96734
DLAA Project No. 13-06

Prepared for:
Planning Consultants Hawaii, LLC.
2331 W. Main Street
Wailuku, Maui, HI 96793

TABLE OF CONTENTS

Section **Page**

1.0 EXECUTIVE SUMMARY 1

2.0 PROJECT DESCRIPTION 2

3.0 NOISE STANDARDS 2

3.1 State of Hawaii, Community Noise Control (HDOH) 2

3.2 U.S. Federal Highway Administration (FHWA) 2

3.3 State of Hawaii Department of Transportation (HDOT) 4

3.4 U.S. Environmental Protection Agency (EPA) 4

3.5 U.S. Department of Housing and Urban Development (HUD) 4

3.6 Community Response to Change in Noise Level 5

4.0 EXISTING ACOUSTICAL ENVIRONMENT 5

4.1 Long Term Noise Measurements 5

4.1.1 Long-Term Noise Measurement Procedure 6
4.1.2 Long-Term Noise Measurement Locations 6
4.1.3 Long-Term Noise Measurement Results 6

4.2 Short Term Noise Measurements 6

5.0 POTENTIAL NOISE IMPACTS 7

5.1 Project Construction Noise and Compliance with HDOH Community Noise Control Rule 7

5.2 Project Generated Stationary Mechanical Noise and Compliance with HDOH Community Noise Control Rule 7

5.2.1 Waste Water Treatment Facility Noise 7

5.3 Vehicular Traffic Noise and Compliance with FHWA/HDOT Noise Limits 8

5.3.1 Vehicular Traffic Noise Impacts on the Surrounding Community 8
5.3.2 Vehicular Traffic Noise Impacts on the Project 9

5.4 Project Site Noise and Compliance with EPA and HUD Noise Guidelines 9

6.0 NOISE IMPACT MITIGATION 9

6.1 HDOH Noise Permit 9

6.2 HDOH Noise Variance 10

6.3 Mitigation of Construction Noise 10

6.3.1 Mitigation of Noise Source 10
6.3.2 Mitigation of Noise Path 11

6.4 Mitigation of Development Noise 11

6.5 Mitigation of Vehicular Traffic Noise 11

6.5.1 Mitigation Through Setbacks or Buffer Zones 11
6.5.2 Additional Noise Mitigation Options 12

REFERENCES 13

LIST OF TABLES

Table 1 HUD Site Acceptability Standards

Table 2 Average Ability to Perceive Changes in Noise Level

Table 3 Community Response to Increases in Noise Levels

Table 4 Summary of Noise Measurement Results

Table 5 Construction Noise Source Control Methods

Table 6 Minimum Setback Distances to Satisfy HUD Site Acceptability Standards

LIST OF FIGURES

Figure 1 Hawaii DOH Maximum Permissible Sound Levels for Various Zoning Districts

Figure 2 Federal Highway Administration Noise Abatement Criteria for Highway Noise

Figure 3 Site Plan and Noise Measurement Locations

Figure 4 Long Term Noise Measurements – Location L1

Figure 5 Typical Sound Levels from Construction Equipment

Figure 6 Waste Water Treatment Operations Projected Noise Levels – Facility Location Option A

Figure 7 Waste Water Treatment Operations Projected Noise Levels – Facility Location Option B

Figure 8 Projected Traffic Noise Level Contours – Existing Condition

Figure 9 Projected Traffic Noise Level Contours – Future without Project Condition

Figure 10 Projected Traffic Noise Level Contours – Future with Project Condition

Figure 11 Projected Change in Traffic Noise Levels Due to Project

Figure 12 Waikapu Country Town Noise Map

LIST OF APPENDICES

Appendix A Acoustic Terminology

Appendix B Photographs at Project Site

1.0 EXECUTIVE SUMMARY

1.1 The proposed Waikapu Country Town project is located in the Waikapu community on the Island of Maui. The project site, consisting of approximately 1576 acres, is intersected by Honoapiilani Highway and is bordered by mostly agricultural fields to the east, with and south, and the residential community of Waikapu to the north. A majority of the land is zoned for agricultural uses and a small portion is zoned as an urban district. Waikapu Country town is proposed to be a "complete community" development with various categories of residential units (i.e., single family, mufti family, etc.) along with commercial and civic uses, and a waste water treatment facility. The purpose of this environmental noise assessment is to evaluate potential noise impacts to the proposed development as well as to the surrounding community.

1.2 The project area is currently exposed to varying daytime ambient noise levels, depending on the proximity to major roadways. The areas adjacent to Honoapiilani Highway experience the highest ambient noise levels during peak traffic hours where vehicular traffic noise is the dominant noise source. Ambient noise levels range from 53 to 64 dBA adjacent to Honoapiilani Highway. The ambient noise environment is relatively low in areas that are far from the major roadways. The noise sources that exist throughout the project site include traffic, wind, birds, occasional aircraft flyovers, and construction equipment.

1.3 Development of project areas will involve excavation, grading, and other typical construction activities. The Waikapu Country Town project may impact the adjacent residential homes in the Waikapu community due to their proximity to the construction site. In addition, residences from the initial phases may be impacted by construction noise from subsequent phases. Noise from construction activities should be short term and must comply with State of Hawaii Department of Health (HDOH) noise regulations.

1.4 The various phases in the long range development plan will incorporate stationary mechanical equipment that is typical for commercial and residential buildings. Expected mechanical equipment may include air handling equipment, condensing units, refrigeration units, etc. as well as mechanical equipment utilized at the waste water treatment facility. Noise from this mechanical equipment and other equipment must meet the State Department of Health *Community Noise Control* rules, which stipulate maximum permissible noise limits at the property line. The design of the proposed Waikapu Country Town community should give consideration to controlling the noise emanating from stationary mechanical equipment so as to comply with the HDOH noise rules and to prevent noise impacts to the residences.

1.5 Based on data collected of similar facility and operations, the waste water treatment facility is not expected to produce high noise levels at or beyond property lines adjacent to it. It is anticipated that noise level at both potential locations would be compliant with the HDOH noise regulations for all operating ours and classifications. The exact noise level generated by the facility will be a function of the specific design, equipment selection, and operations. If noise from the proposed facility is significantly higher than the data collected at a similar facility, it may require additional acoustical mitigation based on the specifics of the actual equipment and design.

1.6 Future traffic volume increases on Honoapiilani Highway, Waiko Road and the surrounding roadways due to the development of the Waikapu Country Town project are not significant, i.e., less than 1 dB which is insignificant and less than the threshold of human perception.

1.7 For homes within the Waikapu Country Town development located more than 60 feet from the edge-of-pavement of Honoapiilani Highway, the FHWA maximum noise limit of 67 dBA

will be satisfied. The projected traffic volumes and speed limits on the future roadways that provide access to the proposed development are expected to be insignificant.

1.8 To satisfy HUD site acceptability standards and reduce the noise impact to the Waikapu Country Town homes adjacent to Honoapiilani Highway, a minimum setback distance of 60 feet from the edge-of-pavement must be provided. If the minimum setback distance cannot be provided, additional noise mitigation options (such as a noise barrier wall) should be considered.

2.0 PROJECT DESCRIPTION

The proposed Waikapu Country Town project is located in the Waikapu community on the Island of Maui. The project site, consisting of approximately 1576 acres, is intersected by Honoapiilani Highway and is bordered by mostly agricultural fields to the east, with and south, and the residential community of Waikapu to the north. A majority of the land is zoned for agricultural uses and a small portion is zoned as an urban district. Waikapu Country town is proposed to be a "complete community" development with various categories of residential units (i.e., single family, mufti family, etc.) along with commercial and civic uses, as well as a waste water treatment facility. The purpose of this environmental noise assessment is to evaluate potential noise impacts to the proposed development as well as to the surrounding community.

3.0 NOISE STANDARDS

Various local and federal agencies have established guidelines and standards for assessing environmental noise impacts and set noise limits as a function of land use. A brief description of common acoustic terminology used in these guidelines and standards is presented in Appendix A.

3.1 State of Hawaii, Community Noise Control (HDOH)

The State of Hawaii Community Noise Control Rule [Reference 1] defines three classes of zoning districts and specifies corresponding maximum permissible sound levels due to *stationary* noise sources such as air-conditioning units, exhaust systems, generators, compressors, pumps, etc. The Community Noise Control Rule does not address most *moving* sources, such as vehicular traffic noise, aircraft noise, or rail transit noise. However, the Community Noise Control Rule does regulate noise related to agricultural, construction, and industrial activities, which may not be stationary.

The maximum permissible noise levels for stationary mechanical equipment are enforced by the State of Hawaii Department of Health (HDOH) for any location at or beyond the property line and shall not be exceeded for more than 10% of the time during any 20-minute period. The specified noise limits which apply are a function of the zoning and time of day as shown in Figure 1. With respect to mixed zoning districts, the rule specifies that the primary land use designation shall be used to determine the applicable zoning district class and the maximum permissible sound level. In determining the maximum permissible sound level, the background noise level is taken into account by HDOH.

The criteria for *impulse* or impact noise is separate from stationary noise due to the nature of the sound. HDOH defines impulse noise as " any sound with a rapid rise and decay of sound pressure level, lasting less than one second, caused by sudden contact between two or more surfaces…". Noise from pile driving is considered impulse noise and the maximum permissible noise level is 10 dB above the specified noise limits for stationary sources, as shown in Figure 1.

3.2 U.S. Federal Highway Administration (FHWA)

The FHWA regulation 23 CFR 772 contains highway traffic noise abatement criteria (NAC) for seven land use activity categories and assigns corresponding maximum hourly

equivalent sound levels ($L_{eq(h)}$) for traffic noise exposure [Reference 2, 3]. The Noise Abatement Criteria (NAC) for all seven categories are listed in Figure 2. Due to the mixed-use nature of the proposed project, Waikapu Country Town would fall under Categories B, C and E. The limits are viewed as design goals, and all projects meeting these limits are deemed in conformance with FHWA noise standards.

3.3 State of Hawaii Department of Transportation (HDOT)

The HDOT has implemented the requirements of the FHWA's design goals for traffic noise exposure in its noise analysis and abatement policy [Reference 4]. According to the policy, a traffic noise impact occurs when the predicted traffic noise levels "approach" or exceed FHWA's NAC or when the predicted traffic noise levels "substantially exceed the existing noise levels." The policy also states that "approach" is defined as 1 dB less than FHWA's NAC and "substantially exceed" is defined as an increase of at least 15 dB.

3.4 U.S. Environmental Protection Agency (EPA)

The U.S. EPA has identified a range of yearly day-night equivalent sound levels (L_{dn}) sufficient to protect public health and welfare from the effects of environmental noise [Reference 5]. The EPA has established a goal to reduce exterior environmental noise to an L_{dn} not exceeding 65 dBA and a future goal to further reduce exterior environmental noise to an L_{dn} not exceeding 55 dBA. Additionally, the EPA states that these goals are not intended as regulations as it has no authority to regulate noise levels, but rather they are intended to be viewed as levels below which the general population will not be at risk from any of the identified effects of noise.

3.5 U.S. Department of Housing and Urban Development (HUD)

HUD's environmental noise criteria and standards in 24 CFR 51 [Reference 6] were established for determining housing project site acceptability. These standards are based on day-night equivalent sound levels, L_{dn}, and are not limited to traffic noise exposure. However, for project sites in the vicinity of highways, the L_{dn} may be estimated to be equal to the design hour $L_{eq(h)}$, provided "heavy trucks (vehicles with three or more axles) do not exceed 10 percent of the total traffic flow in vehicles per 24 hours and the traffic flow between 10:00 p.m. and 7:00 a.m. does not exceed 15 percent of the average daily traffic flow in vehicles per 24 hours." For these same conditions, L_{dn}, may also be estimated as 3 dB less than the design hour L_{10}. The HUD Site Acceptability Standards for exterior sound levels are summarized in Table 1. However, HUD also recommends the EPA's L_{dn} 55 dBA goal for outdoors in residential areas.

Table 1. HUD Site Acceptability Standards

Category	Day-Night Sound Level	Comments
Acceptable	Less than or equal to 65 dBA	No special acoustical design consideration necessary
Normally Unacceptable	Greater than 65 dBA, but less than or equal to 70 dBA	5 dB additional attenuation required through use of barriers or in design to ensure interior noise levels are acceptable
	Greater than 70 dBA, but less than or equal to 75 dBA	10 dB addition attenuation required through the use of barriers or in design to ensure interior noise levels are acceptable
Unacceptable	Greater than 75 dBA	Attenuation measures must be submitted on a case-by-case basis

The intent of the L_{dn} 65 dBA outside criteria is to achieve 45 dBA indoors, however, the standard also applies to locations where quiet outdoor space is required. HUD will sometimes allow upgrades to the building shell to meet an interior L_{dn} of 45 in Normally Unacceptable or Unacceptable areas. This can be accomplished by specifying building facades, windows, and doors with a higher STC rating than normal construction.

3.6 Community Response to Change in Noise Level

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, the average ability of an individual to perceive changes in noise levels is well documented and has been summarized in Table 2 [Reference 7]. These guidelines permit direct estimation of an individual's probable perception of changes in noise levels.

Table 2. Average Ability to Perceive Changes in Noise Level

Sound Level Change (dB)	Human Perception of Sound
0	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	Two times (or 1/2) as loud
20	Four times (or 1/4) as loud

A commonly applied criterion for estimating a community's response to changes in noise level is the 'community response scale' proposed by the International Standards Organization (ISO) of the United Nations [Reference 8]. The scale shown in Table 3 relates changes in noise level to the degree of community response and allows for direct estimation of the probable response of a community to a predicted change in noise level.

Table 3. Community Response to Increases in Noise Levels

Sound Level Change (dB)	Category	Response Description
0	None	No observed reaction
5	Little	Sporadic Complaints
10	Medium	Widespread Complaints
15	Strong	Threats of Community Action
20	Very Strong	Vigorous Community Action

The values stated in Tables 2 and 3 should not be considered regulatory requirements because they are not associated with a specific governing document for this project. However, these tables are very useful in assessing the human perception to changes in sound levels and they are considered to be supplemental information to the governing State of Hawaii Community Noise Control Rule, which does not discuss community response to changes in noise levels.

4.0 EXISTING ACOUSTICAL ENVIRONMENT

Two types of noise measurements were conducted to assess the existing acoustical environment in the vicinity of the project location. The first noise measurement type consisted of continuous long-term ambient noise level measurements. The second type of noise measurement was short-term and included traffic counts. The purpose of the short-term noise measurements and corresponding traffic counts is to calibrate the traffic noise prediction model. The noise measurements were conducted between June 26, 2014 and June 29, 2014.

The methodology, location, and results for each of the measurements are described below and the measurement locations are illustrated in Figure 3. Photographs of the measurements locations are provided in Appendix B.

4.1 Long Term Noise Measurements

Continuous long-term ambient noise level measurements were conducted to assess the existing acoustical environment in the vicinity of the project site. Long-term measurements (taken continuously over the course of multiple days) offer a baseline for establishing

existing ambient noise levels in the area and are used for estimating future noise levels by adding the ambient levels to other noise levels generated from the proposed project.

4.1.1 Long-Term Noise Measurement Procedure

Hourly equivalent sound levels were recorded for approximately 3 days at one location. The measurements were taken using a Larson-Davis, Model 820, Type 1 Sound Level Meter together with a Gras, Model 40AQ Type 1 Microphone. Calibration was checked before and after the measurements with a Larson-Davis Model CAL200 calibrator. Both the sound level meter and the calibrator have been certified by the manufacturer within the recommended 2-year calibration period. The microphones were mounted on tripods at 8 feet above grade. A windscreen covered the microphone during the entire measurement period. The sound level meter was secured in weather-resistant cases.

4.1.2 Long-Term Noise Measurement Locations

Location L1: The sound level meter was located near the center of the project site, adjacent to the Maui Tropical Plantation events stage. This location is approximately 280 from the edge-of-pavement to Honoapiilani Highway. The dominant noise source was vehicular traffic from the highway. Secondary noise sources included birds, wind, occasional aircraft flyovers. There was also intermittent construction noise near the stage area during the measurement period.

4.1.3 Long-Term Noise Measurement Results

The measured $L_{eq(h)}$ and the 90 percent exceedance level (L_{90}) in dBA are graphically presented in Figure 4. The ambient sound levels at L1 were dynamic and depended significantly on the vehicular traffic patterns of the highway (where higher ambient noise levels occurred during peak traffic hours). The range of $L_{eq(h)}$ during the day (7:00 AM to 10:00 PM) and during the night (10:00 PM to 7:00 AM) and average calculated day-night level are summarized in Table 4 below.

Table 4. Summary of Noise Measurement Results (dBA)

Measurement Location	7 AM-10 PM $L_{eq(h)}$ Range	10 PM-7 AM $L_{eq(h)}$ Range	Average L_{dn}
L1 – Project Site Central	53-64	49-59	62

4.2 Short Term Noise Measurements

An approximate 30-minute L_{eq} was measured at two locations approximately 50 feet from the edge-of-pavement of Honoapiilani Highway and Waiko Road. Vehicular traffic counts and traffic mix were documented during the measurement period. The noise measurement was taken using a Larson-Davis Laboratories, Model 824, Type-1 Sound Level Meter together with a Larson-Davis, Model 2541 Type-1 Microphone. Calibration will was checked before and after the measurement with a Larson-Davis Model CAL200 calibrator. Both the sound level meter and the calibrator have been certified by the manufacturer within the recommended calibration period.

5.0 POTENTIAL NOISE IMPACTS

5.1 Project Construction Noise and Compliance with HDOH Community Noise Control Rule

The various construction phases of the project will generate significant amounts of noise. Depending on when construction occurs, the Waikapu Country Town development may impact existing adjacent properties, such as the homes and businesses adjacent to Honoapiilani Highway and Waiko Road. Similarly, residences from the initial phases may be impacted by construction noise from subsequent phases due to their proximity to the construction site.

Development of the project areas will involve excavation, grading, and other typical construction activities during construction. The use of impact equipment is not anticipated. The actual noise levels produced during construction will be a function of the methods employed during each stage of the construction process. Typical ranges of construction equipment noise are shown in Figure 5. Earthmoving equipment, e.g., bulldozers and diesel-powered trucks, will probably be the loudest equipment used during construction. In cases where construction noise is expected to exceed the HDOH "maximum permissible" property line noise levels, a permit must be obtained to allow the operation of construction equipment.

5.2 Project Generated Stationary Mechanical Noise and Compliance with HDOH Community Noise Control Rule

The Waikapu Country Town development is proposed to be a “complete community” which includes several categories of residential units (i.e., single family, mufti family, etc.) along with neighborhood retail and commercial uses, parks, open space, and a school. The development is also proposing to include a waste water treatment facility. The town will be surrounded by agricultural land.

The various phases in the long range development plan will incorporate stationary mechanical equipment that is typical for commercial buildings. Expected mechanical equipment may include air handling equipment, condensing units, refrigeration units, etc. Noise from this mechanical equipment at the commercial, mixed-use, and school sites could significantly impact the proposed adjacent noise sensitive residential areas. The HDOH Community Noise Rule stipulates maximum permissible noise limits at the property line for mechanical equipment. The noise limits are 60 dBA during the day and 50 dBA during the night for business and commercial areas. Mitigation of mechanical noise to meet the HDOH noise rules should be incorporated into the project design. For mixed zoning districts, the primary land use designation is used to determine the maximum permissible noise limits. However, the HDOH takes into consideration background noise levels when assessing noise infractions.

The build out of residential units in the long range development plan may also incorporate stationary exterior mechanical equipment. For single family homes, noise limits are 55 dBA during the day and 45 dBA during the night. For multi-family homes, noise limits are 60 dBA during the day and 50 dBA during the night. As with the commercial build out, the design and selection of exterior mechanical equipment for the residential units must comply with the HDOH property line noise limits.

5.2.1 Waste Water Treatment Facility Noise

The waste water treatment facility proposed to service the waste water for the project will require stationary mechanical equipment that will need to comply with the HDOH property line noise limits at the facilities location similarly to the mechanical equipment that will service the residential and commercial buildouts of the project. This equipment may require noise mitigation based on the noise levels of the specific equipment installed and

operations of the facility. There are two proposed locations for the waste water treatment facility's location that can be seen in Figure 3.

The final noise levels produced by the facility will be a function of the equipment installed and the system design. Based on the Water Reclamation and Reuse Report and information provided to us for the proposed facility by Mana Water, the mechanical equipment for the facility is expected to be fully enclosed within a building and the only expected source of exterior noise is from a roof level penetration that is part of the Blower System.

To provide an estimate of the projected noise associated with the Blower System, noise data was collected from the Blower House at the Waimanalo Waste Water Treatment Plant facility in Waimanalo on the Island of Oahu. The data collected was used in conjunction with DataKustik CadnaA software (version 4.5.151) [Reference 9] to create a noise model of the projected noise form the waste water facility on the surrounding areas.

The results of the waste water treatment facility mechanical noise analysis can be seen in Figure 6 and Figure 7. Noise levels in the immediate vicinity of the facility are expected to range from 40-65 dBA and, based on data acquired from the site in Waimanalo, are expected to be below 40 dBA at all of the property lines adjacent to the waste water treatment facility. Because these projected noise levels are based on data acquired from a similar facility and operation, there may be some variation in the equipment noise levels of the operations of the proposed facility. To ensure that noise levels at the surrounding property lines are compliant with the HDOH requirements for stationary mechanical equipment, the system should be design so that the noise levels from the equipment are at or below 70 dBA at 10 feet from the noise source. If the equipment selected for the proposed site has noise levels projected or measured to be above 70 dBA at 10 feet, additional mitigation should be included in the design of the mechanical systems.

5.3 Vehicular Traffic Noise and Compliance with FHWA/HDOT Noise Limits

A vehicular traffic noise analysis was also completed using the CadnaA software for the existing conditions (2013), and future year 2026 projections including the "with project" and "without project" conditions. The traffic noise analysis was based on the peak hour AM and PM traffic volumes provided by the Traffic Consultant [Reference 10]. Intersection geometric configurations and speed limits were also provided by the traffic consultant.

Vehicular traffic noise level contours were calculated throughout the project site and surrounding community. The noise measurement and corresponding traffic counts were used to validate the software at noise measurement locations L1, S1, and S2. The results of the traffic noise analysis for the existing and future year projections are shown graphically in Figures 8 to 10 for the peak AM traffic hour. The calculated hourly equivalent traffic noise levels are not significantly different for the peak AM and peak PM hour, i.e., less than 1 dB, so only the peak AM traffic contours have been presented.

5.3.1 Vehicular Traffic Noise Impacts on the Surrounding Community

Impacts on the surrounding community can be determined by comparing the estimated noise levels for the "future with the project" condition to the "future without the project" condition. Based on the Traffic Consultant's study, future traffic volume increases due to the development of the proposed project are not significant on Honoapiilani Highway, Kuihelani Highway, and Waiko Road. Therefore, existing residences located in the nearby Waikapu community will not experience a significant traffic noise increase due to the proposed Waikapu Country Town development. The change in daytime noise level (future with project vs. future without project) for the community is graphically represented in Figure 11. The yellow contours signify an increase of up to 3 dB which is less than the threshold of human perception. As shown in the figure, existing homes in the

surrounding community are not expected to experience an increase in noise level of more than 1 dB and are unlikely to react to the insignificant increase in vehicular traffic noise.

5.3.2 Vehicular Traffic Noise Impacts on the Project

Future year traffic projections show that the FHWA maximum noise limit of 67 dBA will be satisfied for homes that are located more than 60 feet from the edge-of-pavement of Honoapiilani Highway. Although the FHWA criteria is not a regulatory requirement for this project, as it has no authority to enforce land use, its noise limit criteria is recommended by the FHWA to be used as a guideline for consideration of land use and the impact of traffic noise.

The projected traffic volumes and speed limits on the future roadways that provide access to the Waikapu Country Town development are not significant enough to generate noise levels greater than 60 dB at the adjacent residential property lines. This is true for the main access roads off of Honoapiilani Highway as well as the future Waiale Road extension.

5.4 Project Site Noise and Compliance with EPA and HUD Noise Guidelines

The results from the long-term noise measurements conducted at the Waikapu Country Town site indicate that the existing day-night level is less than 60 dBA for areas located beyond 65 feet from the edge-of-pavement of Honoapiilani Highway. Therefore, the noise levels for a majority of the project site are within the HUD site acceptability standards, which state a design goal of $L_{dn} \leq 65$ dBA for the exterior noise level.

The EPA has an existing design goal of $L_{dn} \leq 65$ dBA and a future design goal $L_{dn} \leq 55$ dBA for exterior noise levels. Noise levels at the project site are currently within both the EPA existing and future design goals at locations beyond 380 feet from the edge-of-pavement of Honoapiilani Highway.

Residences within the Waikapu Country Town development that are located along Honoapiilani Highway and the major perimeter roadways will be exposed to elevated traffic noise. HUD site acceptability standards must be satisfied by providing minimum setback distances or other traffic noise mitigation measures in order to reduce the noise impact to these homes.

It is important to note that the HUD and EPA noise guidelines are design goals and not enforceable regulations, although the HUD site acceptability standards must be satisfied for projects involving HUD or federal financing. However, these guidelines and design goals are useful tools for assessing the noise environment.

6.0 NOISE IMPACT MITIGATION

6.1 HDOH Noise Permit

In cases where construction noise exceeds, or is expected to exceed the State's "maximum permissible" property line noise levels [Reference 1], a permit must be obtained from HDOH to allow the operation of vehicles, cranes, construction equipment, power tools, etc., which emit noise levels in excess of the "maximum permissible" levels.

In order for HDOH to issue a construction noise permit, the contractor must submit a noise permit application to HDOH, which describes the construction activities for the project. Prior to issuing the noise permit, HDOH may require action by the contractor to incorporate noise mitigation into the construction plan. HDOH may also require the contractor to conduct noise monitoring or community meetings inviting the neighboring residents and business owners to discuss construction noise. The contractor should use reasonable and standard practices to mitigate noise, such as using mufflers on diesel and gasoline

engines, using properly tuned and balanced machines, etc. However, HDOH may require additional noise mitigation, such as temporary noise barriers, or time of day usage limits for certain kinds of construction activities.

Specific permit restrictions for construction activities [Reference 1] are:

> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels ... before 7:00 AM and after 6:00 PM of the same day, Monday through Friday."
>
> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels... before 9:00 AM and after 6:00 PM on Saturday."
>
> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels on Sundays and on holidays."

Although not anticipated during construction of the housing development, the use of pile drivers, hoe rams and jack hammers 25 pounds (lbs.) or larger, high pressure sprayers, and chain saws are restricted to 9:00 AM to 5:30 PM, Monday through Friday. In addition, construction equipment and on-site vehicles or devices whose operations involve the exhausting of gas or air, excluding pile hammers and pneumatic hand tools weighing less than 15 pounds (lbs.), must be equipped with mufflers [Reference 1].

The HDOH noise permit does not limit the noise level generated at the construction site, but rather the times at which noisy construction can take place. However, when considering a noise permit application, consideration is also given to any proposed noise mitigation for the project. Therefore, noise mitigation for construction activities should be addressed using project management and the source and path noise control measures discussed in Section 6.3 below.

6.2 HDOH Noise Variance

In cases where nighttime construction is expected, a variance must be obtained from the HDOH to allow the operation of a noise source which emits noise levels in excess of the maximum permissible levels and which operation does not conform to the requirements of the noise permit (i.e., nighttime construction activities which occur between 6:00 p.m. and 7:00 a.m., Monday through Friday). However, nighttime construction is not anticipated for this project so a variance will not be required.

6.3 Mitigation of Construction Noise

6.3.1 Mitigation of Noise Source

Mitigating construction noise at the source is the most effective form of noise control. The source control methods listed in Table 5 below can be applied to most construction equipment.

Table 5. Construction Noise Source Control Methods

Scheduling	Limit activities that generate the most noise to less sensitive time periods (e.g. daytime hours).
Substitution	Use quieter methods/equipment when possible (e.g. low noise generators, smaller excavators, etc.).
Exhaust Mufflers	Install quality mufflers on equipment.
Reduced Power Options	Use smallest size and/or lowest power as required.
Quieter Backup Alarms	Install manual adjustable or ambient sensitive alarms. Do not use backup alarms during night work.

Motors	Insulate or enclose motors
Equipment Selection	Electric equipment is quieter than pneumatic equipment
Equipment Retrofit	Rubber chucks in jackhammers
Equipment Maintenance	Sharpen and balance tools, repair silencing equipment, replace worn parts and open airways
Staging Area	Maximize the distance between the construction staging areas and nearby receptors to the greatest extent possible

In general, a majority of the construction noise mitigation is in the form of scheduling, specifically, limiting the construction hours to the time frame specified by the HDOH. The jackhammer is expected to be the most disruptive piece of equipment used during the construction process so the allowable hours of operation are even more restrictive, as described in Section 6.1.

6.3.2 Mitigation of Noise Path

When source control measures are not sufficient to avoid a noise impact, path control measures must be considered. Non-permanent noise barriers or curtains and equipment enclosures could be installed at the construction site to reduce construction noise in noise sensitive locations. The general contractor could also conduct noise monitoring of construction during noisy or extensive activities at locations close to residential properties.

6.4 Mitigation of Development Noise

The site and building design of the new Waikapu Country Town development should give consideration to controlling the noise emanating from stationary mechanical equipment so as to comply with the HDOH Community Noise Rules [Reference 1]. The location of mechanical equipment on residential, commercial, mixed-use and school properties as well as the waste water treatment facility should take into account proximity to the nearest noise sensitive receiver to reduce noise impacts. For example, outside condensing units should be located far from the neighboring residence's windows or area of outside use (such as a lanai or yard). If sufficient space is not provided between the noise source and receiver, the equipment may require some form of mitigation. Typical noise mitigation for stationary equipment such as air-conditioning and ventilation equipment, refrigerators, compressors, fans, etc, includes mufflers, silencers, acoustical enclosures, noise barrier walls, etc.

A noise map of Waikapu Country Town development, as shown in Figure 12, illustrates the expected noise levels due to AM traffic and stationary mechanical equipment at the commercial, mixed use, and school sites. The graphic assumes that mechanical equipment noise has been mitigated to comply with the daytime property line noise limit of 60 dBA. Refer to Section 5.3 for a description of the traffic noise projections.

6.5 Mitigation of Vehicular Traffic Noise

Vehicular traffic noise from Honoapiilani Highway may impact the proposed development unless noise mitigation is considered.

6.5.1 Mitigation Through Setbacks or Buffer Zones

According to the FHWA's Highway Traffic Noise Analysis and Abatement Guidance [Reference 3], "the FHWA encourages State and local governments to practice compatible land use planning and control near highways. Local governments may use their power to regulate land development to prohibit noise-sensitive land uses adjacent to a highway, or require developers to plan, design, and construct projects that minimize highway traffic noise impacts on adjacent developments." Although the FHWA criteria is not a regulatory requirement for this project, as it has no

authority to enforce land use, its noise limit criteria is recommended by the FHWA to be used as a guideline for consideration of land use and the impact of traffic noise. Furthermore, HUD site acceptability standards must be satisfied for projects involving HUD or federal financing. The setback distances shown in Table 6 are recommended to minimize traffic noise impact and be in compliance with the FHWA's maximum exterior $L_{eq(h)}$ noise limit of 67 dBA and the HUD site acceptability standard of L_{dn} 65 dBA. The setback should be measured from the roadway edge-of-pavement.

Table 6. Minimum Setback Distances to Satisfy HUD Site Acceptability Standards

Roadway	Setback Distance
Honoapiilani Highway	60 feet
Future Waiale Road Extension	None required
Future Main Street	None required
Future Collector and Minor Streets	None Required

6.5.2 Additional Noise Mitigation Options

A comprehensive traffic noise and barrier analysis using roadway layout data and the FHWA Traffic Noise Model Software was not performed. The guidelines listed below are general in nature and should be applied where residential housing is constructed within the setback limits listed above and noise mitigation becomes necessary. The following are effective noise mitigation measures.

- Construct barrier walls and/or earth berms along roadways.
- Air-condition buildings instead of relying on natural ventilation.
- Acoustically soften interior spaces by the addition of thick carpeting with a padding underlayment, an acoustical tile ceiling, louvered closet doors, etc.
- Use exterior wall constructions which exhibit high noise reductions.

Typical exterior-to-interior noise reductions for naturally ventilated homes, i.e., with open windows, are approximately 9 dB. Adding absorption to interior spaces, (acoustically softening), can further reduce the noise levels 1 to 5 dB, depending upon the absorption initially present, and the amount of absorption added to the space. Air-conditioned or mechanically ventilated homes will also typically exhibit higher exterior-to-interior noise reductions achieved by several types of building constructions.

Estimating the noise reduction provided by a barrier, however, is more difficult to generalize. Factors such as distances to roadways and setbacks, intervening ground conditions, barrier construction, barrier height, roadway elevations, etc., will determine the noise reduction afforded by a traffic noise barrier. In general, a 5 to 10 dB reduction can be expected.

REFERENCES

1. Chapter 46, *Community Noise Control*, Department of Health, State of Hawaii, Administrative Rules, Title 11, September 23, 1996.

2. *Department of Transportation, Federal Highway Administration Procedures for Abatement of Highway Traffic Noise*, Title 23, CFR, Chapter 1, Subchapter J, Part 772, 38 FR 15953, June 19, 1973; Revised at 75 FR 32820, July 13, 2010.

3. *Highway Traffic Noise: Analysis and Abatement Guidance*, U.S. Department of Transportation, Federal Highways Administration, December 2011.

4. *Highway Noise Policy and Abatement Guidelines*, Department of Transportation, Highways Division, State of Hawaii, November 29, 2011.

5. *Toward a National Strategy for Noise Control*, U.S. Environmental Protection Agency, April 1977.

6. *Department of Housing and Urban Development Environmental Criteria and Standards*, Title 24, CFR, Part 51, 44 FR 40860, July 12, 1979; Amended by 49 FR 880, January 6, 1984.

7. M. David Egan, *Architectural Acoustics*, McGraw-Hill Book Company, 1998

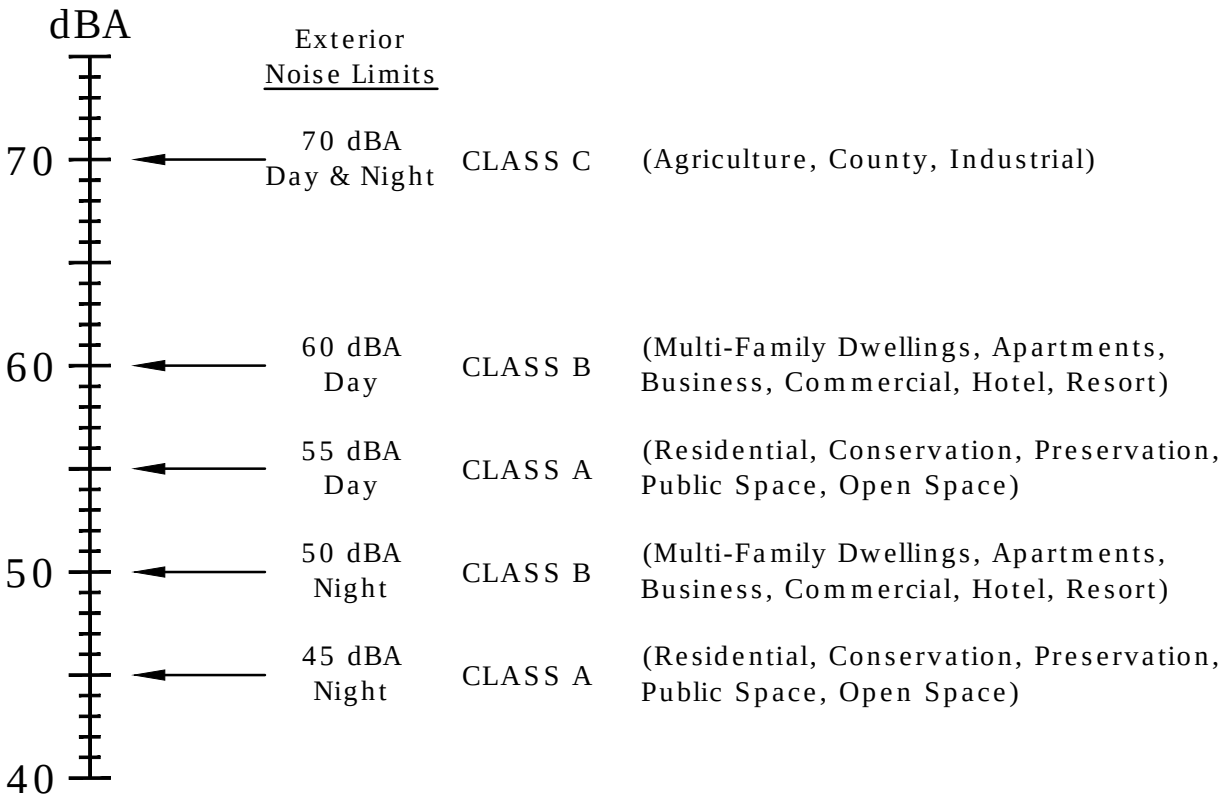
8. International Standards Organization ISO/TC 43, *Noise Assessment with Respect to Community Responses*, New York: United Nations, November 1969.

9. DataKustik CadnaA software program, Version 4.5.151; DataKustik GmbH, 2015.

10. *Waikapu Town Transportation Impact Analysis Report,* Fehr & Peers, December, 2014

HAWAII DEPARTMENT OF HEALTH MAXIMUM PERMISSIBLE SOUND LEVELS FOR VARIOUS ZONING DISTRICTS

Zoning District	Day Hours (7 AM to 10 PM)	Night Hours (10 PM to 7 AM)
CLASS A Residential, Conservation, Preservation, Public Space, Open Space	55 dBA (Exterior)	45 dBA (Exterior)
CLASS B Multi-Family Dwellings, Apartments, Business, Commercial, Hotel, Resort	60 dBA (Exterior)	50 dBA (Exterior)
CLASS C Agriculture, Country, Industrial	70 dBA (Exterior)	70 dBA (Exterior)



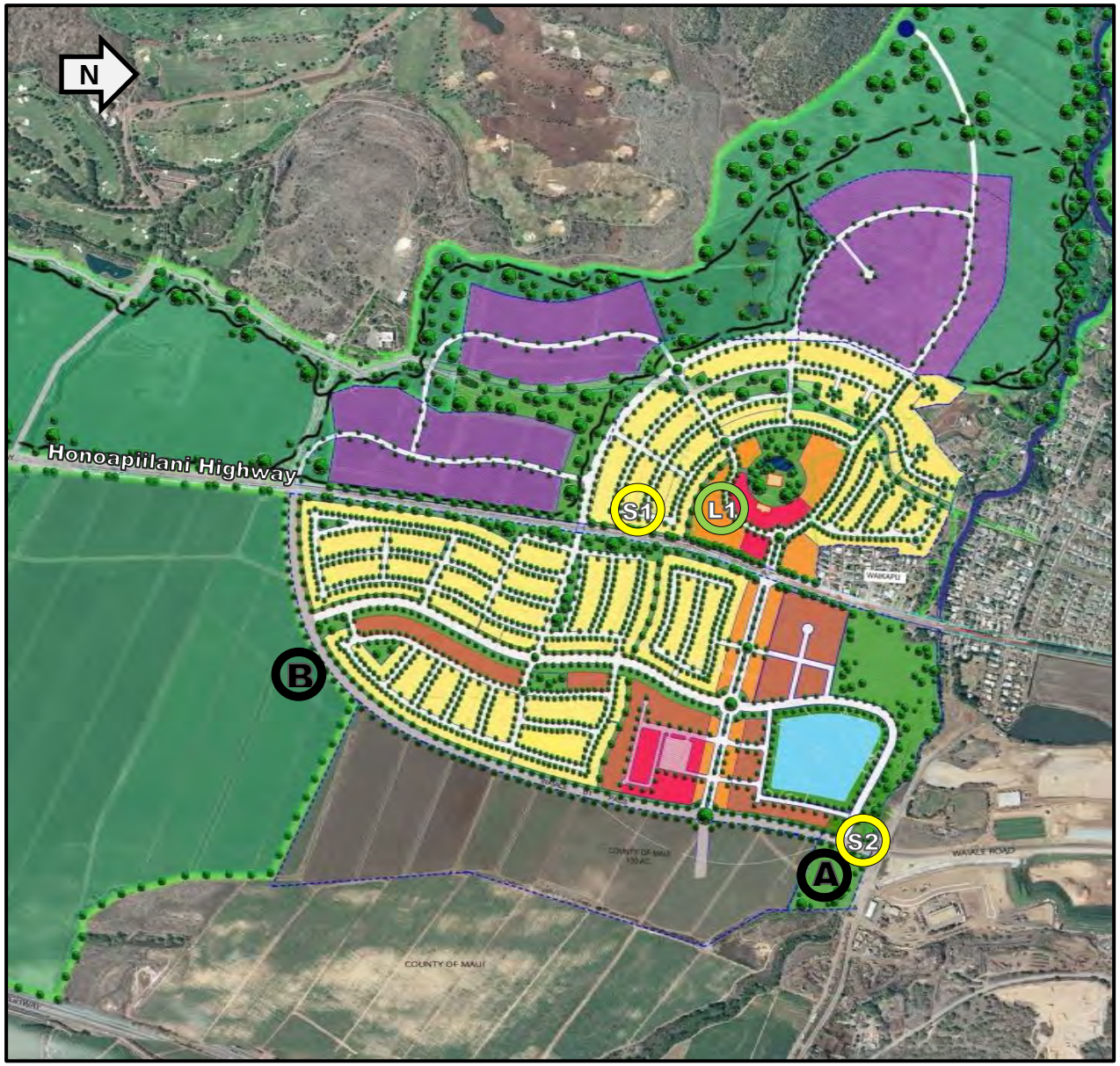
D. L. ADAMS ASSOCIATES
acoustics | performing arts | technology

PROJECT: Waikapu Country Town		
PROJECT NO: 13-06	DATE: November 2016	FIGURE: 1

FEDERAL HIGHWAY ADMINISTRATION NOISE ABATEMENT CRITERIA FOR HIGHWAY NOISE

ACTIVITY CATEGORY	ACTIVITY CATEGORY DESCRIPTION	HOURLY EQUIVALENT SOUND LEVEL L_{eq}
A	LANDS ON WHICH SERENITY AND QUIET ARE OF EXTRAORDINARY SIGNIFICANCE AND SERVE AN IMPORTANT PUBLIC NEED AND WHERE THE PRESERVATION OF THOSE QUALITIES IS ESSENTIAL IF THE AREA IS TO CONTINUE TO SERVE ITS INTENDED PURPOSE.	57 dBA (EXTERIOR)
B	RESIDENTIAL	67 dBA (EXTERIOR)
C	ACTIVE SPORT AREAS, AMPHITHEATERS, AUDITORIUMS, CAMPGROUNDS, CEMETERIES, DAY CARE CENTERS, HOSPITALS, LIBRARIES, MEDICAL FACILITIES, PARKS, PICNIC AREAS, PLACES OF WORSHIP, PLAYGROUNDS, PUBLIC MEETING ROOMS, PUBLIC OR NONPROFIT INSTITUTIONAL STRUCTURES, RADIO STUDIOS, RECORDING STUDIOS, RECREATION AREAS, SECTION 4(F) SITES, SCHOOLS, TELEVISION STUDIOS, TRAILS, AND TRAIL CROSSINGS	67 dBA (EXTERIOR)
D	AUDITORIUMS, DAY CARE CENTERS, HOSPITALS, LIBRARIES, MEDICAL FACILITIES, PLACES OF WORSHIP, PUBLIC MEETING ROOMS, PUBLIC OR NONPROFIT INSTITUTIONAL STRUCTURES, RADIO STUDIOS, RECORDING STUDIOS, SCHOOLS, AND TELEVISION STUDIOS .	52 dBA (INTERIOR)
E	HOTELS, MOTELS, OFFICES, RESTAURANTS/BARS, AND OTHER DEVELOPED LANDS, PROPERTIES OR ACTIVITIES NOT INCLUDED IN A-D OR F.	72 dBA (EXTERIOR)
F	AGRICULTURE, AIRPORTS, BUS YARDS, EMERGENCY SERVICES, INDUSTRIAL, LOGGING, MAINTENANCE FACILITIES, MANUFACTURING, MINING, RAIL YARDS, RETAIL FACILITIES, SHIPYARDS, UTILITIES (WATER RESOURCES, WATER TREATMENT, ELECTRICAL), AND WAREHOUSING	N/A
G	UNDEVELOPED LANDS THAT ARE NOT PREMITTED	N/A

Site Plan and Noise Measurement Locations



Legend

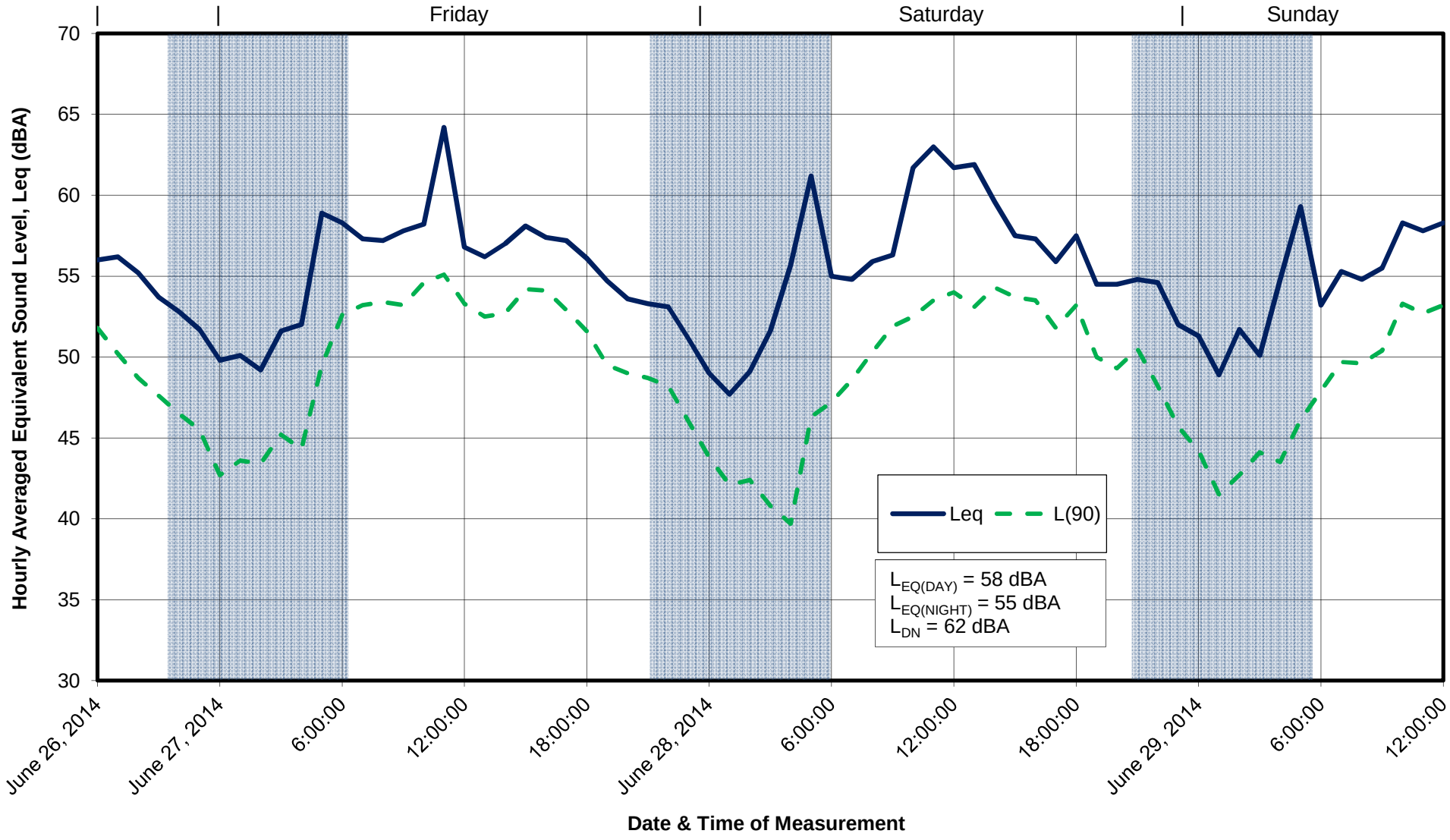
- Long Term Noise Measurement Location
- Short Term Noise Measurement Location
- A — Waste Water Treatment Site Option A
- B — Waste Water Treatment Site Option B

D. L. ADAMS ASSOCIATES
acoustics | performing arts | technology

Waikapu Country Town

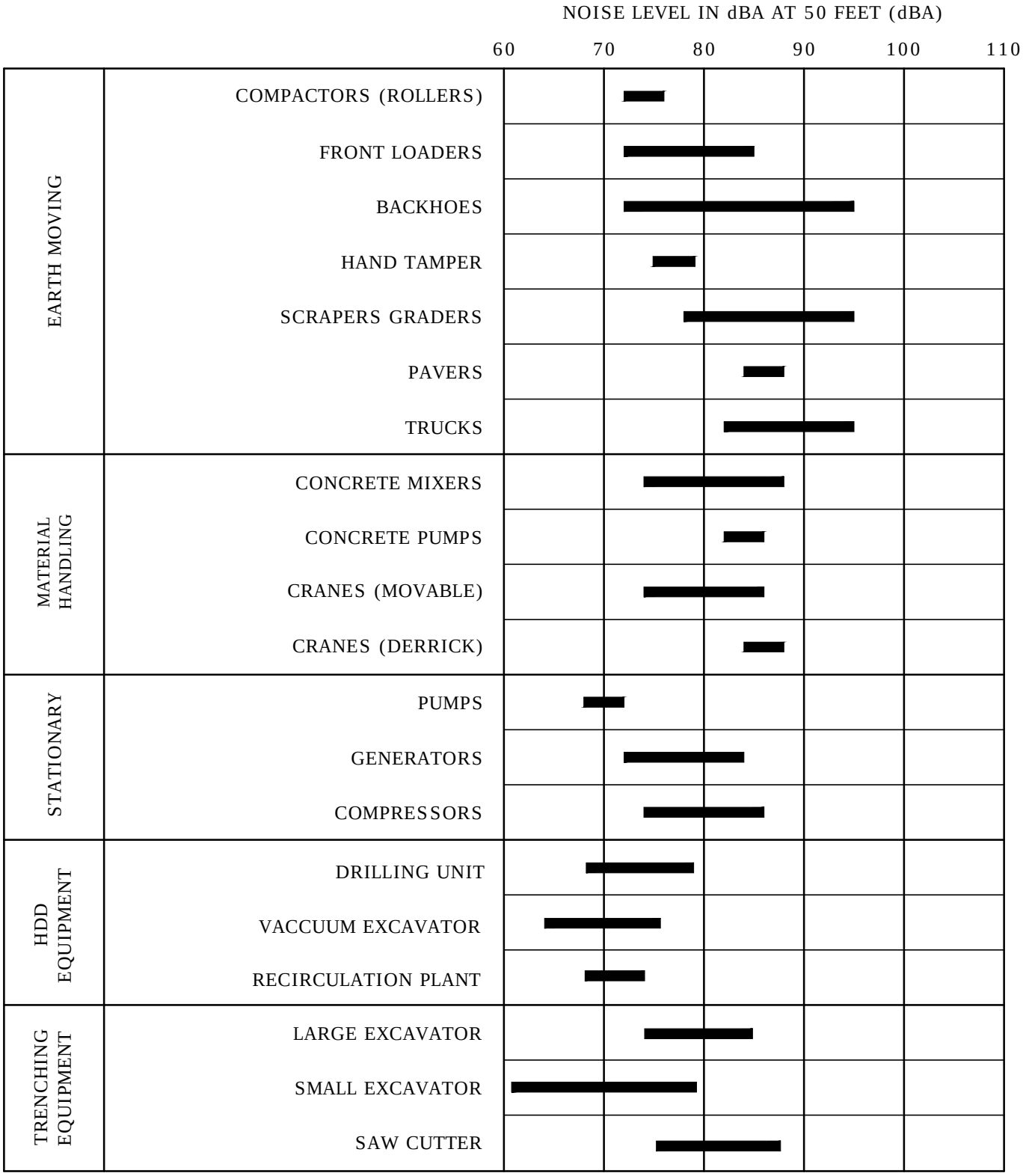
PROJECT NO:	DATE:	FIGURE:
13-06	November 2016	3

Long Term Noise Measurements - Location L1



D. L. ADAMS ASSOCIATES acoustics | performing arts | technology	PROJECT: Waikapu County Town EA		
	PROJECT NO: 13-06	DATE: November 2016	FIGURE: 4

TYPICAL NOISE LEVELS FROM CONSTRUCTION EQUIPMENT



NOTE: BASED ON LIMITED AVAILABLE DATA SAMPLES

D. L. ADAMS ASSOCIATES
acoustics | performing arts | technology

PROJECT:		
Waikapu Country Town		
PROJECT NO: 13-06	DATE: November 2016	FIGURE: 5

Waste Water Treatment Operations Projected Noise Levels – Facility Location Option A

Noise Level Contours

- = 40-45 dBA
- = 45-50 dBA
- = 50-55 dBA
- = 55-60 dBA
- = 60-65 dBA
- = 65-70 dBA
- = 70-75 dBA

D. L. ADAMS ASSOCIATES
acoustics | performing arts | technology

Waikapu Country Town

PROJECT NO:	DATE:	FIGURE:
13-06	November 2016	6

Waste Water Treatment Operations Projected Noise Levels – Facility Location Option B

Noise Level Contours

- = 40-45 dBA
- = 45-50 dBA
- = 50-55 dBA
- = 55-60 dBA
- = 60-65 dBA
- = 65-70 dBA
- = 70-75 dBA

D. L. ADAMS ASSOCIATES
acoustics | performing arts | technology

Waikapu Country Town

PROJECT NO:	DATE:	FIGURE:
13-06	November 2016	7

Vehicular Traffic Noise Contours – Existing Project Condition

Noise Level Contours

- = 40-45 dBA
- = 45-50 dBA
- = 50-55 dBA
- = 55-60 dBA
- = 60-65 dBA
- = 65-70 dBA
- = 70-75 dBA

D. L. ADAMS ASSOCIATES
acoustics | performing arts | technology

Waikapu Country Town

PROJECT NO:	DATE:	FIGURE:
13-06	November 2016	8

Vehicular Traffic Noise Contours – Future without Project Condition

Noise Level Contours

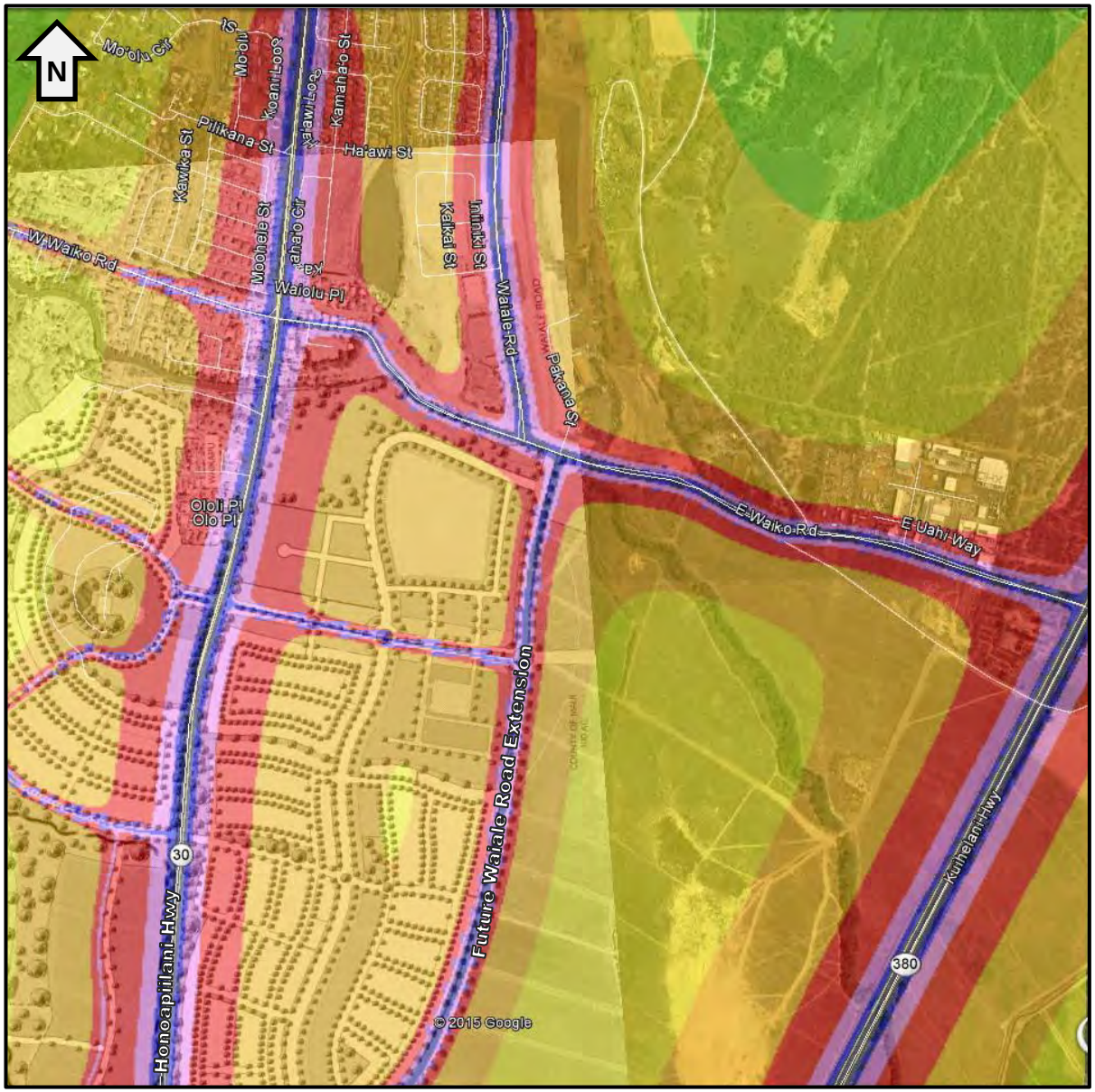
- = 40-45 dBA
- = 45-50 dBA
- = 50-55 dBA
- = 55-60 dBA
- = 60-65 dBA
- = 65-70 dBA
- = 70-75 dBA

D. L. ADAMS ASSOCIATES
acoustics | performing arts | technology

Waikapu Country Town

PROJECT NO:	DATE:	FIGURE:
13-06	November 2016	9

Vehicular Traffic Noise Contours – Future with Project Condition



Noise Level Contours

- = 40-45 dBA
- = 45-50 dBA
- = 50-55 dBA
- = 55-60 dBA
- = 60-65 dBA
- = 65-70 dBA
- = 70-75 dBA

D. L. ADAMS ASSOCIATES
acoustics | performing arts | technology

Waikapu Country Town

PROJECT NO:	DATE:	FIGURE:
13-06	November 2016	10

Projected Change in Traffic Noise Levels Due to Project

Daytime Traffic Noise Delta Contours

= Δ 1-3 dB
= Δ 3-5 dB
= Δ >5 dB

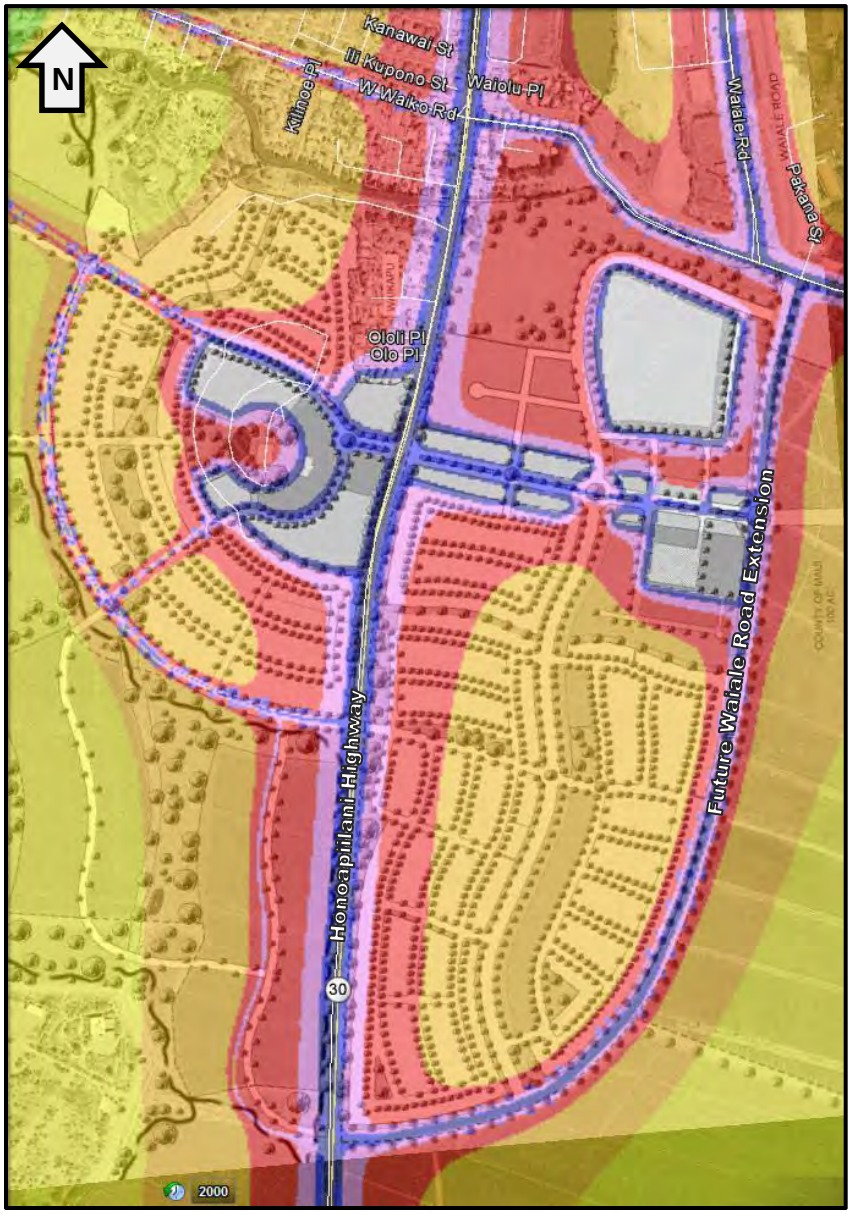
Δ = "Future with Project" - "Future without Project"

D. L. ADAMS ASSOCIATES
acoustics | performing arts | technology

Waikapu Country Town

PROJECT NO:	DATE:	FIGURE:
13-06	November 2016	11

Waikapu Country Town Noise Map



Noise Level Contours

- = 40-45 dBA
- = 45-50 dBA
- = 50-55 dBA
- = 55-60 dBA
- = 60-65 dBA
- = 65-70 dBA
- = 70-75 dBA

Noise map includes daytime vehicular traffic and stationary mechanical equipment at the commercial, mixed use, and school sites.

D. L. ADAMS ASSOCIATES
acoustics | performing arts | technology

Waikapu Country Town

PROJECT NO:	DATE:	FIGURE:
13-06	November 2016	12

APPENDIX A

Acoustic Terminology

Acoustic Terminology

Sound Pressure Level

Sound, or noise, is the term given to variations in air pressure that are capable of being detected by the human ear. Small fluctuations in atmospheric pressure (sound pressure) constitute the physical property measured with a sound pressure level meter. Because the human ear can detect variations in atmospheric pressure over such a large range of magnitudes, sound pressure is expressed on a logarithmic scale in units called decibels (dB). Noise is defined as Aunwanted@ sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/P_{ref}) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and P_{ref} is the reference pressure, 20 µPa, which is approximately the lowest sound pressure that can be detected by the human ear. For example:

If P = 20 µPa, then SPL = 0 dB
If P = 200 µPa, then SPL = 20 dB
If P = 2000 µPa, then SPL = 40 dB

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound sources, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined sound level of 53 dB, not 100 dB. Two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 6 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level

Studies have shown conclusively that at equal sound pressure levels, people are generally more sensitive to certain higher frequency sounds (such as made by speech, horns, and whistles) than most lower frequency sounds (such as made by motors and engines)[1] at the same level. To address this preferential response to frequency, the A-weighted scale was developed. The A-weighted scale adjusts the sound level in each frequency band in much the same manner that the human auditory system does. Thus the A-weighted sound level (read as "dBA") becomes a single number that defines the level of a sound and has some correlation with the sensitivity of the human ear to that sound. Different sounds with the same A-weighted sound level are perceived as being equally loud. The A-weighted noise level is commonly used today in environmental noise analysis and in noise regulations. Typical values of the A-weighted sound level of various noise sources are shown in Figure A-1.

[1] D.W. Robinson and R.S. Dadson, AA Re-Determination of the Equal-Loudness Relations for Pure Tones,@ *British Journal of Applied Physics*, vol. 7, pp. 166 - 181, 1956. (Adopted by the International Standards Organization as Recommendation R-226.

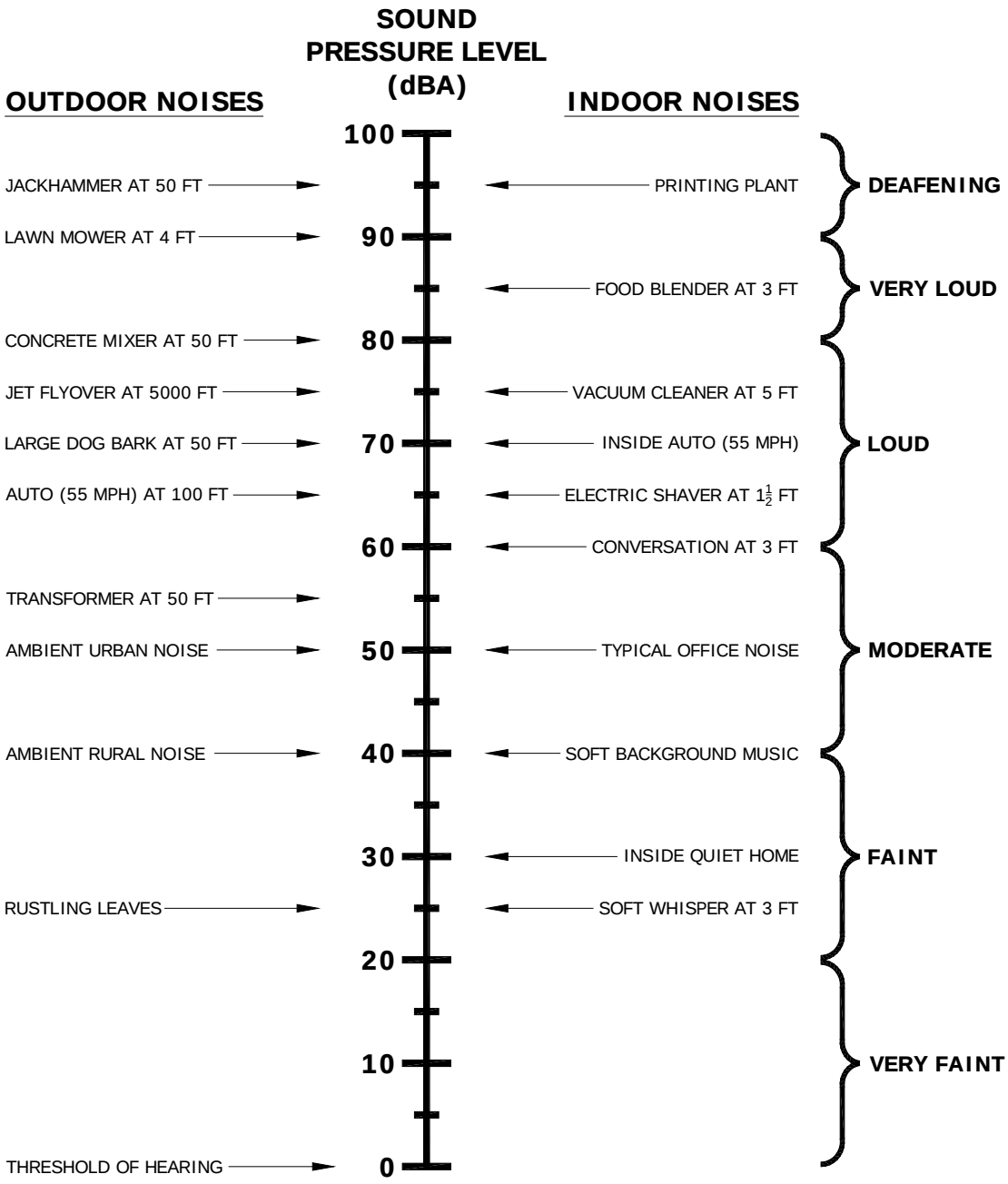


Figure A-1. Common Outdoor/Indoor Sound Levels

Equivalent Sound Level

The Equivalent Sound Level (L_{eq}) is a type of average which represents the steady level that, integrated over a time period, would produce the same energy as the actual signal. The actual *instantaneous* noise levels typically fluctuate above and below the measured L_{eq} during the measurement period. The A-weighted L_{eq} is a common index for measuring environmental noise. A graphical description of the equivalent sound level is shown in Figure A-2.

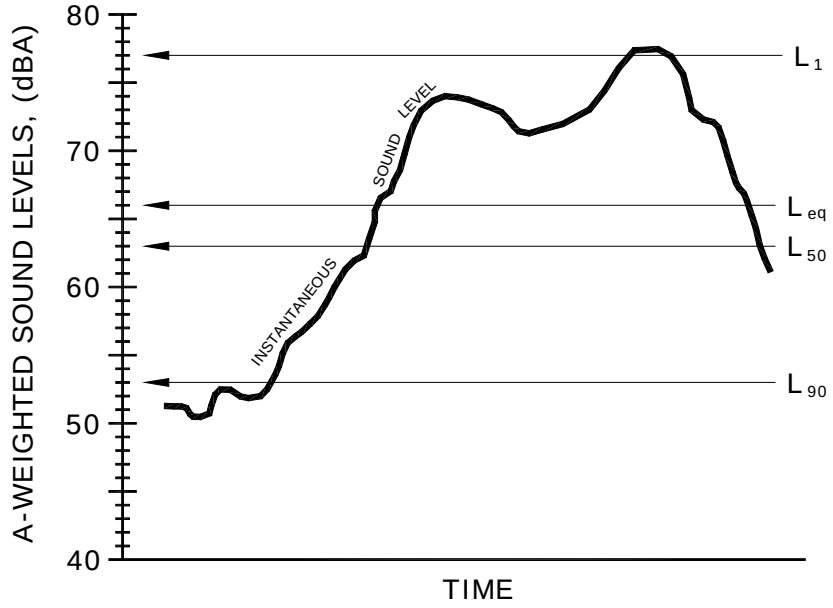


Figure A-2. Example Graph of Equivalent and Statistical Sound Levels

Statistical Sound Level

The sound levels of long-term noise producing activities such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, a statistically-based method of expressing sound or noise levels has been developed. It is known as the Exceedence Level, L_n. The L_n represents the sound level that is exceeded for n% of the measurement time period. For example, L_{10} = 60 dBA indicates that for the duration of the measurement period, the sound level exceeded 60 dBA 10% of the time. Typically, in noise regulations and standards, the specified time period is one hour. Commonly used Exceedence Levels include L_{01}, L_{10}, L_{50}, and L_{90}, which are widely used to assess community and environmental noise. A graphical description of the equivalent sound level is shown in Figure A-2.

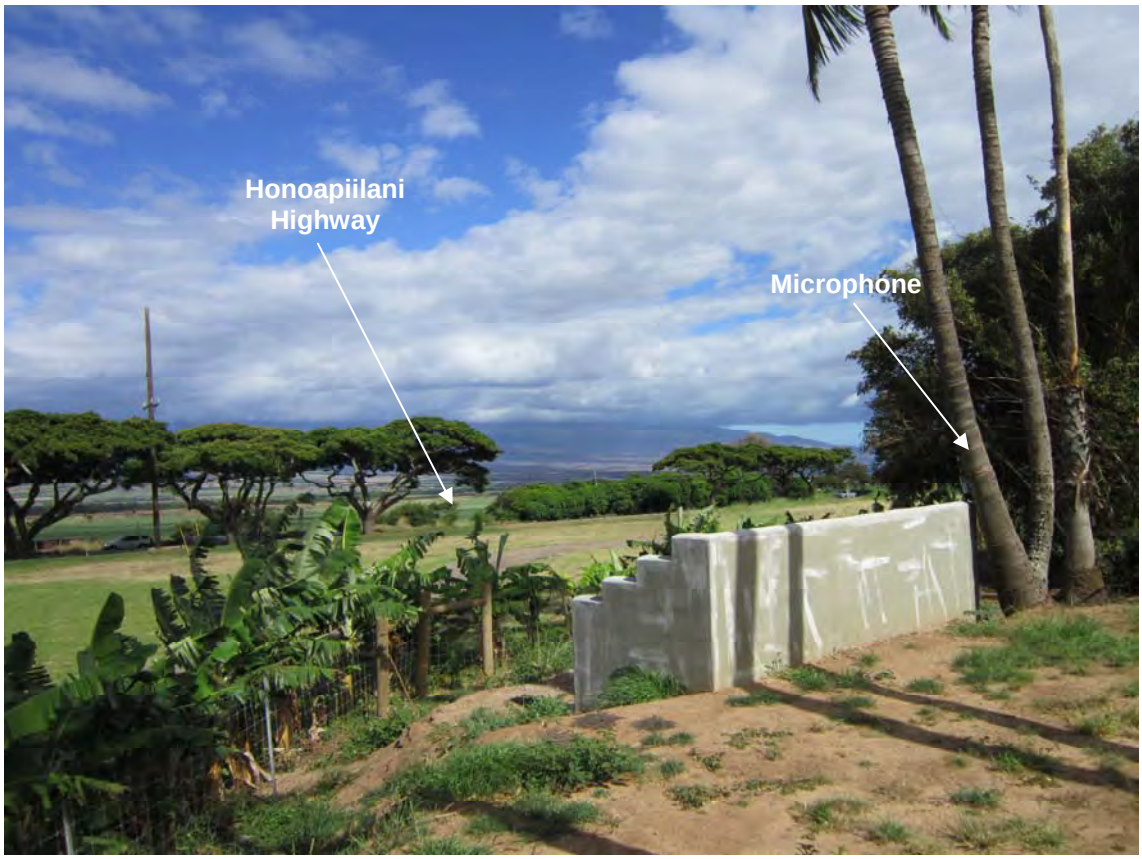
Day-Night Equivalent Sound Level

The Day-Night Equivalent Sound Level, L_{dn}, is the Equivalent Sound Level, L_{eq}, measured over a 24-hour period. However, a 10 dB penalty is added to the noise levels recorded between 10 p.m. and 7 a.m. to account for people's higher sensitivity to noise at night when the background noise level is typically lower. The L_{dn} is a commonly used noise descriptor in assessing land use compatibility, and is widely used by federal and local agencies and standards organizations.

APPENDIX B

Photographs at Project Site

.



Location L1

Located at the center of the project site near the events stage, approximately 280 feet from Honoapiilani Highway.

Microphone mounted on a tripod in palm tree approximately 8' above grade.

APPENDIX E

Archaeological Inventory Survey

DRAFT ARCHAEOLOGICAL INVENTORY SURVEY REPORT FOR SEVERAL PARCELS OF LAND SITUATED WITHIN WAIKAPŪ *AHUPUA`A;* WAILUKU DISTRICT PŪ`ALI KOMOHANA *MOKU*

LOCATED AT TMK: [2] 3-6-002:003; 3-6-004:003, 006; and 3-6-005:007;

ISLAND OF MAUI

FOR: Waikapū Partners LLC.,

BY: Diane Guerriero (B.A.), Andre`e Conley-Kapoi (M.A.), Lisa J. Rotunno-Hazuka (B.A.)

and Jeffrey Pantaleo (MA)

SEPTEMBER 2013

ARCHAEOLOGICAL SERVICES HAWAII, LLC.,
POB 1015; PU`UNENE, HI
96784-1015

"Protecting, Preserving, Interpreting the Past, While Planning the Future"

EXECUTIVE SUMMARY

Under contract to Waikapū Partners, LLC, ASH, Archaeological Services Hawaii, LLC, of Makawao, conducted an archaeological inventory survey (AIS) of several parcels (TMK's 3-6-002:003; 3-6-004:003, 006; and 3-6-005:007) comprising approximately 503-acres. The project area is situated in the upper Waikapū *ahupua`a*, Traditional *Moku* Pū`ali Komohana, Wailuku District, Island of Maui. Waikapū Partners landholdings total 1576-acres; however only 503-acres will be improved and the remaining land will continue in sugarcane and or small scale agriculture. The current investigation was conducted to determine presence/absence, extent, and significance of historic properties within the project area and to formulate future mitigation measures for these remains within the subject area.

The proposed development plan consists of single and multi-family residential units, open space, commercial and civic properties with open space. The project area was divided into five zones based primarily on the TMK's. From *mauka* to *makai* the zones are as follows: Parcel 3 Mauka, constitutes the *mauka* section of TMK 3-6-004:003; Parcel 3 Waena is the middle and remaining section of TMK 3-6-004:003: Parcel 6 is TMK 3-6-004:006; Parcel 7 is the current Maui Tropical Plantation landholdings 3-6-004:007 and Parcel 3 Makai is within TMK 3-6-002:003.

The current undertaking consisted of a pedestrian survey and subsurface exploration through the execution of 150 backhoe test trenches within the five aforementioned zones. Four historic properties designated Sites 50-50-04-7881-7884 (formerly TS1, 3-5) comprised of 19 subcomponent features were newly recorded with the majority related to sugarcane cultivation. One historic property, Site 5197 Waihe`e Ditch is extant within the central portion of the project area and was also recorded. Site 7881 Features 1-18 consists of concrete lined ditches, sluice gates, dirt culverts with concrete lined headwalls. 7882 (TS3) is a disturbed, historic L-shaped retaining wall. Site 7883 (TS3) comprises a World War II bunker and Site 7884 Features 1- 3 (TS 2 and 5) are secondarily deposited historic materials recorded at three localities within the project area. The subsurface testing program constituted 150 backhoe trenches which were primarily negative for cultural remains.

Sites 50-50-04-7881-7884 are assessed a significance of Criterion D, as they have yielded, or have the potential to yield significant information pertaining to the history of the area. Site 7883, the World War II bunker is also significant under Criterion C, as a distinct method or style of construction during a certain era.

Based on the proposed development plan, the historic scatters (Site 7884 Features 2-3) within Parcels 6 and 7 will be adversely affected during development and portions of Waihe`e Ditch (Site 5197) will be

covered. These historic properties have been adequately documented and require no further work besides construction monitoring. Within Parcel 3 Mauka, Sites 7881 (agricultural waterways, sluice gates, reservoirs), 7882 (L-shaped retaining wall) and 7883 (WWII bunker) have also been documented at the inventory level and may be removed if warranted; however archaeological monitoring is recommended. Additionally, if the WWII bunker (Site 7883) can't be incorporated into the development scheme, a memorial plaque documenting this historic site should be erected.

Archaeological monitoring of Parcel 3 Mauka and Waena is primarily recommended for those areas which contain former LCA's and Grants, as well as extant historic properties; however spot monitoring inspections of other localities not expressed above may also be instituted. Parcels 6 and 7 contain numerous LCA's and Grants; thus monitoring will initially be full time until the nature of the subsurface conditions in relationship to the proposed ground-altering activities is determined. Similarly for Parcel 3 Makai, monitoring will initially be full-time; yet it is envisioned that the primary focus will be along the eastern and western perimeters which are close to Waiale and Waiko Roads, areas known to contain sand dune burials. Prior to the commencement of construction, an Archaeological Monitoring Plan (AMP) detailing the localities to undergo monitoring procedures will be prepared and submitted to SHPD for review and approval.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 2

TABLE OF CONTENTS 4

LIST OF FIGURES 9

LIST OF TABLES 16

INTRODUCTION 16

PROJECT AREA 17

Parcel 3 Mauka 23

Parcel 3 Waena 23

Parcel 3 Makai 23

Parcel 6 23

Parcel 7 23

ENVIRONMENT 27

TRADITIONAL AND HISTORICALBACKGROUND 31

Mythological and Traditional Accounts 31

Early Historic Period 35

Historic Background Mid-1800 to Late-1800 36

PRIOR LAND USE 38

LAND TENURE 42

PREVIOUS ARCHAEOLOGY 49

Archaeological Research Conducted in the Environs of the Project Area 54

Previous Archaeological Research Conducted Within the Boundaries of the Project Area 59

SETTLEMENT PATTERNS 63

SITE EXPECITABILY 64

METHODS AND PROCEDURES 64

DOCUMENT REVIEW 64
FIELD METHODOLOGY 64
LAB WORK 65
RESULTS 66
SITE 50-50-04-7881 (TS 1) 66
Site 7881 Feature 1 66
Site 7881 Feature 2 71
Site 7881 Feature 3 73
Site 7881 Feature 3a 73
Site 7881 Feature 4 74
Site 7881 Feature 4a 75
Site 7881Feature 5 78
Site 7881 Feature 6 78
Site 7881 Feature 7 79
Site 7881 Feature 8 80
Site 7881Features 9-18 82
Site 7881 Feature 9 82
Site7881 Feature 10 83
Site 7881 Feature 11 85
Site 7881 Feature 12 86
Site 7881 Feature 13 87
Site 7881 Feature 14 88
Site 7881 Feature 15 89
Site 7881 Feature 16 90
Site 7881 Feature 17 91
Site 7881 Feature 18 93
SITE 7884 (TS2) FEATURE 1 96

SITE 7882 (TS3) 99
Site 50-50-04-7883 (TS3) 101
Temporary Site 4 106
Temporary Sites 21 and 22 109
Temporary Site 21 109
Temporary Site 22 109
PARCEL 3 MAUKA DISCUSSION 111
BACKHOE TESTING RESULTS 112
PARCEL 3 MAUKA 112
OVERALL STRATIGRAPHY 113
Trench 400 117
Trench 406 118
Trench 409 120
Trench 412 120
DISCUSSION PARCEL 3 MAUKA BACKHOE TRENCHING 123
PARCEL 3 WAENA 123
Temporary Sites 23-25 124
OVERALL STRATIGRAPHY FOR EASTERN SECTION OF PARCEL 3 WAENA 127
Trench 1 129
Trench 11 133
Trench 14 134
Trench 23 136
OVERALL STRATIGRAPHY FOR WESTERN SECTION OF PARCEL 3 WAENA 138
Table XIV. Summary of Trench Description for Western Portion of Parcel 3 Waena 138
Trench 08 139
Trench 011 141
Trench 015 142

DISCUSSION PARCEL 3 WAENA BACKHOE TRENCHING 144
PARCEL 3 MAKAI 144
OVERALL GENERAL STRATIGRAPHY 145
Trench 100 149
Trench 102 150
Trench 110 152
Trench 116 153
Trench 121 155
Trench 125 157
Trench 137 158
DISCUSSION PARCEL 3 MAKAI BACKHOE TRENCHING 160
PARCEL 6 160
OVERALL GENERAL STRATIGRAPHY 161
Trench 202 166
Trenches 205, 207 and 209 168
Trench 208 171
Trench 218 173
Trench 222 175
DISCUSSION PARCEL 6 BACKHOE TRENCHING 176
PARCEL 7 MAUI TROPICAL PLANTATION 177
OVERALL GENERAL STRATIGRAPHY 179
Trench 302 184
Trench 306 186
Trench 309 188
Trench 310 189
Trench 318 191
Trench 319 193

Trench 324-Site 7884 Fe. 3 193
Site 5197 Waihe`e Ditch 197
DISCUSSION OF PARCEL 7 206
CULTURAL MATERIALS 209
Ceramics 209
Glass 209
INITIAL SIGNIFICANCE ASSESSMENT 213
DISCUSSION 214
RECOMMENDATIONS 215
REFERENCES 216
APPENDIX A 219
PARCEL 3 MAUKA 220
PARCEL 3 WAENA 224
PARCEL 3 MAKAI 226
PARCEL 7 TRENCHES 243

LIST OF FIGURES

Figure 1. Location of Project Area on U.S.G.S. Wailuku Quadrangle 19
Figure 2. Tax Map Key 3-6-004 Showing Location of Project Areas-Parcel 3 Mauka and Parcel 3 Waena (TMK 3-6-004: 003), Parcel 6 (TMK 3-6-004: 006), Parcel 7 (different TMK 3-6-005:007), Parcel 3 Makai and Cane Flumes and Possible former Water source (Blue) (Also note LCA's and Grants outlined in background) 20
Figure 3. Enlarged Parcel 7 (Purple) Showing Grants, LCA's, Existing Water (Blue) and Possible Water Sources (Red) 21
Figure 4. Location of Parcel 3 Makai Project Area within Tax Map Key 3-6-002:003 (pors) 22
Figure 5. Location of Project Area on Aerial Photograph 24
Figure 6. Location of Project Area on Topographic Map of Waikapū Partners Landholdings (also shown are cane field roads) 25
Figure 7. Waikapū County Town Conceptual Development Map 26
Figure 8. Location of Historic Properties within Project Area 29
Figure 9. United States Department of Agriculture Soils Map with Project Area denoted in black 30
Figure 10. Map Illustrating Project Area, Wailuku District and *Ahupua`a* Boundaries from John Wesley's *A Gazetteer of Territory of Hawai`i* (1935) 34
Figure 11. Map of Maui Island Showing Traditional Moku (Districts) from Kame`lelehiwa (1992) 34
Figure 12. Dodge, F. S. and John M. Donn (1906) Hawaiian Government Survey Map of Maui 37
Figure 13. Map of Upper Waikapū Showing *`ili*, *'Auwai* , Flumes, Ditches, Structures and Reservoir #2 39
Figure 14. Copy of Monsarrat Map of 1882 40
Figure 15. Enlarged Portion of Monsarrats' Map (1882) Showing LCA's and Areas with Cane in Upper Waikapū 41
Figure 16. Walker Site Map depicting locations of archaeological site locations (adapted from Sterling 1998). 51
Figure 17. USGS Map Showing Location of Previous Archaeological Investigations and Historic Properties in Waikapū *ahupua`a* 52
Figure 18. USGS Map Showing Location of Former Plantation Camps Properties in Waikapū *Ahupua`a* 53
Figure 19. USGS Map Showing Location of Previous Archaeological Investigations in Upper Waikapū 56

Figure 20. USGS Map Showing Location of Previous Archaeological Investigations in Upper Waikapū 57
Figure 21. Plan View Map of SCS Project Area Showing Trench Locations ST1-31 within Current Parcel 3 Mauka and Parcel 6 60
Figure 22. Plan View Map of a portion of Parcel 3 Mauka Showing Location of 7881 Features 1-15 and Site 7883 Features 2 and 3 68
Figure 23. Plan View Map Showing Relationship of Site 7881 Features 1-6 69
Figure 24. Site 7881 Feature 1 (TS1), View to Northwest towards Upper Valley 70
Figure 25. Site 7881 Feature 1, View to North with Feature 6 on Right 70
Figure 26. Site 7881 Feature 1 (TS1) Emptying into Reservoir (Feature 3) thru modernized Chute (Feature 3a) (View to South) 71
Figure 27. Site 7881 Feature 2 Ditch with Feature 5 in the foreground right (View to West) 72
Figure 28. 7881 Feature 2 Ditch at juncture with Feature 7 diversion feature in foreground (View to West) 72
Figure 29. Site 7881 Feature 3 Reservoir, View to South 73
Figure 30. Overview Photograph of Feature 1 (Left) and Feature 3a (Right) 74
Figure 31. Photograph of Site 7881Features 1 and 2 ditches and diversion structures Features 4, 4a and 5 (View to South) 75
Figure 32. Photograph of Site 7881 Features 4, 4a and 5 Water Diversion Features (Bottom) 76
Figure 33. Site 7881 Feature 1 (ditch), Feature 5 (Water Containment Feature) and Feature 4 (Sluice Gate) (View to North) 77
Figure 34. Site 7881 Feature 2 ditch Flowing East from Feature 4a with Portion of Feature 5 bottom right (View to East) 77
Figure 35. Photograph of Site 7881 Feature 6 foreground with Feature 1 ditch background (View to North) 78
Figure 36. Photograph of Site 7881 Feature 1-Ditch (left) and Feature 6-Water Diversion (right) (View to North) 79
Figure 37. Site 7881 Feature 7 Sluice Gate in Foreground and Feature 8 Background (View to Northeast) 80
Figure 38. Photograph of Site 7881 Feature 8 showing Two Channels, Feature 2 Ditch continues East and Overflow beyond Sluice Gate to Waikapū Stream (View to North) 81
Figure 39. Up-Close Photograph of Feature 8 (View to east) 81
Figure 40. Photograph of Site 7881 Feature 9 Intake on West side (View to East) 82
Figure 41. Photograph of Site 7881 Feature 9 Out take on East (View to North) 83
Figure 42. Photograph of Site 7881 Feature 10 Intake on West (View to East) 83

Figure 43. Site 7881 Feature 2 Ditch along the north side of access road are remnant retention walls, mortar and water-worn cobbles and Sub-angular basalt cobbles, section before Site 7881 Feature 10, View to North 84
Figure 44. Feature 2 Ditch flowing into Site 7881 Feature 10 Culvert (View to West) 84
Figure 45. Photograph of Site 7881 Feature 11 Intake on West (View to East) 85
Figure 46. Photograph of Site 7881 Feature 11 Out-take (View to West) 86
Figure 47. Overview Photographs of Site 7881 Feature 12 Intake (View to East) left and Feature 12 Out-take (View to West) right 87
Figure 48. Photographs of Site 7881 Feature 13 Intake (View to East) left; Feature 13 Out-take (View to West) right 88
Figure 49. Overview Photographs of Site 7881 Feature 14 Intake (View to East) left; Feature 14 Out-take (View to West) right 89
Figure 50. Photographs of Site 7881 Feature 15 In-take (View to East) left and Feature 15 Out-take View to West (right) 90
Figure 51. Photographs of Site 7881 Feature 16 Intake, View to Southeast (left) Out-Take, View to West 91
Figure 52. Overview Photographs of Site 7881 Feature 17 Intake (View to East) left and Feature 17 Out-take (View to East) 92
Figure 53. Photograph of Site 7881 Feature 17 Out-take (View to South) 92
Figure 54. Photograph of Site 7881 Feature 17 Valves (View to South) 93
Figure 55. Overview Photographs of Site 7881 Feature 18 and Faced Wall (left photo) (View to Northeast); Feature 18 East side (right photo) (View to East) 94
Figure 56. Plan View Map of Parcel 3 Mauka and Portions of Parcel 6 and 7 Showing Location of 7881 Features 15-18, Site 7882, 7883 Feature 2 and 3 and Site 7884 Features 1-2 95
Figure 57. Site 7884 Feature 1 Historic Scatter along Feature 2 Ditch, View to West 96
Figure 58. Site 7884 Feature 1 (TS2) Secondary Deposit of Historic Refuse 97
Figure 59. Overview Photograph of Site 7884 Feature 1 Historic Material 97
Figure 60. Photograph of Ceramic Assemblage 98
Figure 61. Overview Photograph of Site 50-50-04-7882 an L-shaped Retaining Wall, View to Southeast 99
Figure 62. Overview Photograph of Cross-Section of Site 7882, View to East 100
Figure 63. Site 7882 foreground and Site 7881 Feature 2 background, View to Southwest 100
Figure 64. Plan View Map of Site 50-50-04-7882 101
Figure 65. Overview Photograph of Site 7883 (TS3), View to West (top) View to East (bottom) 103

Figure 66. Plan View Map of Site 7883 World War II Bunker 104
Figure 67. Overview Photograph of Embrasure with Concrete Encased Pipe to Right (top) View to West; Photograph of Access into Site 7883 (TS3) (bottom) View to West 105
Figure 68. Overview Photograph of Isthmus from Site 7883 (TS3), View to East 106
Figure 69. Overview Photograph of Site 7883 Feature 1, View to West 107
Figure 70. Overview Photograph of Site 7883 Feature 1 with Modern PVC Valves 107
Figure 71. Site 7883 Feature 1 Pipe Fittings 108
Figure 72. Photograph of Coca-Cola Bottle 108
Figure 73. Photograph of Temporary Site 21 Rock Mound and Temporary Site 22 in background within Parcel 3 Mauka, View to Northwest 110
Figure 74. Overview Photograph of Temporary Sites 21 and 22 within Parcel 3 Mauka, View to Northwest 110
Figure 75. Photograph of Temporary Site 22 Rock Mound within Parcel 3 Mauka, View to Northwest 111
Figure 76. Plan View Map Showing Northeast Portion (Red) of Parcel 3 Mauka and LCA's and Grants 114
Figure 77. Plan View Map Showing Parcel 3 Mauka Northeast Portion and Trench Locations 115
Figure 78. Overview of Parcel 3 Mauka North from TR-401, View to Northeast 116
Figure 79. Overview Parcel 3 Mauka North, View to East 116
Figure 80. Stratigraphic Profile of TR 400 North Wall 118
Figure 81. Photograph of TR406 South Wall (Top); Stratigraphic Profile of TR406 South Wall (Bottom) 119
Figure 82. Stratigraphic Profile of TR 409 East Wall 120
Figure 83. Overview of TR 412 within Parcel 3 Mauka, View to East 121
Figure 84. Photograph of TR 412 South Wall (top); and Stratigraphic Profile of TR 412 South Wall (bottom) 122
Figure 85. Overview Photograph of Parcel 3 Waena Eastern Section with Clearing Pile Site 7884 Feature 3 in the background, View to Northwest 124
Figure 86. Plan View Topographic Map Showing Trench`s 1-27 and 01-015 and TS 23-25 within Parcel 3 Waena 125
Figure 87. Overview Photograph of Parcel 3 Waena from TR 22 with Temporary Site 23 Rock Mound, View to Southeast 126
Figure 88. Overview Photograph of Parcel 3 Waena (Western Section) from Reservoir, View to South 126
Figure 89. Overview Photograph of TR 1 North Wall Profile 130
Figure 90. Stratigraphic Profile of TR 1 North Wall Profile 131
Figure 91. Up Close Photograph of Sand Deposit within TR 1, View to North 131

Figure 92. Stratigraphic Profile of TR 1 West Wall Profile 132
Figure 93. Photograph of Stratigraphic Profile of TR 11 South Wall..... 133
Figure 94. Stratigraphic Profile of TR 11 South Wall 134
Figure 95. Photograph of Stratigraphic Profile of TR 14 South Wall..... 135
Figure 96. Stratigraphic Profile of TR 14 South Wall 136
Figure 97. Photograph of Stratigraphic Profile of TR 23 East Wall 137
Figure 98. Stratigraphic Profile of TR 23 East Wall..... 137
Figure 99. Photograph of Stratigraphic Profile of TR 08 West Wall..... 140
Figure 100. Stratigraphic Profile of TR 08 West Wall 140
Figure 101. Photograph of Stratigraphic Overview of TR 011 South Wall..... 141
Figure 102. Stragraphic Profile of TR 011 South Wall 142
Figure 103. Photograph of Stratigraphic Profile of TR 015 North Wall Profile..... 143
Figure 104. Stratigraphic Profile of TR 015 North Wall Profile 143
Figure 105. Plan View Topographic Map of Parcel 3 Makai (Yellow) Showing Location of Trenches 100-141, Grant and Reservoir 148
Figure 106. Photograph of Stratigraphic Profile of Trench 100 South Wall with Streambed Deposit.... 149
Figure 107. Stratigraphic Profile of Trench 100 South Wall 150
Figure 108. Photograph of Stratigraphic Profile of Trench 102 with Streambed Deposit, View to West151
Figure 109. Stratigraphic Profile TR 102 South Wall..... 151
Figure 110. Photograph of South Wall of Trench 110..... 152
Figure 111. Stratigraphic Profile of South Wall of Trench 110..... 153
Figure 112. Photograph of West Wall of Trench 116, View to West 154
Figure 113. Stratigraphic Profile TR 116 West Wall..... 154
Figure 114. Overview Photograph of Trench 121, View to South 155
Figure 115. Close-up Photograph of South Wall of TR 121 Showing Charcoal Staining..... 156
Figure 116. Stratigraphic Profile of South Wall of Trench 121 156
Figure 117. Photograph of West Wall of Trench 125, View to West 157
Figure 118. Stratigraphic Profile of West Wall of Trench 125 158
Figure 119. Photograph of South Wall of Trench 137 159
Figure 120. Stratigraphic Profile of Trench 137 South Wall 159
Figure 121. Overview Photograph of Parcel 6 Showing Commercial Agricultural Activities, View to Northeast 161
Figure 122. Overview Photograph of Parcel 6 Showing Fallow Sugarcane and Proposed Location of TR 212, View to East 162

Figure 123. Overview Photograph of Parcel 6 after Mature Sugarcane was Removed, View from TR 223 and to Northwest 162
Figure 124. Topographic Map Showing Location of Former Trenches 1-7 (Black), Current Backhoe Test Trenches 200-225 (Red) within Parcel 6 (Green) 163
Figure 125. Enlarged Topographic Map of Parcel 6 Showing location of LCA's and Grants 164
Figure 126. Photograph of North Wall near Base of Excavation of Test Unit 202 167
Figure 127. Stratigraphic Profile of North Wall of Test Unit 202 168
Figure 128. Photograph of South Profile of TR 205 (top); Stratigraphic Profile of South Wall TR 205 . 169
Figure 129. Photograph of South Wall of TR 207 170
Figure 130. Photograph of South Wall of TR 209 170
Figure 131. Overview Photograph of Trench 208 Pre-excavation within Parcel 6, View to East 171
Figure 132. Photograph of Stratigraphic Profile of Trench 208 (TR 208), North Wall 172
Figure 133. Stratigraphic Profile of North Wall of Trench 208 (TR 208) 172
Figure 134. Photograph of Site 7884 Feature 2 Secondarily Deposited Historic Materials around TR 218 173
Figure 135. Photograph of West Wall of Trench 218 (top) Stratigraphic Profile of Trench 218 (TR 218) West Wall 174
Figure 136. Photograph of West Wall of Trench 222 within Parcel 6 175
Figure 137. Stratigraphic Profile of West Wall of Trench 222 176
Figure 138. Overview Photograph of Parcel 7 in area of TR 300-303, View to West 178
Figure 139. Overview Photograph of Parcel 7 in area of TR-320, View to East 178
Figure 140. Overview Photograph of Parcel 7 in area of TR 318, View to West 178
Figure 141. Tax Map Key of Parcel 7 Showing Location of Trenches 300-324, LCA's and Grants 179
Figure 142. Overview Photograph of Trench 302 Pre-Excavation within Parcel 7, View to East 184
Figure 143. Photograph of East Wall of TR 302 within Parcel 7 185
Figure 144. Stratigraphic Profile of TR 302 East Wall 185
Figure 145. Overview Photograph of TR 306 Pre-Excavation, View to South 186
Figure 146. Photograph of East Wall of TR 306 187
Figure 147. Stratigraphic Profile of TR 306 East Wall 187
Figure 148. Photograph of South Wall of Trench 309 188
Figure 149. Stratigraphic Profile of South Wall of Trench 309 189
Figure 150. Photograph of South Wall of Trench 310 190
Figure 151. Stratigraphic Profile of South Wall of Trench 310 190
Figure 152. Overview Photograph of Trench 318 Base of Excavation 191

Figure 153. Photograph of South Wall of Trench 318 192
Figure 154. Stratigraphic Profile of South Wall of Trench 318 192
Figure 155. Photograph of TR 319 West Wall 193
Figure 156. Overview Photograph of TR 324 Pre-excavation, View to East 194
Figure 157. Photographs of North Wall of TR 324 (top); and Close-up of Gravel Deposit along North Wall 195
Figure 158. Stratigraphic Profile of Trench 324 North Wall 196
Figure 159. Historic Material from Site 7884 Feature 3 (TR 324) North Wall 196
Figure 160. Overview Photograph of Site 50-50-04-5197 Waihe'e Ditch Extending North to South thru the Waikapū Tropical Plantation Land Holdings (Google earth 2013) 197
Figure 161. State Department of Agriculture Map Showing Site 5197 Waihe`e Ditch and Spreckels Ditch 199
Figure 162. Overview Photograph Site 5197 Waihe'e Ditch Emerging from an Underground Culvert from the Northern Property Boundary, View to North 200
Figure 163. Overview Photograph of Waihe'e Ditch from an Underground Keystone Tunnel/Bridge, View to South 200
Figure 164. Overview Photograph of Keystone Arched Tunnel/Bridge, View to South 201
Figure 165. Overview Photograph of Site 5197 Waihe`e Ditch Showing two Types of Construction along the Ditch (photo from atop the keystone arched tunnel/bridge), View to South 201
Figure 166. Overview Photograph of Site 5197 Waihe'e Ditch Showing Older Construction with Stacked Rock Atop the Concrete Lined Ditch (View of Western Side Wall 202
Figure 167. Overview Photograph of Second Bridge from the North, Metal Beam and Cement Construction (background), Older Drainage Culvert (foreground), View to Northeast 202
Figure 168. Photographic Overview Second Bridge, Metal Beam and Concrete Construction, View to West 203
Figure 169. Photographic Overview from Second Bridge with Tee-Bar Reinforcements Across Ditch, View to Southwest 203
Figure 170. Overview Photograph of Third Bridge from North, Cement Construction with PVC Drainage, View to North 204
Figure 171. Overview Photograph of Third Bridge with Older Penstock with Metal Shut-off Valve (left), View to South 204
Figure 172. Overview Photograph of Fourth Bridge from North, West of Maui Tropical Plantation and Reservoir with Modern Wooden Construction, View to North 205

Figure 173. Overview Photograph of Site 5197 Waihe'e Ditch with Modern Concrete Lining, View to Northeast 205
Figure 174. Overview Photograph of Extant Portion of Concrete Swale along Northern Cane Easement in Parcel 7 207
Figure 175. Overview Photograph of Concrete Swale along Cane Flume Easement 208
Figure 176. Photograph of a Dark Olive Green Wine Bottle from Site 7884 Feature 3 at Parcel 7 TR 324 210
Figure 177. Photograph of Site 7884 Feature 3 from Parcel 7 TR 324 Ceramic Assemblages 210
Figure 178. Photograph of Glass Assemblages from Site 7884 Feature 3 Parcel 7 TR-324 211
Figure 179. Photograph of Ceramic Sherds on Surface by Site 7881 Feature 3 (Reservoir) Parcel 3 Mauka 211
Figure 180. Photograph of TS 2 Ceramics within Parcel 3 Mauka 212

LIST OF TABLES

Table I. Summary of Land Commission Awards within Parcel 3 Mauka 43
Table II. Continuation of Summary of Land Commission Awards within Parcel 3 Mauka 44
Table III. Summary of Grants within Parcel 3 Mauka 45
Table IV. Summary of Land Commission Awards within Parcel 6 46
Table V. Continued Summary of Land Commission Awards within Parcel 6 47
Table VI. Summary of Grant within Parcel 6 47
Table VII. Summary of Land Commission Awards within Parcel 7 48
Table VIII. Summary of Grants within Parcel 7 49
Table IX. Summary of Grants within Parcel 3 Makai 49
Table X. Previous Archaeological Studies Conducted in the Waikapū *Ahupua`a* 61
Table XI. Summary of Summary of Backhoe Trenches Parcel 3 Mauka North 117
Table XII. Summary of Trench Description for Eastern Section of Parcel 3 Waena 128
Table XIII. cont'd Summary of Trench Description for Eastern Portion of Parcel 3 Waena 129
Table XIV. Summary of Trench Description for Western Portion of Parcel 3 Waena 138
Table XV. Summary of Backhoe Trenches Parcel 3 Makai East of State Highway 30 146
Table XVI. cont'd Summary of Backhoe Trenches Parcel 3 Makai East of State Highway 30 147
Table XVII. Summary of Backhoe Trenches Parcel 6 165
Table XVIII. cont'd Summary of Backhoe Trenches Parcel 6 166
Table XIX. Summary of Backhoe Trenches Parcel 7 182
Table XX cont'd . Summary of Backhoe Trenches Parcel 7 183

INTRODUCTION

At the request of Mr. Michael Summers for client, Waikapū Partners, LLC, ASH, Archaeological Services Hawaii, LLC, of Wailuku, conducted an archaeological inventory survey (AIS) within several parcels (TMK's 3-6-002:003; 3-6-004:003, 006; and 3-6-005:007) consisting of approximately 503-acres situated in the upper Waikapū *ahupua`a*, Pū`ali Komohana Traditional *Moku,* Wailuku District, Island of Maui (Figures 1-7). Waikapū Partners landholdings total 1576 acres; however only 503-acres will be improved and the remaining will continue in sugarcane and or small scale agriculture. The current investigation was conducted to determine presence/absence, extent, and significance of historic properties within the project area and to formulate future mitigation measures for these remains and the project area.

The proposed improvements will be a combination of single and multi-family residential units, commercial and civic properties. Agriculturally classified lands will be rezoned to urban and rural and developed creating a "complete country community" within approximately 503-acres (see Figure 7). Although the majority of the project area has undergone compounded surficial disturbances from commercial and small scale agricultural and animal husbandry pursuits (see Figure 5) providing little evidence of surface historic properties, the area was intensively settled from the pre-Contact period through the historic era as evidenced by numerous *kuleana* lands (Land Commission Awards-LCA), several large lot grants, coupled with archival research and prior archaeological studies of the area (see Figures 2-4). Due to the expansive alterations across the subject area, the AIS procedures consisted of a pedestrian survey and subsurface investigations through mechanical excavations.

The pedestrian survey noted four historic properties designated Sites 50-50-04-7881-7884 (formerly TS1 -5) comprised of 19 subcomponent features with the majority of the features related to sugarcane cultivation (Figure 8). Site 7881 Features 1-18 consists of concrete lined ditches, sluice gates, dirt culverts with concrete lined headwalls. 7882 (TS3) is an historic L-shaped retaining wall. Site 7883 (TS4) the World War II bunker and Site 7884 Features 1- 3 (TS 2 and 5) are secondarily deposited historic materials recorded at three localities within the project area. The subsurface testing program constituted 150 backhoe trenches which were primarily negative for cultural remains.

PROJECT AREA

The project area is located on the northwestern alluvial slopes of the West Maui Mountains in Waikapū *ahupua'a* (Figure 1). It is comprised of approximately 520-acres within four separate TMK's 3-6-002:003; 3-6-004:003, 006; and 3-6-005:007. The subject area straddles Honoa`pi`ilani Highway in the area of the Maui Tropical Plantation, south of Waikapū Town proper (see Figures 2-7). It is bounded by Waikapū Stream to the north, portions of the Sandalwood Golf Course, an old rock Quarry (designated as

"Pit" on TMK) and sugarcane fields to the south, sugarcane fields to the east, and a reservoir and the West Maui Forest Reserve to the west. The project area slopes drastically from west to east ranging in elevation from 1080 ft. amsl to 230 ft. amsl. It contains two extant ditches, Waikapū Ditch South, which runs west to east along the northern boundary, and Waihe`e Ditch (Site 50-50-04-5197), which runs north to south and bounds the east side of Parcel 6 within the central portion of the parcel. Also noted on several maps is the Everett Ditch which extends from the upper valley similar and parallel to Waikapū Ditch South, but it eventually curves to the north following along the base of Wailuku Heights Subdivision. The presence of a southern leg (Waikapū Ditch South) implies that a Waikapū Ditch North would have been present; however no such ditch has been observed. Interestingly, if a northern leg was present, it would have likely followed the path of Everett Ditch.

Although the project area extends all the way to the southern edge of the stream, the development will remain at least 100 ft. from the stream, such that the cane access road which parallels the stream, as well as the steep to moderate slopes down to the stream's edge will not be encroached upon by development. This 100 ft. buffer zone was mandated in 1992 by the State Land Use District Boundary Review for Maui, Molokai, Lanai, Honolulu where a 100-ft corridor on both sides of Waikapū Stream was placed into a Conservation District (Office of State Planning: 31).

For the purposes of discussion and testing, the subject project area has been divided into five distinct zones, all of which correspond to the four respective TMK number, with the exception of TMK 3-6-004:003 which was subdivided into two areas. These five zones consist of Parcel 3 Mauka and Parcel 3 Waena within TMK 3-6-004:003, Parcel 3 Makai at TMK 3-6-002:003, Parcel 6 is within TMK 3-6-005:006 and Parcel 7, which constitutes the Maui Tropical Plantation area at TMK 3-6-005:007. These zones are further discussed below and shown on Figures 1, 2, 6 and 7. .

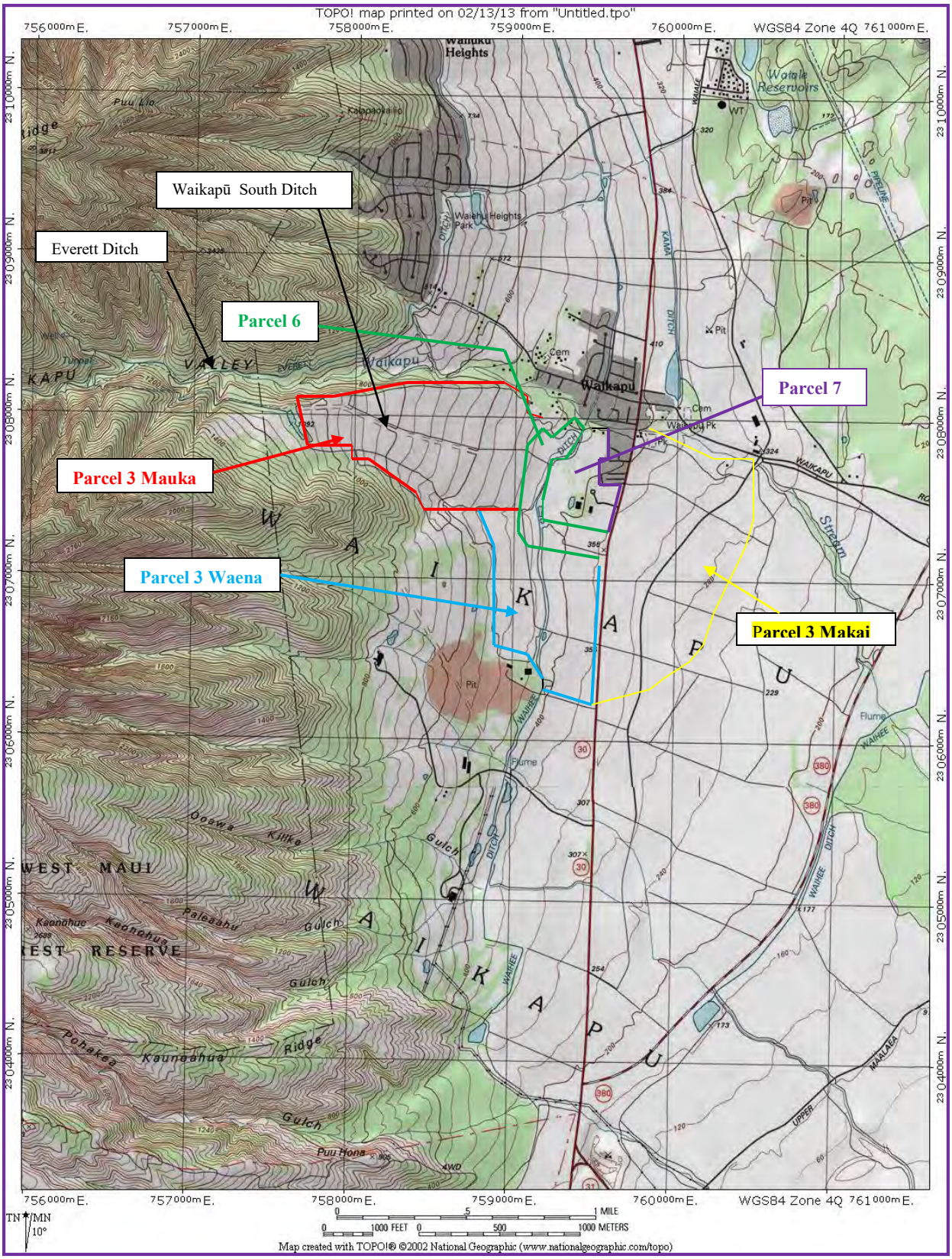


Figure 1. Location of Project Area on U.S.G.S. Wailuku Quadrangle

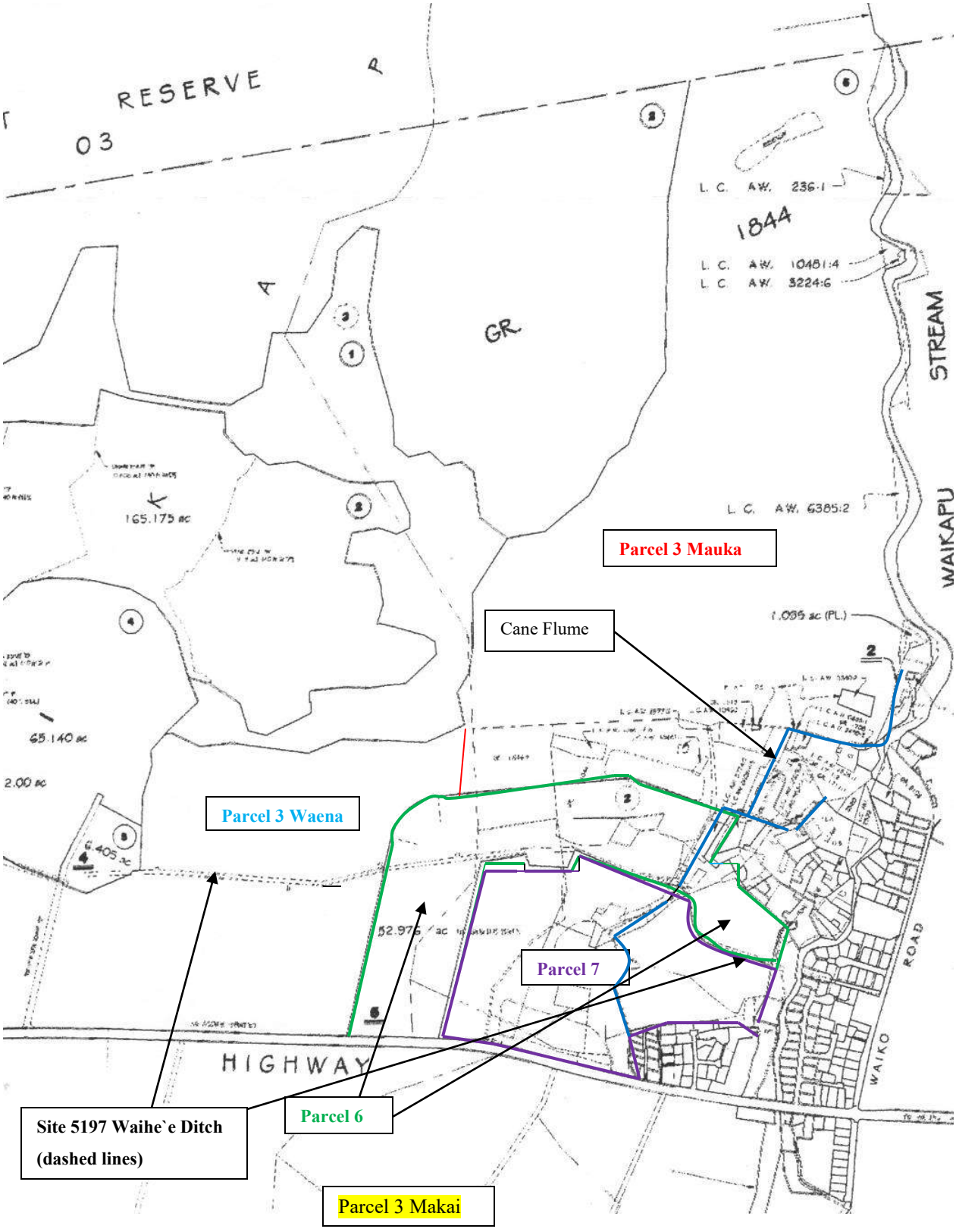


Figure 2. Tax Map Key 3-6-004 Showing Location of Project Areas-Parcel 3 Mauka and Parcel 3 Waena (TMK 3-6-004: 003), Parcel 6 (TMK 3-6-004: 006), Parcel 7 (different TMK 3-6-005:007), Parcel 3 Makai and Cane Flumes and Possible former Water source (Blue) (Also note LCA's and Grants outlined in background)

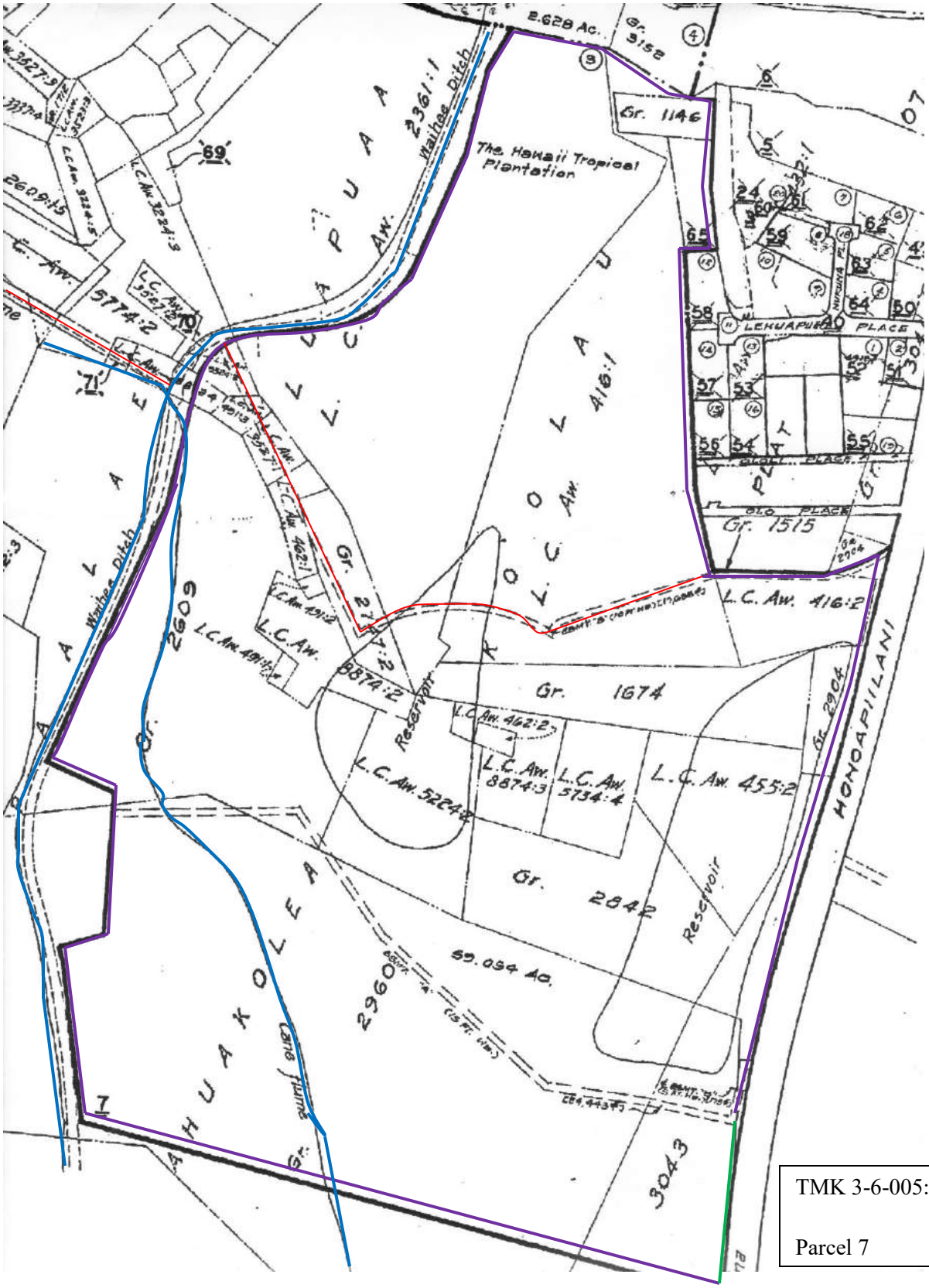


Figure 3. Enlarged Parcel 7 (Purple) Showing Grants, LCA's, Existing Water (Blue) and Possible Water Sources (Red)

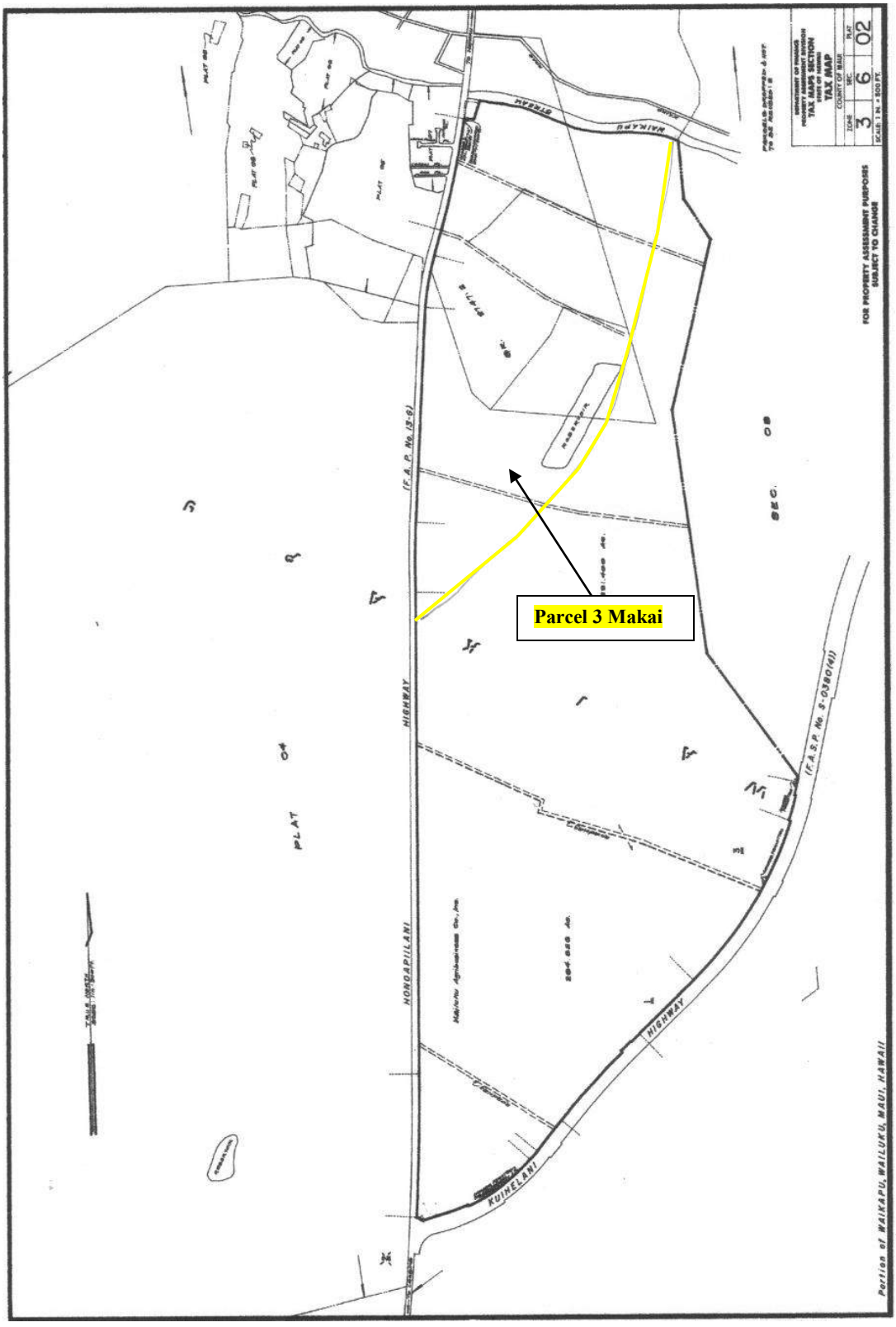


Figure 4. Location of Parcel 3 Makai Project Area within Tax Map Key 3-6-002:003 (pors)

Parcel 3 Mauka

Parcel 3 Mauka is the northern portion of TMK 3-6-004:003 and comprises approximately 180 acres that defines the northwestern portion of the project area. It is bounded on the north by Waikapū Stream and Waikapū Ditch South, as well as a rural residential area on the northeast. To the west is a densely wooded ridge and reservoir; to the south the ridge continues as well as portions of Waikapū Sandalwood Golf Course and fallow sugarcane fields of Parcel 3 Waena and to the east are sugarcane fields of Parcel 6. Parcel 3 Mauka is currently utilized as pastureland, but was formerly fallow sugarcane. Approximately 75 acres of the 180 are slated for commercial, single and multi-family residential and civic uses (schools and parks) (Figure 4). The remaining acreage will be utilized for agriculture, retention basins, hiking trails and open space.

Parcel 3 Waena

Parcel 3 Waena is the southern portion of TMK 3-6-004:003 and comprises approximately 70-acres located west and adjacent to Honoa`piilani Highway (RT.30), southeast and adjacent to Parcel 6 with the golf course bounding the west and the former rock pit on the south. Site 5197 (Waihe`e Ditch) bisects the parcel north/south (see Figures 1, 2, 6 and 7). Parcel 3 Waena is currently utilized as active sugarcane, pastureland and small scale agriculture. The entire parcel will be developed with large rural lots on 59-acres and open space and agriculture on approximately 12-acres.

Parcel 3 Makai

Parcel 3 Makai is a portion of TMK 3-6-002:003 and comprises approximately 250 acres that are bounded on the west by Honoa`piilani Highway, Waikapū Stream and Waiko Road on the north, and the remaining portions of this parcel (TMK 3-6-002:003). Parcel 3 Makai is cultivated in active sugarcane and is slated for commercial and civic (schools and parks) development along with single-family and multi-family residential use (see Figures 1, 4, 6 and 7).

Parcel 6

Parcel 6 is an L-shaped parcel designated TMK3-6-005:006 and consists of 52.976 acres that is bounded by Parcel 3 Mauka and Parcel 3Waena to the west, Parcel 3 Waena to the south, a portion of Site 5197 (Waihe`e Ditch) and Parcel 7 to the east and rural development to the north. The northern third of Parcel 6 is currently utilized as pastureland was formerly fallow sugarcane; the central portion is in small scale agriculture for vegetables and fruit trees, and the southern third is active sugarcane.

Parcel 7

Parcel 7 is within the central portion of the overall project area and consists of the 59.054 acres which constitutes TMK 3-6-005:007 and the Maui Tropical Plantation. This parcel is enclosed by Waihe`e Ditch

to the west; Honoa`piilani Highway and residential development to the east; existing rural and residential lots to the north and Parcel 6 to the south (see Figures 1, 2, 6 and 7). Parcel 7 will be improved with commercial, multi-family and single-family units, parks and open space.

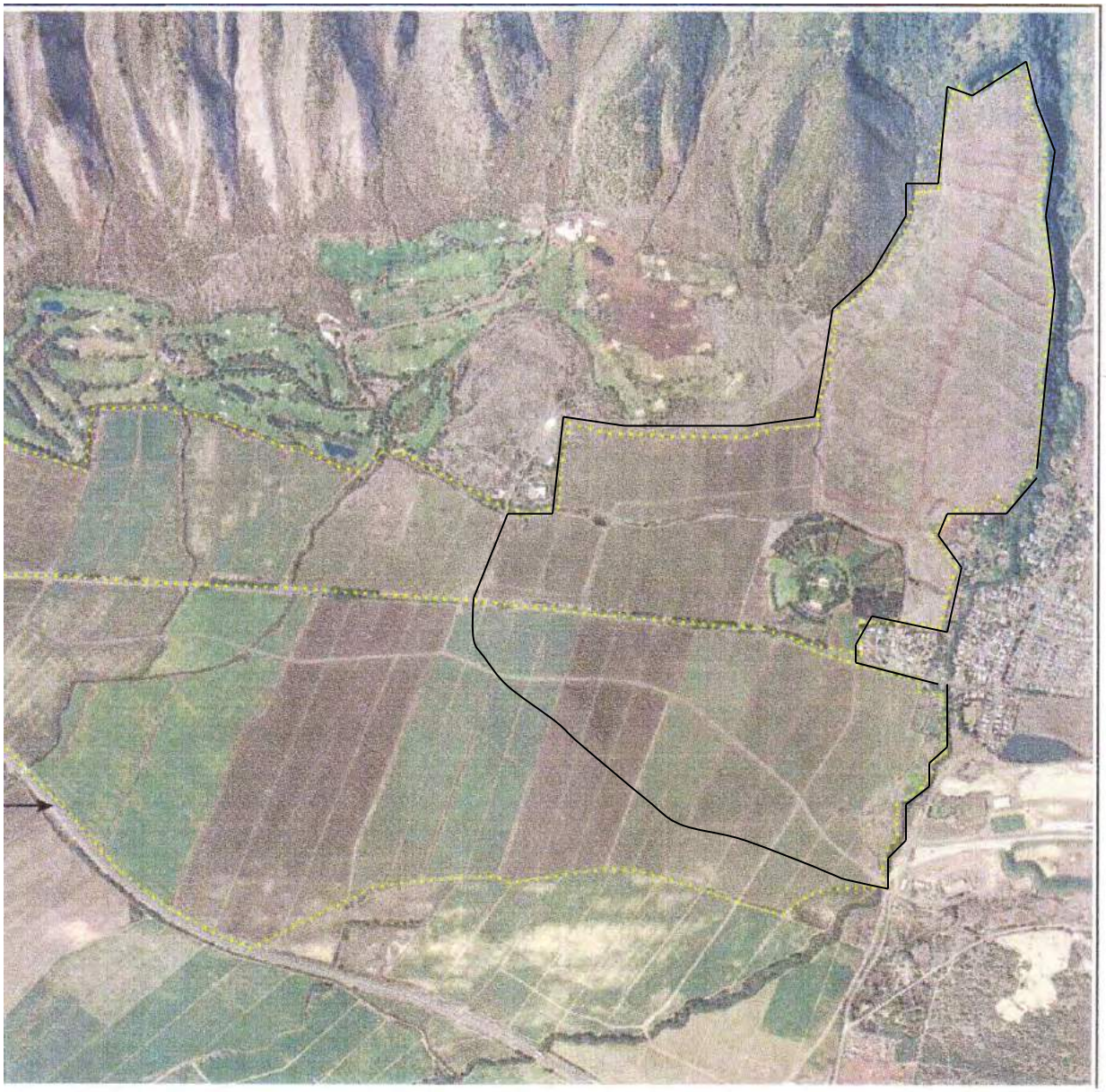


Figure 5. Location of Project Area on Aerial Photograph

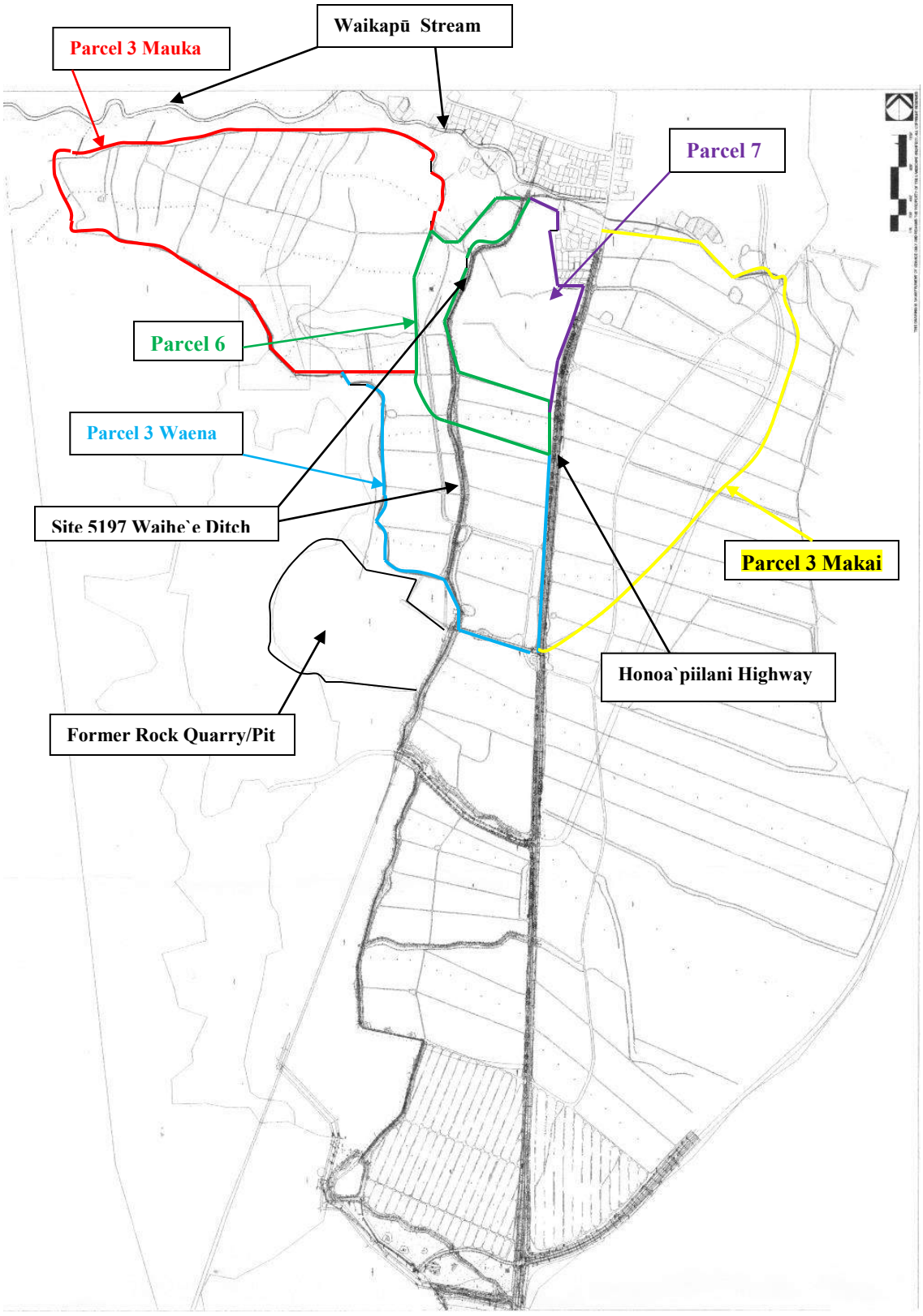


Figure 6. Location of Project Area on Topographic Map of Waikapū Partners Landholdings (also shown are cane field roads)

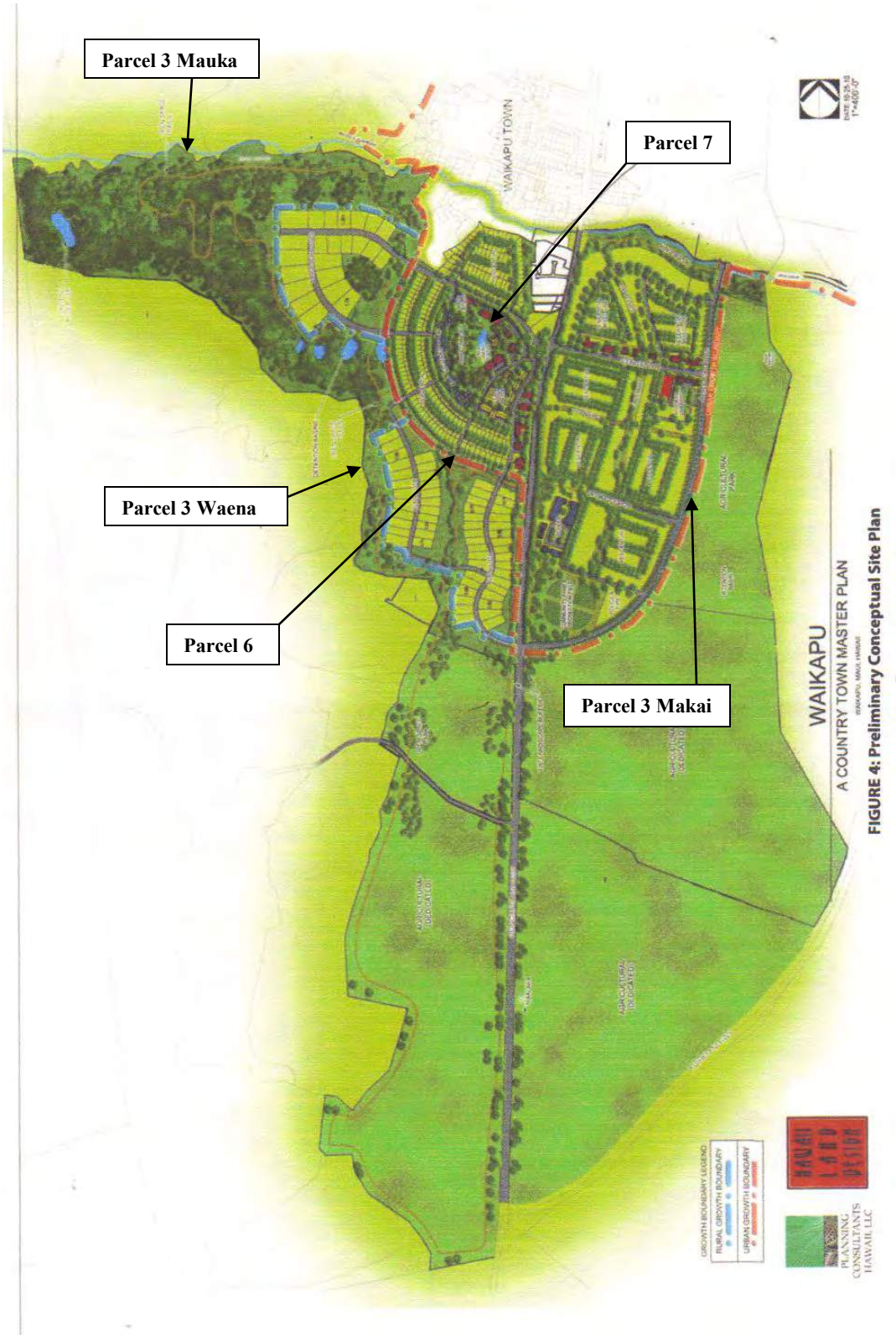


Figure 7. Waikapū County Town Conceptual Development Map

ENVIRONMENT

The project area is situated on the slopes of the West Maui Mountains and the extreme northwestern periphery of the isthmus of Maui. The terrain slopes severely in the western portion (Parcel 3 Mauka) and gradually tapers to a gentle slope and flat terrain along the eastern edge. It has been artificially altered by sugarcane cultivation, animal husbandry practices and commercial development. Through these grading activities, the subject parcel contains clearing push piles, and series of alternating berms and flat terraced areas.

Elevation for Parcel 3 Mauka ranges from approximately 1100 ft. above mean sea level (amsl) to 355 ft. amsl; Parcel 3 Waena ranges from approximately 600 ft. amsl to 360 ft. amsl; Parcel 6 from about 440 ft. amsl to 400 ft. amsl; Parcel 7 ranges from approximately 400 ft. amsl to 360 ft. amsl and Parcel 3 Makai from 360 ft. amsl to 230 ft. amsl.

Soils include Iao clay (IcB), 3-7% slopes, Wailuku silty clay (WvB), 3-7% slopes, Wailuku silty clay (WvC),7-15% slopes, Pulehu cobbly silt loam (PrA) 3 to 7% slopes, Pulehu cobbly clay loam (PtB) 0 to 3% slopes and Pulehu silt loam (PpB) are all present in the project area and consist soils that were developed in alluvium derived from basic igneous rock and are well-drained soils on smooth alluvial fans and valley fill. For Iao Series soils permeability is moderately slow, runoff is medium, and the erosion hazard is slight to moderate. This soil is for sugarcane and home sites (Foot et al. 1972). For Wailuku Series the substratum is gravelly and cobbly alluvium. Permeability is moderate, runoff is slow to medium, and the erosion hazard is slight to moderate. Parcel 3 Mauka is located at the highest elevation and comprised of Wailuku soils (WvC), Parcel 3 Waena, Parcels 6 and 7 and portions of Parcel 3 Makai are made up of Iao soils (IcB). The lower portion of Parcel 3 Makai contains the Pulehu series.

Vegetation in Parcel 3Mauka, Parcel 3 Makai, Parcel 6 and Parcel 7 consists almost entirely of alien invasive species typical of previously disturbed areas and fallow sugarcane fields. The vegetation in Parcel 3 Mauka was previously identified by Allison Chun Ph.D., during a previous investigation and her findings were as follows:

> vegetation includes, “sparse clumpy alien grassland, such as giant guinea grass or (*Panicum mazimum*), natal redtop or (*Rhynchyletrum repens*), sourgrass or (*Digitaria insularis*), and numerous other noxious weedy invasive species, including castor bean (*Ricinis communis*), spiny amaranth (*Amaranthus spinosus*), apple of Peru (*Nicandra physaliodes*), coat buttons (*Tridax procumbens*), cherry tomato (*Leonotis nepetifolia*), bitter gourd (*Mormordica charantis*), rattlepod (*Crotalaria pallida*), lion’s ear (*Leonotis nepetifolia*), cow pea (*Macroptillion lathyroides),* partridge pea (*Chamaechrysta nitcitans*), hairy horsetail (*Conyza bonariensis*), telegraph weed (*Heterotheca grandiflora*), beggarweed (*Desmodium tortuosum*) and beggars tick (*Bidens pilosa*), sow

thistle (*Sonchus oleraceus*), flora's paintbrush (*Emilia fosbergii*), verbena (*Verbena litoralis*), swollen finger grass (*Chloris barbata*), balloon plant (*Asclepias physocarpa*), koa haole (*Leucaena leucocephala*), and indigo (*Indigofera suffructicosa*). The weedy native ʻuhaloa (*Waltheria indica*) is also present. This assemblage is indicative of a highly disturbed ecosystem and typical of recently grubbed areas. The northern boundary along the top of Waikapū Stream has a more forested ecosystem that includes eucalyptus (*Eucalyptus spp.*), Christmas berry trees (*Schinus terebinthifolius*), guava (*Psidium guajva*), abutilon (*Abutilon grandifolium*), ironwood trees (*Casuarina spp.*) and morning glory (*Ipomoea spp.*).

Vegetation in Parcel 3 Makai predominately consists of active sugarcane cultivation by Hawaii Commercial and Sugar (HC&S), along the periphery of the cane, the access roads and corridors the vegetation consists almost entirely of alien invasive species, a few scattered Kiawe (*Prosopis sp.*), and koa-haole (*Leucaena glauca*) trees were identified.

Rainfall for lower portions of the project area including Parcel 3 Waena, Parcel 3 Makai, Parcels 6 and 7 would be similar to Waikapū Town which is approximately 20 inches (500 mm). For Parcel 3 Mauka located in the upper portion near the valley would be higher but not as heavy as in the upper valley which is close to 354 inches (9000 mm) (Creed Vol. I 1993:8).

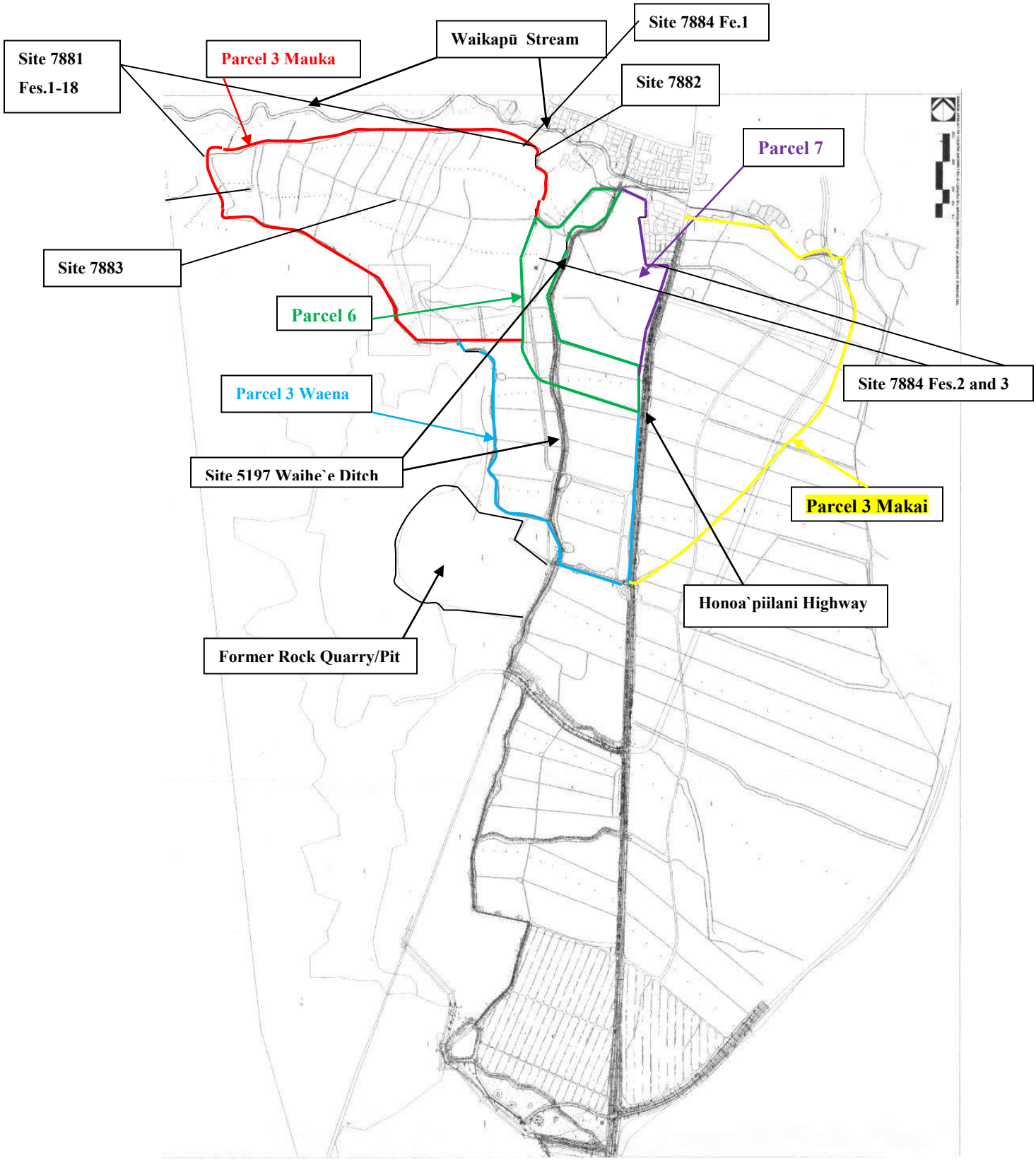


Figure 8. Location of Historic Properties within Project Area

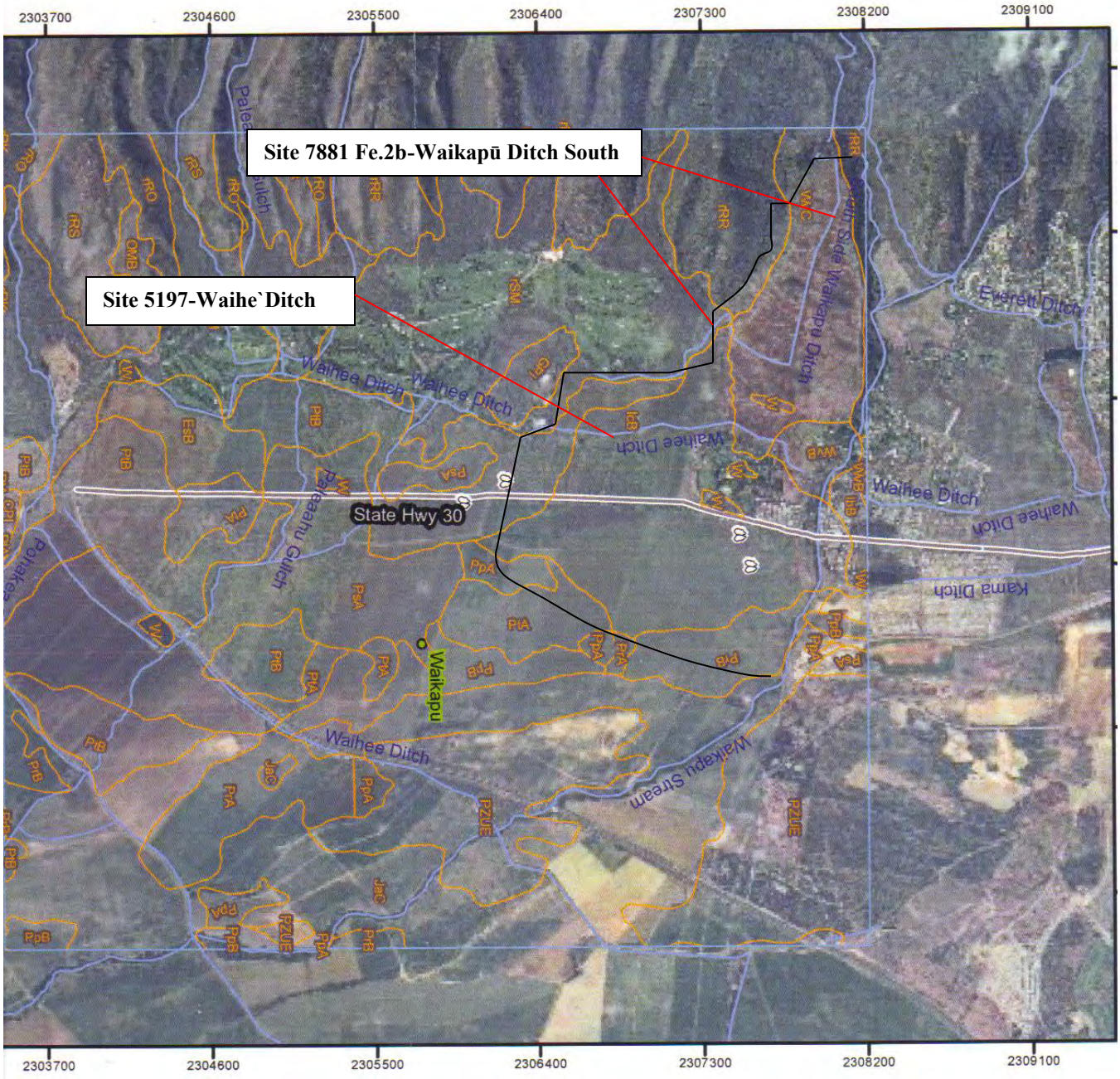


Figure 9. United States Department of Agriculture Soils Map with Project Area denoted in black

TRADITIONAL AND HISTORICALBACKGROUND

An in depth historical document research is presented by Victoria Creed in *Settlement Pattern for Waikapū* (Creed 1993). The landowners' commissioned Ms. Jill Engledow to write *The History of Waikapū* as a supporting document and it is presented in Appendix A. An inventory survey, data recovery procedures and limited historical documentary research was performed for the then proposed Waikapū Golf Course. The reader is referred to these earlier reports for additional detailed information pertaining to the history of the area.

Mythological and Traditional Accounts

The Hawaiian creation chant (*Kumulipo*) describes Maui as a direct ancestor of the Hawaiian people and a descendant of Wakea on the Ulu line (Beckwith 1970:226). The island of Maui was named for the demi-god Maui, a well-known trickster hero throughout Polynesia. A synopsis of the ruling class in Hawai`i is provided below. According to oral traditions, Halo was one of the first chiefs of Maui who ruled the Wailuku District. By A.D. 1500 East Maui was ruled by a line of independent *Ali`i Nui*. Other lines of chiefly hierarchies emerged at this time, resulting in a rise in conflicts and competition. By A.D. 1600, Maui was unified by the Wailuku chief Pi`ilani (Fornander 1880:87). During the eighteenth century, the *mo`i (*a rank of chief) Kekaulike undertook raids against Hawai`i Island. Following the annexation of Hana and Kipahulu Districts to Kamehameha I, Kahekili II first recaptured Hana and Kipahulu from Kamehameha I and then conquered O`ahu and Molokai. Kaua`i was also annexed through marriage (Pantaleo 2001).

Customarily on Maui, land divisions into *moku* (districts), *ahupua`a* (sub-districts), and *`ili* (smaller divisions) were said to have taken place "under a *kahuna* (priest) named Kalaihaohi`a (Hew the bark of the *ohia* tree) each ruled over by an agent appointed by the landlord of the next larger division, and the whole under the control of the ruling chief over the whole island" (Beckwith: 1970:383). Fornander suggests that this would have occurred at the end of the 15th century or at the beginning of the 16th century (Fornander 1916/17, Vol. 6:248).

According to Sterling, "The system of land tenure which prevailed in ancient times was radically changed in the reign of Kamehmeha III by the Mahele of 1848, yet the boundaries of the ancient subdivisions of land remain unchanged to the present day. This applies particularly to the *ahupua`a* which has been termed the unit of land in Hawai`i". And these boundaries were said have been established approximately 20 generations back in Hawaiian tradition or 500 years ago according to Stokes' basis of chronology (Sterling 1998:3). This typology of land division (the *ahupua`a*) allowed the Native Hawaiian populace

access to various ecosystems and resources from *mauka* to *makai* which were essential for traditional living.

Kirch proposed that the populace on Maui was traditionally centered at Lahaina and Wailuku (1985). As such, so was the political power. The current district (*moku*) of Wailuku is comprised of the following *ahupua`a*: Wai`ehu, Waihe`e, Waikapū, and Wailuku (Figure 10). This region has also been referred to poetically as NāWai`ehā (four waters) (Pukui and Elbert 1986: 377). According to Sterling, Waikapū originally belonged to no district:

> On Maui the lands of Waikapū and Wailuku appropriated almost the whole of the isthmus, belonged to no district and in the *Mahele* were said to be in Na Poko (Sterling 1998:63). Sterling further states that the *ahupua`a* of Waihe`e and Waiehu were independent of any *moku* but listed in the Book of the Mahele as being in Pū`ali Komohana.

There seems to be a discrepancy between Waikapū and Wailuku not belonging to any traditional district or *moku.* As exemplified on Figure 11, Wai`ehu, Waihe`e, Waikapū, and Wailuku appear to be situated within Pū`ali Komohana *moku* whose boundaries follow the modern District of Wailuku shown on Figure 10 (Kame`eleihiwa 1992: 241).

Wailuku was the center of political and military power on Maui during the seventeenth and eighteenth centuries. Legendary battles were fought in Wailuku, including battles involving Kihapi`ilani, son of Pi`ilani, and Kalani`opu. The battle referred to as the Kalae`ili`ili Battle (1765), consisted of a revolt based upon what was perceived as an unfair distribution of resources by Chief Ke'eaumoku and other Molokai chiefs from the Waihe`e River Valley and the offshore marine resources. The Maui populace thought that these resources should provide ample food for them and they were being treated unfairly. Eventually, the Molokai chiefs were driven out of Waihe`e. Another war fought in Kaupō was called the Battle of Kaleoka`īlio where Kalaniōpu`u was at Hāna and sent his warriors to Kaupō (part of Hāna District) to slaughter and plunder the people residing there. When King Kahekili heard of this mistreatment, he sent his warriors to Kaupō and the fighting commenced. Eventually, the Hawai`i warriors were severely defeated and the war was called the Battle of Kaleoka`īlio where the bodies of Hawai`i warriors were heaped up like kukui branches before the Maui warriors. Kalaniōpu`u and his remaining warriors fled to Hawai`i Island where they prepared again for war against Kahekili. In 1776, Kalaniōpu`u returned again to war against Maui landing at Keone`ō`io at Honua`ula, Mākena and Kīhei, the first battle began at Mā`alaeawhere the Hawai`i warriors held strong against the Maui warriors. Both

Hawai`i and Maui warriors fled and prepared for war again the next day. On this day, the battle was fought further inland along the lower sand dunes of Wailuku at Kakanilua. It was at this place that Kahekili, with the help of Oahu warriors fought valiantly against the Hawai`i warriors and the Hawai`i warriors were being slaughtered and a few retreated to Kalepolepo where Kalaniōpu`u and his wife, Kalola was waiting. Kalaniōpu`u was told how badly they were being defeated, and Kalaniōpu`u turned to his wife, who also happened to be the sister to Kahekili, and said we need to end this war. Kalaniōpu`u and Kalola decided that Kiwalo, their son should go to his Uncle Kahekili to ask for forgiveness and stop the fighting. Kahekili agreed to end the fighting and Maui was victorious again. The slaughter of Hawai`i Island at the lower sandhills of Wailuku was called the Battle of Kakanilua.

The land that encompasses the Wailuku District was extremely fertile with an abundance of water; thus, enabling large scale cultivation of *kalo* (taro). Handy provides a post-Contact description of the agricultural activities in the Wai`ehu area and suggests that the "old" (possibly pre-Contact) taro terraces have been destroyed:

> …the area from Waihe'e to Wailuku Valley was the largest continuous area of wet taro cultivation in the islands…in the early days the terraces were nearly continuous in a belt between the sand dunes and the present irrigation ditch….This is the second valley of the famous Na Wai Eha of western Maui, and it is watered by twin streams. The canfields now extend throughout this region, continuously from Waihe'e on the lower slopes; but above Waiehu and Puakala from the upper roads following the irrigation ditches well toward the upper limits of the cane, a few old plantations still persist. Some are used for raising wet taro, some for truck gardening. However, except for these few patches the old terraces of the upper slopes are entirely ploughed under [Handy and Handy 1940 (revised 1991):496, 497].

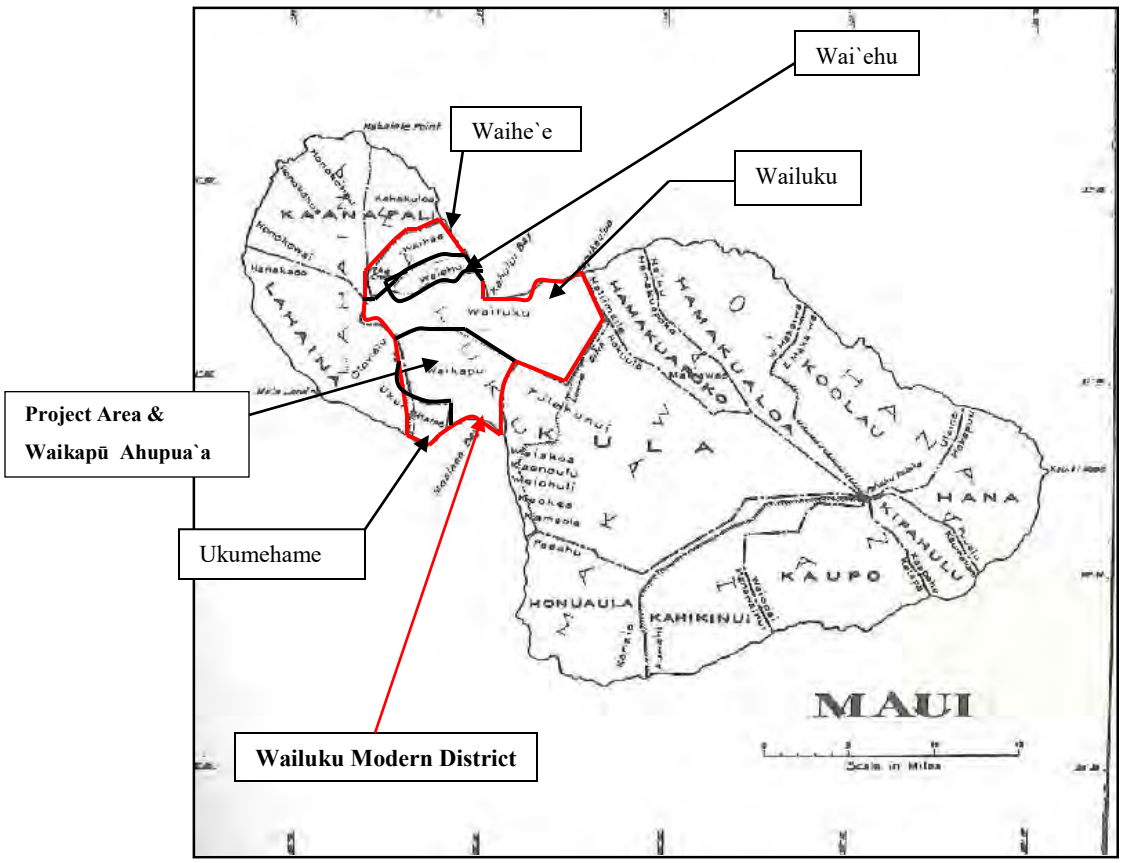


Figure 10. Map Illustrating Project Area, Wailuku District and *Ahupua`a* Boundaries from John Wesley's *A Gazetteer of Territory of Hawai`i* (1935)

Figure 11. Map of Maui Island Showing Traditional Moku (Districts) from Kame`lelehiwa (1992)

Early Historic Period

In reference to the Hawaiian Monarchy, at the time of European contact in A.D. 1778, Maui was united under a single political polity under the rule of *mo`i* Kahekili. By A.D. 1795, Kahekili ruled all of the islands apart from Hawai`i Island. Kamehameha I, *mo`i* of Hawai`i Island, attacked Maui, Molokai, and O`ahu islands. Keli`imaika, brother of Kamehameha I of Hawai`i Island, unsuccessfully attempted to retake Hana and Kipahulu. In 1790, Kamehameha I overpowered Kalanikupule's forces at the Battle of `Iao Valley on Maui. Kalanikupule's ultimate defeat of the Battle of Nu`uanu on O`ahu ascertained Kamehameha I as absolute ruler of the islands, with the exception of Kaua`i. Kamehameha the Great's favorite wife, Hana-born Ka`ahumanu, served as his counselor (Pantaleo 2001).

After the death of Kamehmeha I in 1819, Ka`ahumanu declared herself *kuhinanui* (premier) sharing of regal authority with the new young King Liholiho (Kamehameha II). It is suggested that she confronted the new king and implied that it was his father's wishes for her to share rulership of the land. From the time of Liholiho's departure for England in 1823, until Ka`ahumanu's death in 1832, she virtually ruled the kingdom. It was during the aforementioned time frame that the strength of the ancient *kapu*(prohibition) system began to fail. Ka`ahumanu, who disagreed with the restrictions of traditional *kapu* system, persuaded Liholiho to abolish it. "The train of circumstances leading up to the final act of abolition of the *kapu* and the old religious system cannot easily be traced in detail…Some authorities state that immediately after the installation of Liholiho as king, Ka`ahumanu proposed to him that the *kapu* be disregarded and she announced her own intention to disregard them" (Kuykendall1938:66-67). With the overthrow of the *kapu* system she was free to exercise her political authority but this prohibition inadvertently cleared the way for the Christian missionaries in 1820. With the emergence of Christianity, the *heiau* (religious structures) associated with the native religious practices were destroyed and abandoned.

In reference to the island of Maui, Ke`eaumoku, brother of Kamehameha I's wives Kaheihei'maile and Ka`ahumanu, presided over the island until his death in 1824. Ke`eaumoku was succeeded by the sister of Chief (Governor) Boki, Wahinepi`o. Hoapili succeeded Wahinepi`o and ruled Maui between 1826 until 1840, and was followed by Keoniana (John Young II). Lahaina, located in West Maui, was the center of power in the Hawaiian Kingdom. Kamehameha III (Kauikeaouli), the last son of Kamehameha I, rose to the throne when he was ten years old - due to the death of his older brother. During his younger years, Ka`ahumanu continued to govern with the assistance of a council of chiefly advisors. Kamehameha III reigned from 1825 to 1854, the longest period of power in the history of Hawai`i. During this period, he resided in Lahaina from 1837 to 1845 (Pantaleo 2001).

In 1778, with the appearance of Captain James Cook in Kahului Bay on Maui, the post-contact documentation of the indigenous populace on Maui began. A comprehensive account of history of the Hawaiian Kingdom commencing from contact (1778) is provided in Kuykendall (1938). There were additional voyagers to Hawai`i subsequent to the arrival of Cook - including La Perouse and Vancouver. By the early 1800s, whaling ships, merchants, and missionaries had arrived. The arrival of foreigners severely impacted the demographics of the Hawaiian people and caused a significant depopulation of the native people due to the introduction of Western diseases, in combination with the populace beginning to cluster around growing port towns. According to Kuykendall (1938:336), an early estimate of the population (made by missionaries) in 1823 was 142,050 and decreased to 86,593 by 1850. In 1832, the population of Waihe`e/Wai`ehu region was reported by the missionaries as 827, or approximately twenty percent of the populace in the *Na Wai Eha* District.

Historic Background Mid-1800 to Late-1800

In 1845, land reform legislation, which eventually developed into 'The Great Māhele', was introduced. During the *Māhele* in 1848, crown lands were divided between the Government, Royalty, and commoners (Figure 12). The Board of Commissioners to Quiet Land Titles received applications for land claims. When a land claim was validated, a Land Claim Award (LCA) was awarded. Following payment of this claim, a Royal Patent (R.P.) was issued. The Great Māhele initiated extreme social, economic, and political changes within the traditional Hawaiian culture on all the islands. The Māhele resulted in the division of lands according to a system of private ownership based on Western legal concepts. In the first phase of this process, Kamehameha III subdivided his lands among the highest *ali`i* (royalty) *konohiki* (chiefs), and some favored *haole* (foreigners). This process of redistribution severed the political and social relationships of the traditional system of land use (Moffatt and Fitzpatrick 1995:11). Following this change, *maka`āinana* (commoners) were then permitted to pursue legal title and ownership to land they had cultivated and inhabited, in addition to pursue purchase of other government lands. At the end of the Māhele, naturalized foreign citizens were given the right to purchase land in Hawai`i. The ultimate result of this decision placed more land in the hands of non-Hawaiians than native Hawaiians between the years of 1850 and 1865 (Moffatt and Fitzpatrick 1995:51).

> In 1848, there were approximately 88,000 Hawaiians, but only 14,195 applications were made…of the 14,195 *kuleana* claims, only 8,421 were actually awarded. The *Maka'āinana* received less than 1% of the land. Countless Native Hawaiians lost their land use rights as a result of the Great Mahele of 1848, with the establishment of a system of private land ownership. Many landless Native Hawaiians signed on as laborers in the

emerging sugar industry, which began on Maui in the 1820s. Within a short time, large tracts of land were turned over to commercial agriculture, primarily sugarcane cultivation (Kame`eleihiwa 1992:295). In many cases, the purchases or leases to non-Hawaiians included entire *`ili* or *ahupua`a*.

As of 1893, a Hawaiian Government Survey indicated that less than one percent of the total land in the Hawaiian Kingdom had been awarded as *kuleana* land (Moffatt and Fitzpatrick 1995:50-51) (see also Kame`eleihiwa 1992). Changes instigated during the Māhele had a significant impact across the Hawaiian Islands. As previously mentioned, the 'Great *Māhele*' of 1848, brought with it an official change in the organization of land possession and significant changes for the people in Hawai`i. The most noteworthy aspect would be that the people could now own land fee simple, and the *maka`āinana* had the prospect to obtain land.

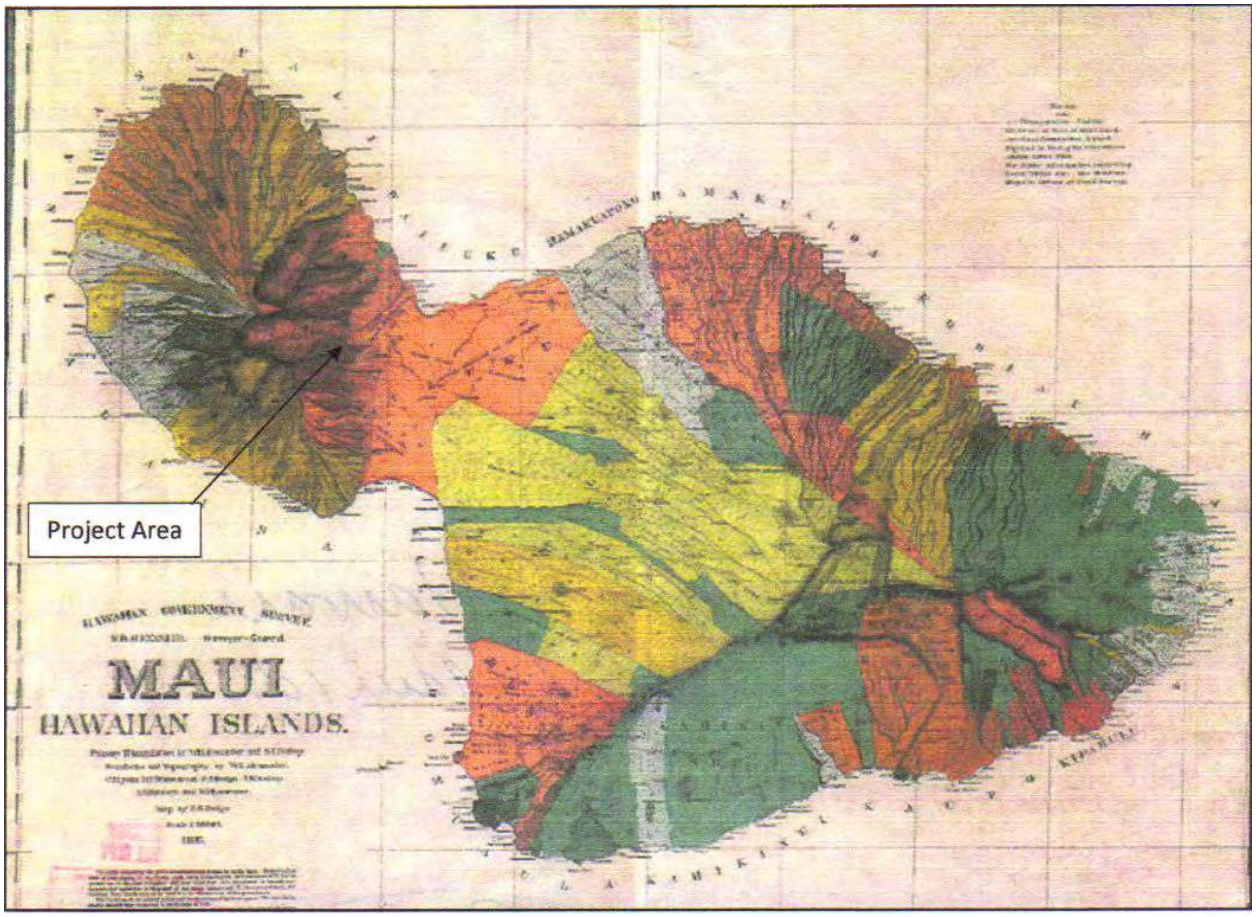


Figure 12. Dodge, F. S. and John M. Donn (1906) Hawaiian Government Survey Map of Maui

In the course of land distribution associated with the *Māhele*, frequent claims were granted along the streams for small plots of taro (*kalo*) cultivation. For example, Figures 2, 3, 14 and 15 shows narrow bands of LCA awards that ran thru the *'ili* of Olohe, Pikoku, Luapuaa, Kamauhali, Punia, Kaapala/Keopala, Paalae, Ahuakolea, and Koolau. This current flume and possible former '*auwai* (ditch) may have emptied into a pond that reportedly was located south of the *'ili* Luapuaa and presently located within the Maui Tropical Plantation, Parcel 7 (see Figure 3 and not two reservoirs on map).

PRIOR LAND USE

The Waikapū Stream supported major irrigation systems with numerous pondfields (*lo'i)* and irrigation canals/ditches *(`auwai)*, as well as agricultural crops and animal husbandry practices evidenced by LCA testimony during the Mahele and early map documentation (Figure 13). Subsequently, by the late-1800s the Waikapū Stream utilizing the same *'auwai* irrigation systems contributed to sugarcane cultivation that expanded far beyond the valley. According to Creed,

> The Waikapū stream ran thru the center of a huge *lo'i* 925+ acre field complex. From the stream in the upper part of the valley, one '*auwai* (ditch) historically named Everett ran thru the *mauka* periphery of the Waikapū village on the north towards Wailuku [see Figure 1]. And another '*auwai* (ditch) named Waikapū South [see Figures 1 and 9] ran east from the upper valley stream towards Ma'alaea thru the *' ili* of Pikoku, Punia, and Kalaupelu and probably extended *makai* at some earlier time and then rejoined the stream. Supporting evidence for this hypothesis is Monsarrat's 1882 map shows a late 19th century sugarcane ditch (the Waihe'e Ditch) dissects this area and LCA 411 in Kaumuilio (below the government road) to Poonui complains that his water had been cut off by the foreigners but remedies were then made so he could continue his cultivation. There may be other *'auwai* as well, such as the area below the Ohia Stream *'auwai* in the upper valley where the configuration of a narrow band of awards runs almost perpendicular through the middle of the *lo'i* fields of Ohia, Palama and Loaloa. This narrow band may define another ditch system although the map does not show one (Creed 1993:77).

As previously discussed in the Project Area description section, based on a review of Figures 1 and 9, the Waikapū Ditch South extends from the upper valley towards the project area in an east/west direction. It appears to cut through and/or bisect Parcel 3 Mauka and then makes a 90 degree angle proceeding in a south direction towards the golf course and follows the golf course along its eastern boundary. There does not appear to be a Waikapū Ditch North but along the north side of Waikapū Stream also extending from the upper valley is Everett Ditch which runs roughly east/west and the begins to curve north below Wailuku Heights subdivision. Waihe`e Ditch is also present within the project area running north south bounding Parcels 6 and 7. During the course of the current survey, several sections of ditches were noted along the northern side of the project area and are further discussed in the results section.

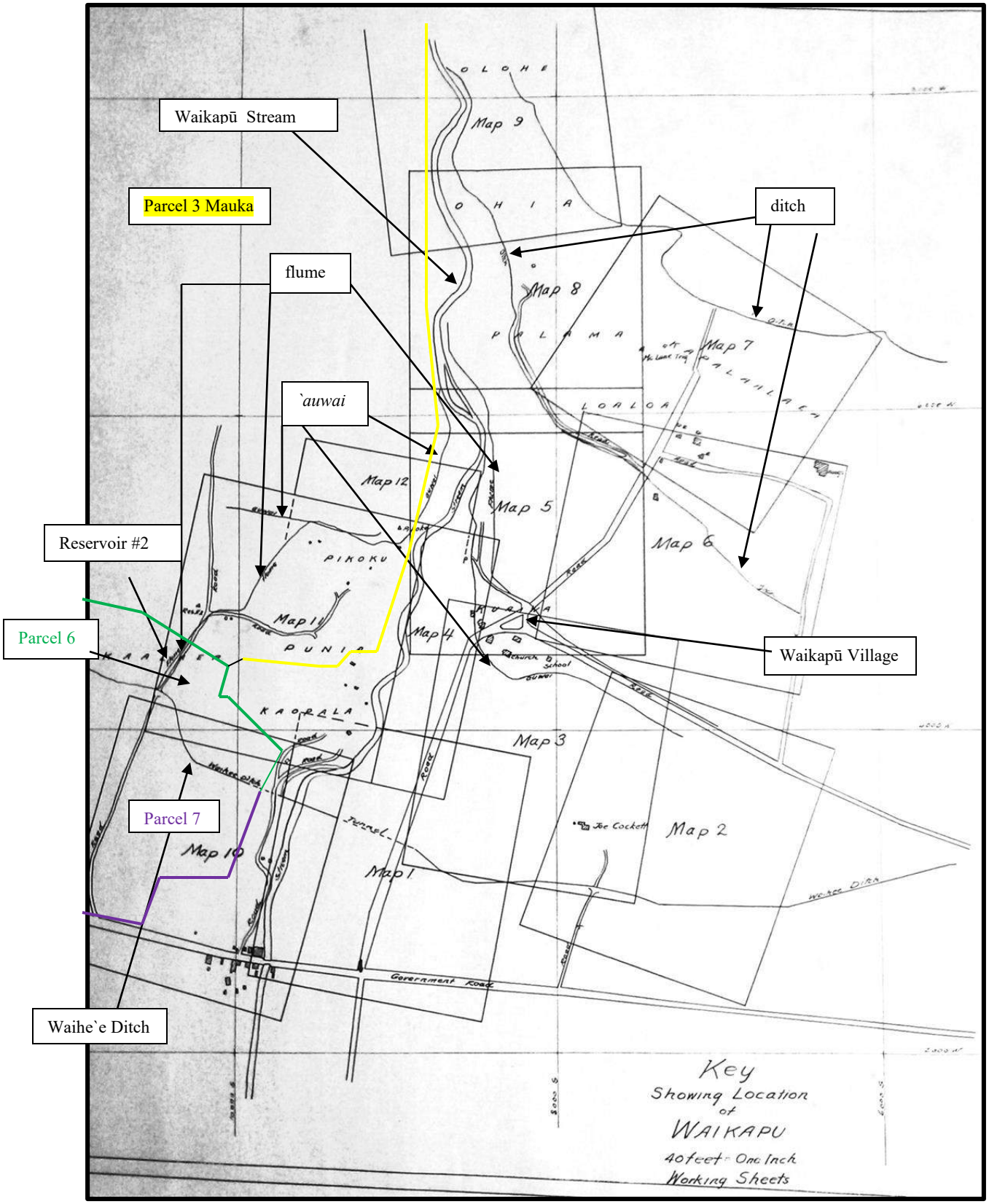


Figure 13. Map of Upper Waikapū Showing *`ili*, *'Auwai* , Flumes, Ditches, Structures and Reservoir #2

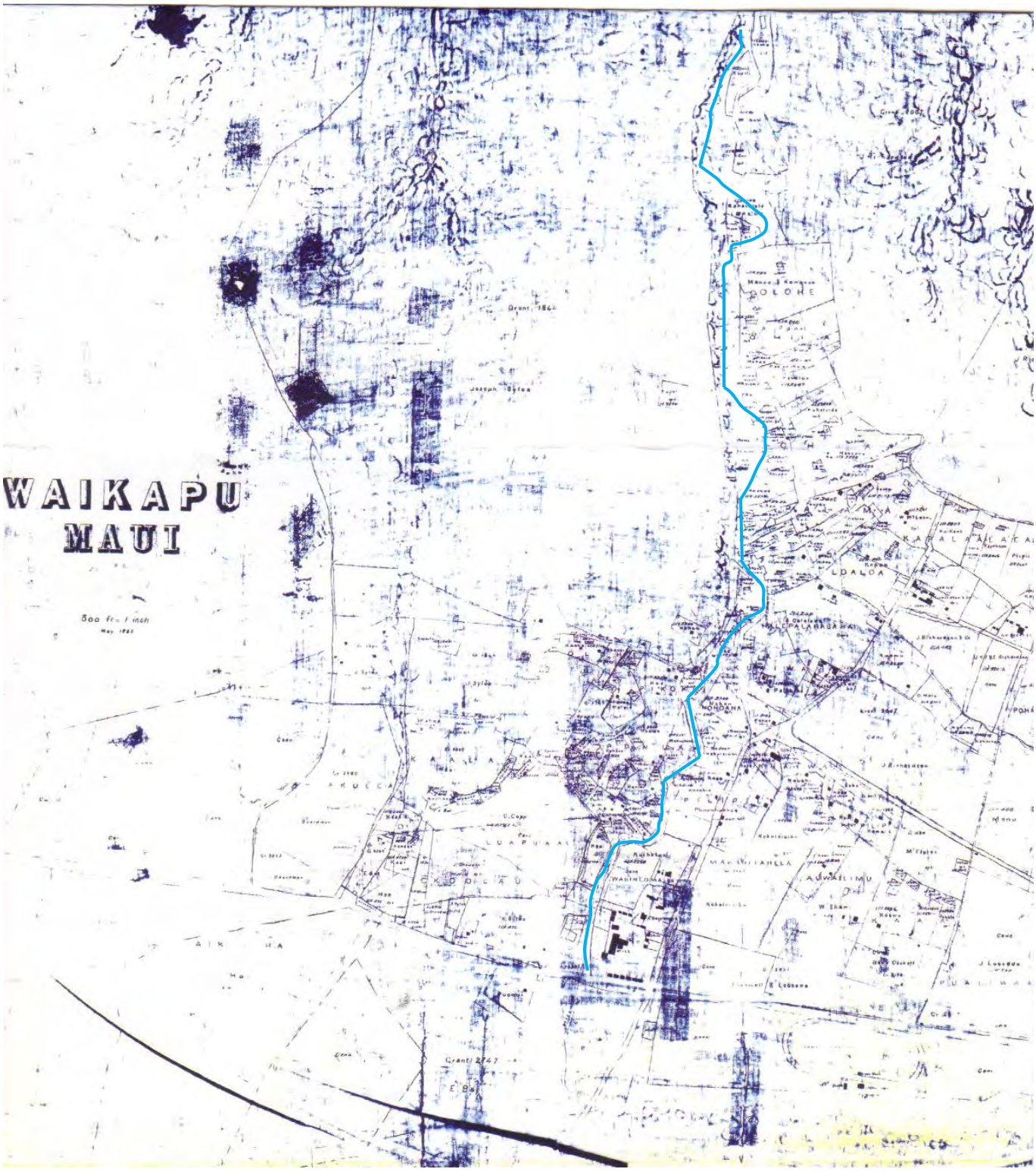


Figure 14. Copy of Monsarrat Map of 1882

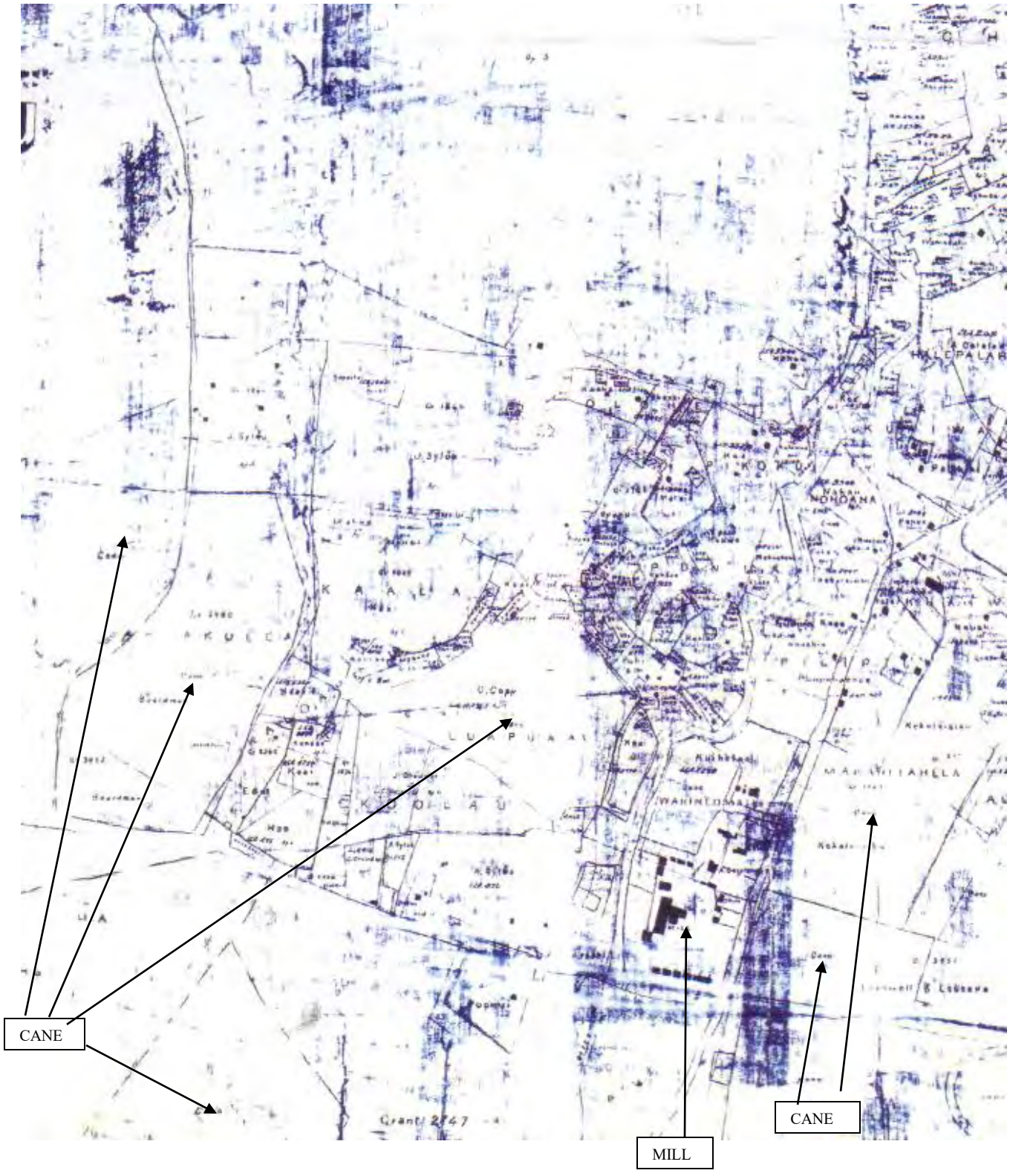


Figure 15. Enlarged Portion of Monsarrats' Map (1882) Showing LCA's and Areas with Cane in Upper Waikapū

LAND TENURE

The entire Waikapū *ahupua`a* is comprised of 15,684 acres, where 121 claims were heard for Waikapū during the Mahele of 1845 (Creed 1993). Of these claims, 100 or 82% were awarded. Of these awards, the claimants listed in descending order the following land usage, *lo`i*, *kula*, house lot, salt, *wauke*, Hala, unspecified, potato, pig, sugar, fish , banana and a bull pen. Based on Creeds analysis, *lo`i* constituted the vast majority with 50%, *kula* 2.1%, house lots (1.8%) and the remaining less than 0.5%.

For the subject project area, an analysis of the land tenure for the five specific project areas was conducted and this assessment also assisted in the placement of back trenches for subsurface testing. The analysis is as follows:

In Parcel 3 Mauka, a total of twenty-eight (28) LCA's and seven (7) Grants were identified (Tables I-III). Of the LCA claims, the majority were for *lo`i* (n=21), *kula* (n=11), house lots (n=5) and *hala* (n=5). For the seven grants, only two had land use which was for sugarcane at Grant 1844 Apana 1 and 2. Note that these aforementioned counts are based on the presence or mention of the specific land use, not the actual number of times the item was present within the parcel; hence if the testimony stated four *hala* trees, *hala* was documented as one.

In Parcel 3 Waena no LCA or Grants were documented.

In Parcel 6, a total of nineteen (19) LCA's and one (1) Grants were identified within this section (see Tables IV-VI). For the nineteen *Kuleana* claims, two had no information, *lo`i* were represented by 16, *kula* (n=7), house lots (n=3) and one no information. The Grant (GR 3152) was to Cornwell but no land use information was available.

In Parcel 7, there were eleven (11) Land Commission Awards and 8 Grants. For the *Kuleana* claims there were *lo`i* (n=7), house lots (n=6), *kula* (n=2), sugarcane (n=1) and *`auwai* (n=1). Of the eight Grants, only 2 had information which consisted of sugarcane (Tables VII-VIII).

In Parcel 3 Makai no Land Commission Awards were claimed and a total of one (1) Grant was identified within this section and consisted of a reservoir and sugarcane (Table IX).

Table I. Summary of Land Commission Awards within Parcel 3 Mauka

LCA Parcel 3 Mauka	Hala	Lei Hala	House lot	Kula	Mo'o Kula	Taro Lo'i	Wauke	Taro Pauku
Charles Copp 236:1 Luapuaa and Kaluapuaa				2			1	
Ehunui 2499:3 Pikoku	1	4				7		
Makuakane 2522:1 Punia				1				
Makuakane 2522:2 Pikoku						3		
Makuakane 2522:3 Waikalulu				1				
Hakiki 2577:2 Olohe			1			7		
Hakiki 2577:3 Olohe			1			2		
Poepoe 2609:1 Kaalaea								1
Poepoe 2609:2 Olohe						2		
Poepoe 2609:3 Pikohu						1		
Poepoe 2609:4 Maalaea			2 in Maalaea					
Poepoe 2609:5 Kaalaea					1			
Makaio (Mataio) 3020:2 Kamaukalii /Kamauhali				1		6		
Kualaia 3110:3M Pikooku				1		4		
Kualaia 3110:3M:2 Ohia						2		

Table II. Continuation of Summary of Land Commission Awards within Parcel 3 Mauka

LCA Parcel 3 Mauka	Hala	Lauhala	House lot	Kula	Mo'o Kula	Potato Mo'o	Taro Lo'i	Taro Pauku
Nahanua 3340:2 Nohoana, Aweoweo luna		2			1		8	
Opunia 3224:6 Kaopala			1					
Koa 3528:2 Pikoku							4	
Kaai 5774:2 Luapuaa							6	
Kamakaipoa 6385:1 Pikoku (2.11acres)							6	
Kamakaipoa 6385:2 Kaloapelu Apana 2	1			1	2		5	
Kamakaipoa 6385:2 Kamauhalii (1.94 acres)	1							
Kamakaipoa 6385:2 Maluapuaa						2	3	
Napailoi 10481:2 Waihalulu			1	1				
Napailoi 10481:3 Waihalulu				1			8	
Napailoi 10481:4 Kaopala								1
Nalei 10460:1 Olohe							2	
Nalei:2 10460 Luapuaa							26	1

(Source: Creed 1993)

Table III. Summary of Grants within Parcel 3 Mauka

Grant Parcel 3 Mauka	Date	Issued to	Land Use
1513			
1704			
1706			
1711:1			
1844:1 Apana 1	Also extends down to Parcel 6	Joseph Sylva	Sugarcane
1844:2	Also extends down to Parcel 6	Joseph Sylva	Sugarcane
3527:2			

(Source: Creed 1993)

Table IV. Summary of Land Commission Awards within Parcel 6

RP	LCA	House lot	Kula	Mo'o Kula	Mo'o of Kalo	Taro Lo'i	Taro pauku	Ponds / Pools / Depressions
	Kaoahaliu 2361:1							
	Poepoe 2609:1 Kaalaea						1	
	Poepoe 2609:2 Olohe					2		
	Poepoe 2609:3 Pikohu					1		
	Poepoe 2609:4 Maalaea	2 in Maalaea						
	Poepoe 2609:5 Kaalaea		1 potato					
	Opunui 3224:3 Kaloaloa						1	
	Opunui 3224:5 Kaloaloa		1					
	Naanaa 3337:4 Kaalaea					6		
3156	Kamohai 3527:1 Kaalaeapelu		1				1	
3156	Kamohai 3527:2 Kaalaea			1		3		
	Kamohai 3527:3 Kaalaea			1		6		
	Kekua 5551:1 Kainauhali					15		1
	Kekua 5551:2 Kaalaea					2		
4014	Kaai 5774:2 Luapuaa					6		

Table V. Continued Summary of Land Commission Awards within Parcel 6

LCA	Kalo	House lot	Kula	Ponds / Pools / Depressions	Mo'o of Kalo	Taro Lo'i	Taro pauku
Mahoe 10160:1 Ahuakolea 1.99 Ac.		1	1			1	
Napaeloi 10481:1 Paalae	1	1	1			31	1
Wahinealii 11022:3 Palama					1		
9524:2							

Table VI. Summary of Grant within Parcel 6

Grant	Date	Issued to	Land Use
Grant 3152	1878	Spreckles	Sugarcane and Reservoir

(Source: Creed 1993)

Table VII. Summary of Land Commission Awards within Parcel 7

RP	LCA	‘Auwai	House lot	Mo’o Kula	Taro Lo’i	Taro pauku	Sugarcane / Ko
41	John Crowder 416:1 (7ac&1ac) Koolau	1	1				
41	John Crowder 416:2 (8.9ac) Aikanaka		1				
324	Haa 455:2 Kaaikanaka /Aikanaka? (35ac)		1				1
	Mahuka 462:1 Kaopala		1	1	6		
	Mahuka 462:2 Kaloapelu		1	1	10		
3139	Haawahine 491:1 Koloapelu / Kaleapelo / Kaloapelu?				4		
	Haawahine 491:2 Koloapelu/ Kaleapelo / Kaloapelu?				1		
	Haawahine 491:3 Koloapelu/ Kaleapelo/ Kaloapelu?				2		
	5224:2						
8874	Kaneae 8874:2 Kaloapelu		1			1	
	Kaneae 8874:3 Kaloapelu					1	
	Kaula LCA 5734:4	This is a claim for Waikele, Island of Oahu (TMK 3-6-05) 122					

Table VIII. Summary of Grants within Parcel 7

Grant	Date	Issued to	Land Use
1146			
1674			
2842			
2904			
2609			
2747:2		**Eugene Bal**	**Reservoir and Sugarcane**
2960		**Boardman**	**Sugarcane**
3043		**Boardman**	**Sugarcane**

(Source: Creed 1993)

Table IX. Summary of Grants within Parcel 3 Makai

Grant Parcel 3 Makai	Date	Issued to	Land Use
2747:2		**Eugene Bal**	**Reservoir and Sugarcane**

(Source: Creed 1993)

As exemplified in the land use tables and Figures 14 and 15, other post-Contact land use consisted of the commercial production of sugarcane. The earliest commercial sugar production on Maui Island began in Wailuku in 1823 when Hungtai Sugar Works was founded by Chinese merchants. Wailuku Sugar Company was started in November of 1862 by James Robinson and Company, Thomas Cumming, J. Fuller, and C. Brewer and Company. In 1865, C. Brewer and company acquired controlling interest, with Robinson and Company and Cumming as the minority stockholders. In 1894, the Waihe`e Sugar Company and the Waikapū Sugar Company were bought out by the Wailuku Sugar Company. To assist in the infrastructure of sugarcane production, railroad construction was initiated in 1895. At this same time, political and economic issues surrounding water-rights emerged to the forefront (Donham 1989:15).In the 1980's, the Wailuku Sugar Company converted to the Wailuku Agribusiness in order to diversify agricultural production.

PREVIOUS ARCHAEOLOGY

The early archaeological studies conducted on Maui consisted of recording *heiau* (religious structures) sites along the coastline. These studies were carried out by Thomas G. Thrum in 1909, followed by J. F. G. Stokes in 1916, and in 1920 by Kenneth P. Emory. An island-wide archaeological survey was

executed in 1928 by Winslow Metcalf Walker (Figures 16 and Table X). During this archaeological investigation, the previously recorded sites of Thrum, Stokes, and Emory were revisited and new sites were recorded to produce the first island wide survey (1931). Walker's survey primarily focused on sites portraying substantial construction. Thrum recorded four *heiau* in the Waikapū *ahupua`a*, two in the village and two at or near the shore. It appears that he only saw portions of the larger one located in the village (Creed 1993).

> Reaching the Wailuku section little that is new was gathered of a definite character, and much of what I have from early history is unknown to the old residents. Two heiaus were reported at Waikapū, formerly, one below the road abreast of T. Everett's, of large size, and one below the Catholic church, a small structure working probably in conjunction with the larger one. Portions of the large one was said to be still seen, but the small one was destroyed. The names of these were forgotten. Unfortunately no evidence was found in confirmation with this report nor anyone who had knowledge thereof. The same relates to an alleged heiau, each, formerly at Puuhele, at Maalaea, at Kihei and at Kalepolepo, of small size, and a larger one at Kulaihakoko, but no one else seems to have heard of them (Thrum 1909-1918:59).

According to Walker, an unnamed *heiau* and petroglyphs are located "a quarter mile from the village of Mā`alaea at the base of the foothills of the West Maui mountains" (Walker, 1931:43, 58-60, and 201-206). Creed suggests that it is not possible to infer the location of Walker's "ancient village". There appears to be confusion if he is referring to the location of the historic wharf and associated structures in Mā`alaea or to the area of the "house and shelter site" currently documented as State Site numbers 50-50-09-1441 and 1287 (Creed 1993:26).

Research indicates previously documented archaeological sites in the Mā`alaea Bay environs. These sites include Site 1169 (now including former Site 1199) consisting of sixty petroglyphs on eleven boulders located inland and northwest of the harbor, Site 1440 (now including Site 1286) comprised of a *piko* stone and a grinding stone located on the lawn of Buzz's Wharf (Figure 17). Site 1287 is documented as the Mā`alaea complex that extends from Mā`alaea to McGregor Point (same area that Walker describes shelters being located). Site 1441 contains three C-shapes and appears to be located within Site 1287 (Moore and Kennedy 1994:8 and 9).

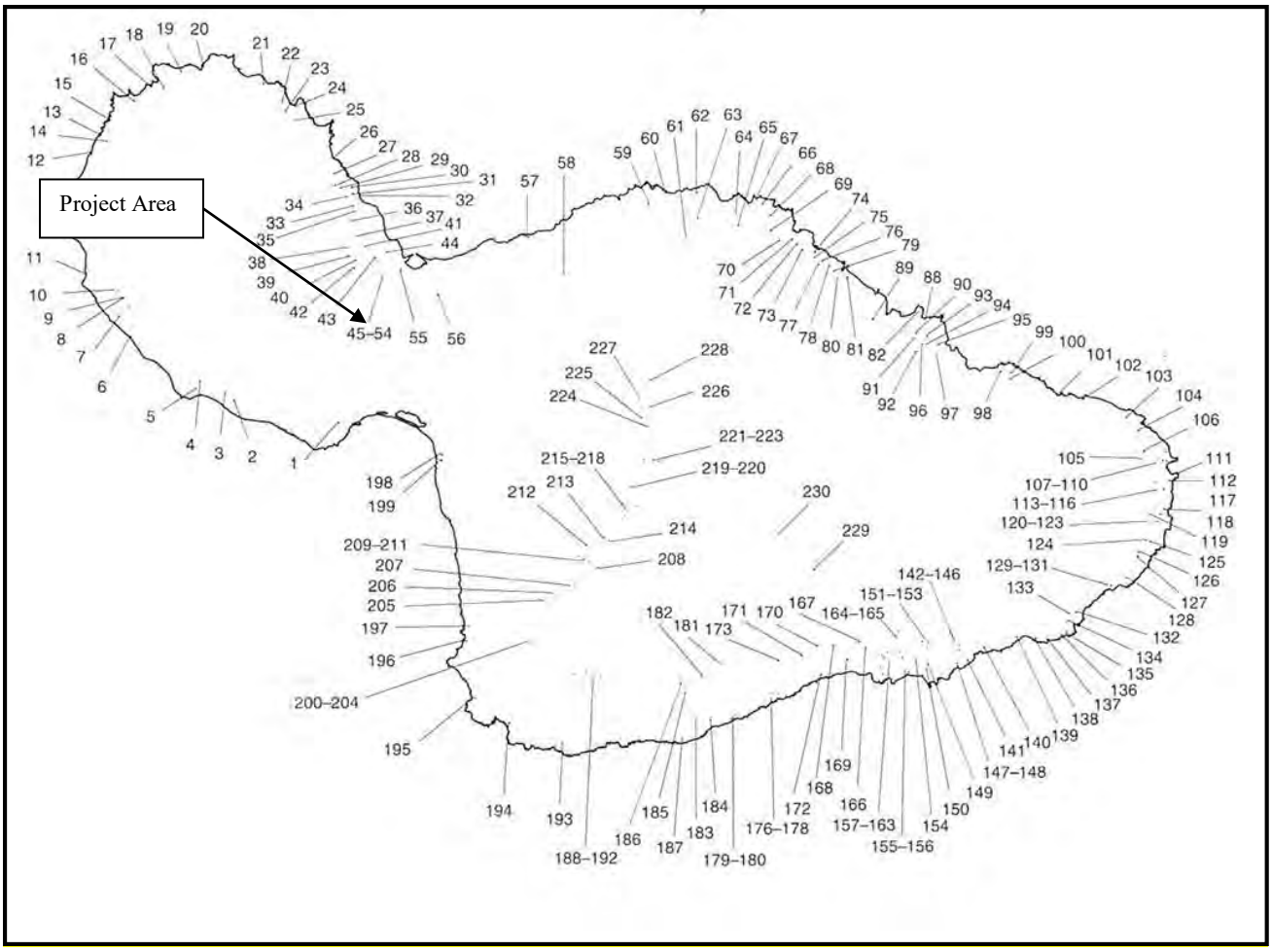


Figure 16. Walker Site Map depicting locations of archaeological site locations (adapted from Sterling 1998).

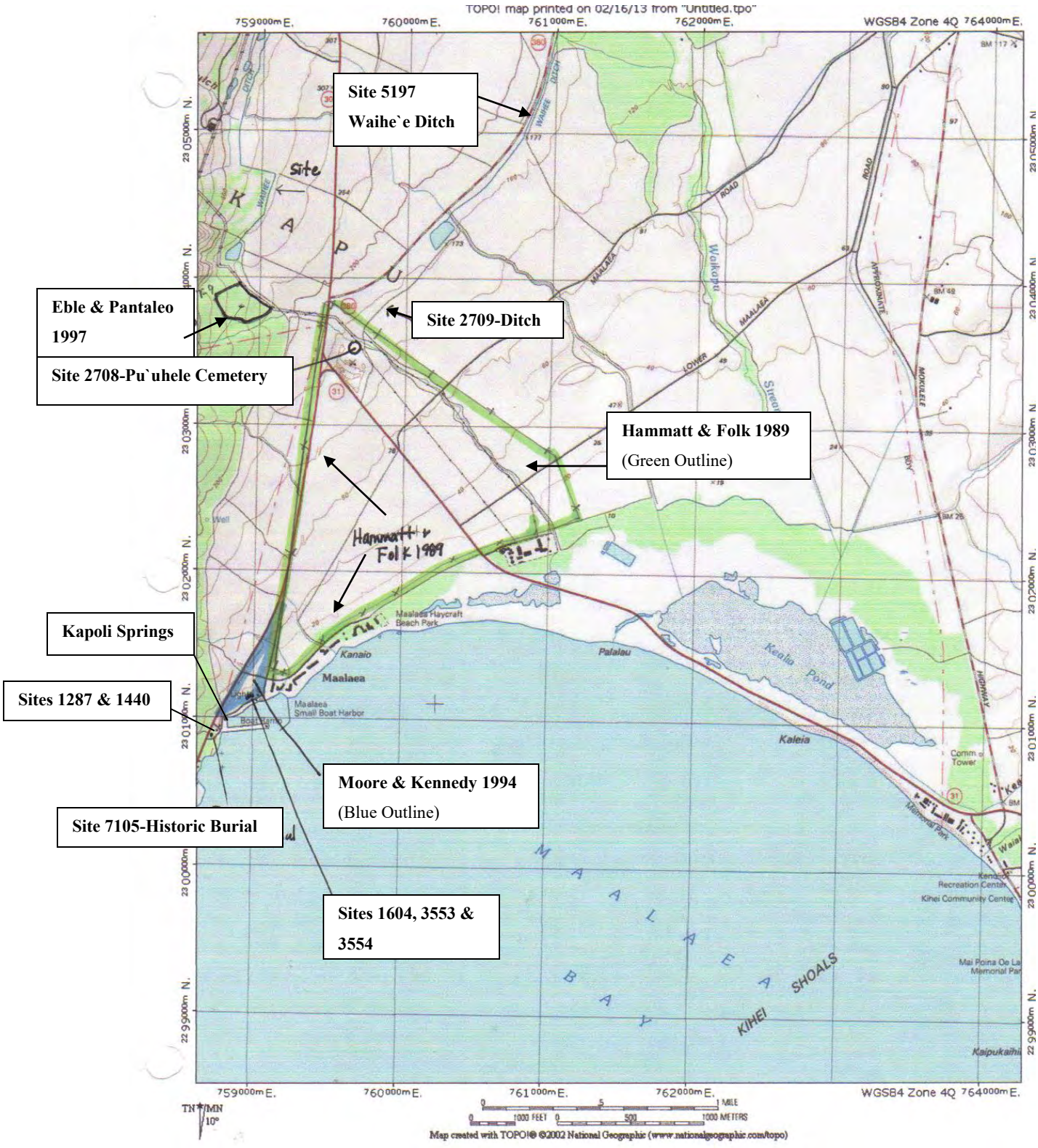


Figure 17. USGS Map Showing Location of Previous Archaeological Investigations and Historic Properties in Waikapū *ahupua`a*

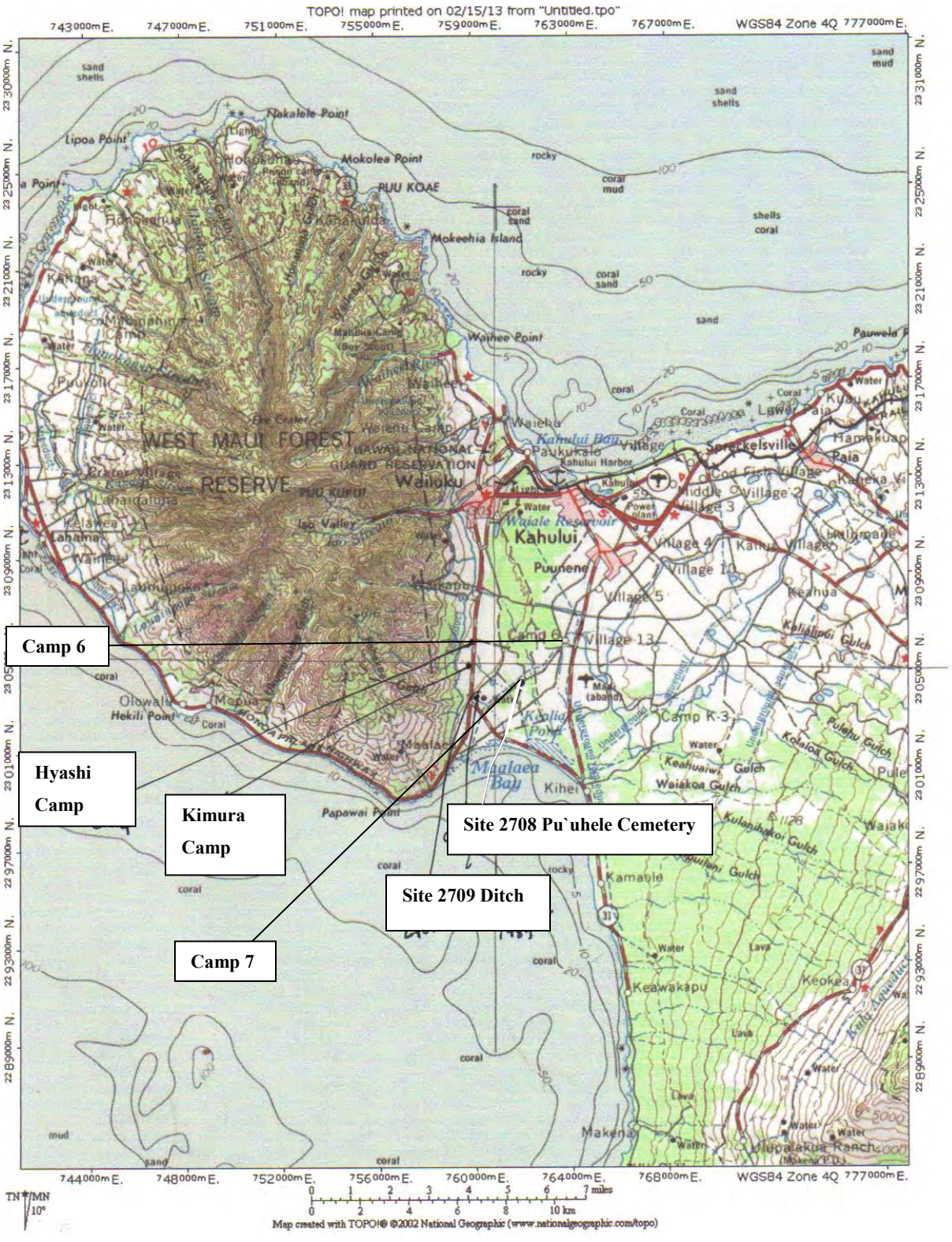


Figure 18. USGS Map Showing Location of Former Plantation Camps Properties in Waikapū *Ahupua`a*

Archaeological Research Conducted in the Environs of the Project Area

Since these earlier studies, numerous archaeological studies have been conducted in the Waikapū and Wailuku *ahupua`a*. The majority of the studies have been implemented based on requirements set forth in the laws pertaining to the environmental impact of proposed development. A significant portion of development has occurred in areas of fallow pineapple and sugarcane. The impact of commercial agriculture on archaeological sites located in non-sand substrates located below 500 feet amsl appears to be severe and has resulted in the complete destruction of a significant portion of pre-contact sites. In areas that contain a sand matrix, intact, previously disturbed and isolated human remains have been documented. Pre-contact site components appear to have been less impacted by intensive agricultural in areas located above 500 feet amsl. Post-contact sites in the region are typically associated with agricultural activities [clearing mounds, water diversion structures (flumes and ditches), habitation, roads, and railroads] and ranching activities (walls).

Cultural Surveys Hawai`i conducted a 600 acre archaeological survey near Mā`alaea that resulted in the documentation of a historic plantation ditch (50-50-09-2709) and a post-contact cemetery (50-50-09-2708) Hammatt and Folk (1989). The plantation ditch was documented on 1900's plantation maps and referred to as Reservoir No. 13 (Figure 16). The cemetery at Pu`uhele contained at least seven burials with tombstones, two possible rock mound burials, and a single niche burial (Creed 1993:27).

In 1989 and 1991, PHRI completed a six hundred acre archaeological inventory survey within the Waikapū Mauka Partners Golf Resort. Haun's initial inventory survey (1989) suggested that the archaeological sites below the 500 feet amsl had been obliterated by intensive cultivation of sugarcane and pineapple (Figures 19 and 20). There were, however, pre-contact intact sites located above the 500 feet amsl. Nine archaeological sites consisting of more than 46 features were documented. Haun concluded from excavation results that the majority of the archaeological features were agricultural (clearing mounds, terraces, cleared areas, walls, excavated depressions, and modified outcrops). In addition to the agricultural features, temporary habitation features (C-shapes and enclosures) were also present. During the data recovery component of the research, permanent habitation sites were also documented and exhibited complex architectural designs (Brisbin, Haun, and Jensen 1991:28 and 32). This region appears to have been utilized primarily for dryland agricultural activities with minimal associated habitation and occasional ranching activities. Radiocarbon dates ranged from the early 1500's through the historic era.

An inventory survey was conducted by Archaeological Consultants of Hawai`i (ACH) on a parcel of land located directly to the west (*mauka*) of the site complexes recorded by Haun (1989) and Brisbin *et al.* (1991). During the inventory survey, eleven site complexes were recorded that contained seventy-four related features and sub-features, in addition to seven additional single feature sites. Site complexes contained a variety of features: agricultural, habitation (both temporary and permanent), religious, and burials (Kennedy 1992). As previously noted, these archaeological sites appear to be a continuation of sites identified to the east. Radiocarbon dates ranged from A.D. 1040 through 1950.

Two separate archaeological inventory surveys were conducted by Archaeological Consultants of Hawai`i for the proposed Waikapū Mauka water tank location in 1991 (see Figures 17 and 18). During the initial survey and subsurface testing for the water tank and access road, a residential complex with two associated agricultural features was documented. The revised water tank location boundaries partially overlapped the initial delineated boundaries. In conclusion, five features were documented within the boundaries of the two proposed water tank locations. Three features were documented in the first survey and two were documented during the second survey. Site 2904 contains three features: Feature-A (a habitation enclosure and a C-shape), Feature-B (two agricultural terraces and four clearing mounds), and Feature-C (an agricultural terrace). Subsurface testing within Feature-A produced a single piece of marine midden, *Kukui* shell, coral, and charcoal (Kennedy and Maigret 1991).

Archaeological Consultants of Hawai`i performed an archaeological inventory survey for the Maui Ocean Center located in Mā`alaea (Moore and Kennedy 1994). The surface survey identified one site of historic significance, the Mā`alaea Ebisu Jinja) (State Site 50-50-09-1604). During the sub-surface testing, twenty-five backhoe trenches were excavated and human burials were encountered and designated State Site 50-50-09-3553 and 3554 (Figure 17).

Aki Sinoto Consulting conducted an archaeological inventory survey consisting of thirteen backhoe trenches in a parcel which included the proposed Coral Wireless Waiko Baseyard location (Titchnel 1995). No cultural remains were encountered; however, due to the possibility of encountering human remains in the sand substrate monitoring was recommended for any future ground disturbing activities.

Garcia and Associates conducted an archaeological inventory survey of fifteen acres for a proposed base course production and composting facility located north of Pōhākea Gulch (Eble and Pantaleo 1997) (see Figures 17 and 20). The survey resulted in the identification of a single structural component. A historic wall segment that incorporated a wooden post and wire fencing material was documented and was

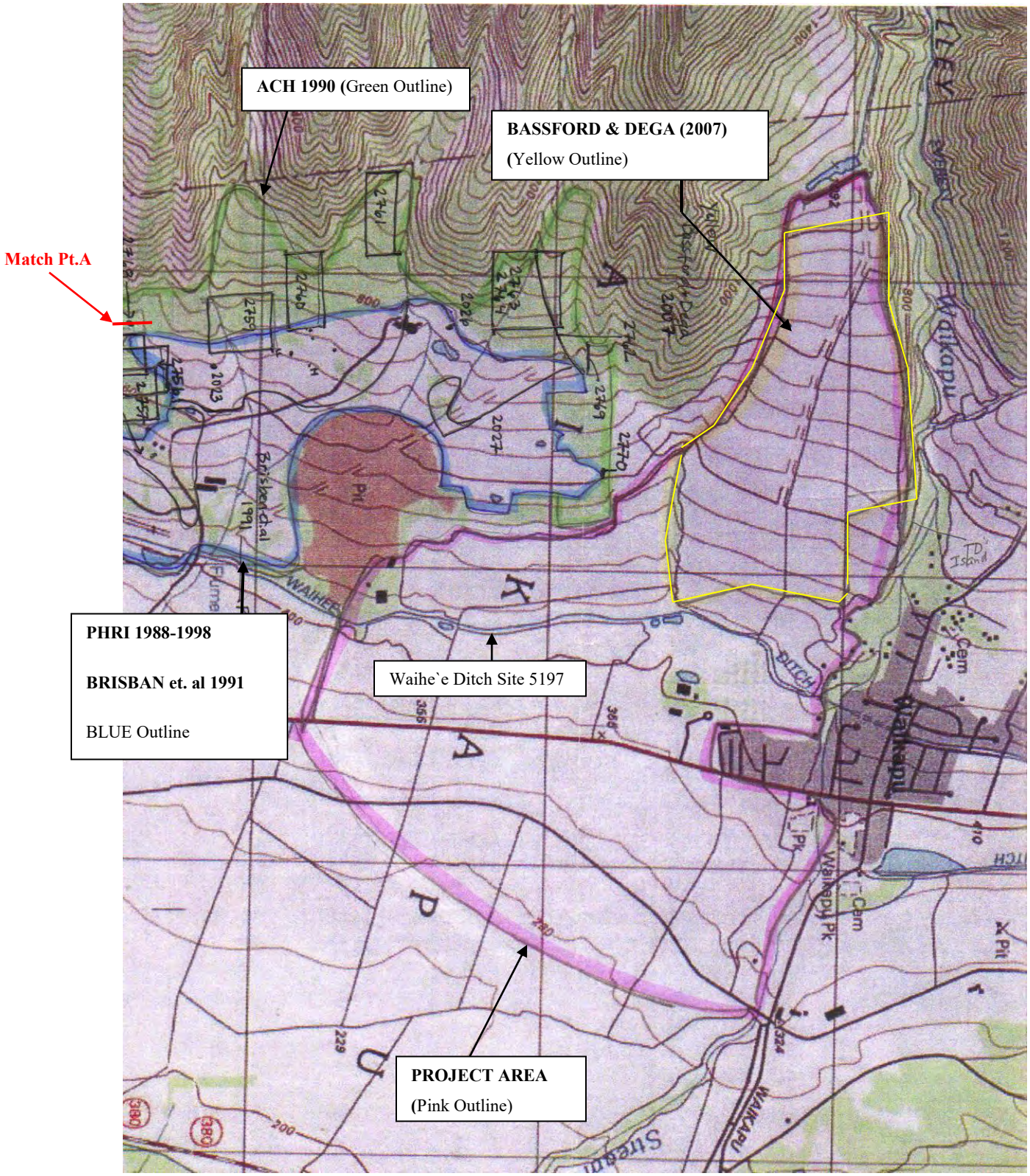


Figure 19. USGS Map Showing Location of Previous Archaeological Investigations in Upper Waikapū

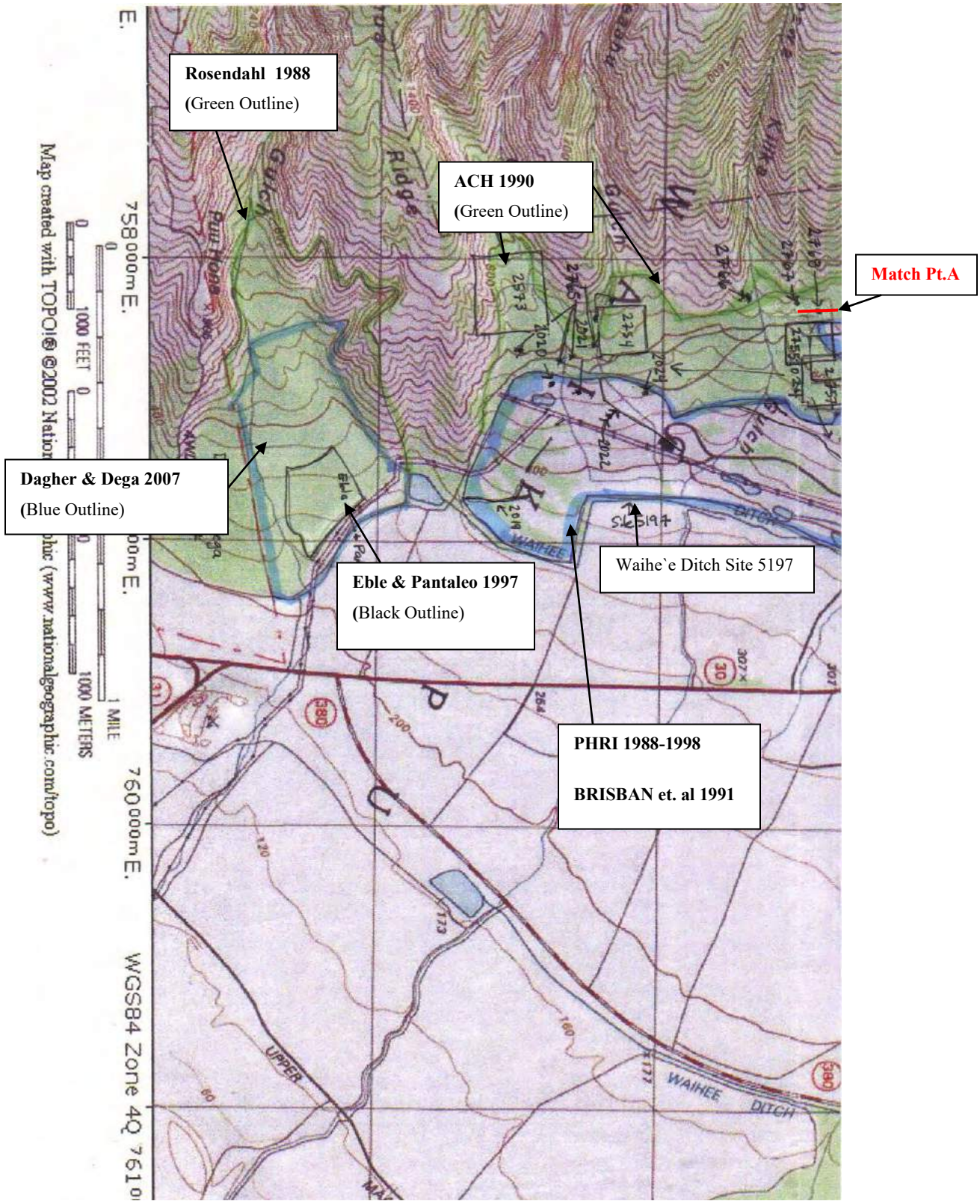


Figure 20. USGS Map Showing Location of Previous Archaeological Investigations in Upper Waikapū

possibly associated with Site 50-50-09-6062 or -6063 originally documented by PHRI in 1988 (Eble and Pantaleo 1997:9).

An archaeological inventory survey was conducted by Scientific Consultant Services for five lots and a proposed road corridor in the Kehalani Mauka Subdivision (Dega 2003). There were three archaeological sites encountered: the Hopoi Reservoir (50-50-04-5473), the Kama Ditch (50-50-04-5474), and an isolated find basalt adze (50-50-04-5478).Subsurface testing consisted of eighteen trenches that were culturally sterile. A later inventory survey was conducted in the same Kehalani Mauka property and addressed lots not studied during the initial study. This later research documented six additional archaeological sites that consisted of several plantation clearing mounds (50-50-04-5492), a historic surface scatter (50-50-04-5491), a roadway (50-50-04-5489), previously recorded Waihe`e Ditch (50-50-04-5197), and a series of lesser ditches (50-50-04-5490 and -5493) (Dega 2004).

Scientific Consultants Services conducted an archaeological assessment in the Kehalani lands east of the Honoapi`ilani Highway. Subsurface testing resulted in recent agricultural debris located in Stratum II (Monaham 2003). There were no significant findings reported during this study.

Archaeological monitoring was implemented for the Kehalani Subdivision and off-site improvements along the Waiale Road by Scientific Consultant Services (Morawski, Shefcheck, and Dega 2006). Five sites were recorded and consisted of a historic road bed (50-50-04-5963), a sugarcane flume (50-50-04-5964), an *in situ* burial (50-50-04-5680), and two areas of isolated human remains (50-50-04-5965 and -5966). Remains associated with the isolated finds were encountered in a previously disturbed soil matrix that was most likely associated with the initial construction of the Waiale Road.

A 60-acre archaeological inventory survey was conducted by Scientific Consultant Services for the proposed Pōhākea Rock Quarry expansion project (Dagher and Dega 2007). This survey resulted in the re-identification and documenting six sites previously recorded by Paul H. Rosendahl, Inc. (PHRI) in 1988. During the preliminary survey, these sites were only designated temporary site numbers. The present study assigned State Inventory of Historic Properties (SIHP) numbers 50-50-09-6061 through -6065. One of the previously identified sites T-9 was reevaluated during the 2007 study and was determined to be a natural unmodified boulder field. The other sites were all documented as historic ranching sites and complexes based on context and construction (Dagher and Dega, 2007:ii). During the 2007 survey, two additional sites were documented. An enclosure (50-50-09-6066) and a modified outcrop (50-50-09-6067) which were both presumed to be associated with historic ranching activities

based on context and lack of traditional artifacts. This study resulted in the documentation of seven sites (five from initial study and two from later survey) containing twenty-three features.

In 2008 T.S. Dye and Colleagues, Archaeologist, Inc. conducted a historic properties assessment for the proposed Coral Wireless Waiko Baseyard cellular site. The objective of this archaeological investigation was to evaluate if the new antenna and equipment would have a negative effect on documented historic properties. The report concludes that due to significant ground altering activities previously conducted within the immediate APE and no historic properties documented in the proposed footprint that there will be no visual effect on historic properties. The report does recommend monitoring of any subsurface excavation during construction due to the possibility of encountering human remains in the sand substrate.

Previous Archaeological Research Conducted Within the Boundaries of the Project Area

An archaeological assessment was conducted on a 208 acre parcel of land by Scientific Consultant Services (Bassford and Dega, 2007). This parcel of land is located within the current project area's boundaries of Parcel 3 Mauka (Figures 19, 21 and Table X). A pedestrian survey only resulted in the documentation of modern commercial agricultural debris and no historically significant sites, features, or artifacts. Subsurface testing consisted of thirty-one backhoe trenches that were evenly distributed throughout project area. Trenching activity yielded no significant finds as well. Due to the negative findings, the archaeological inventory survey was reclassified as an archaeological assessment.

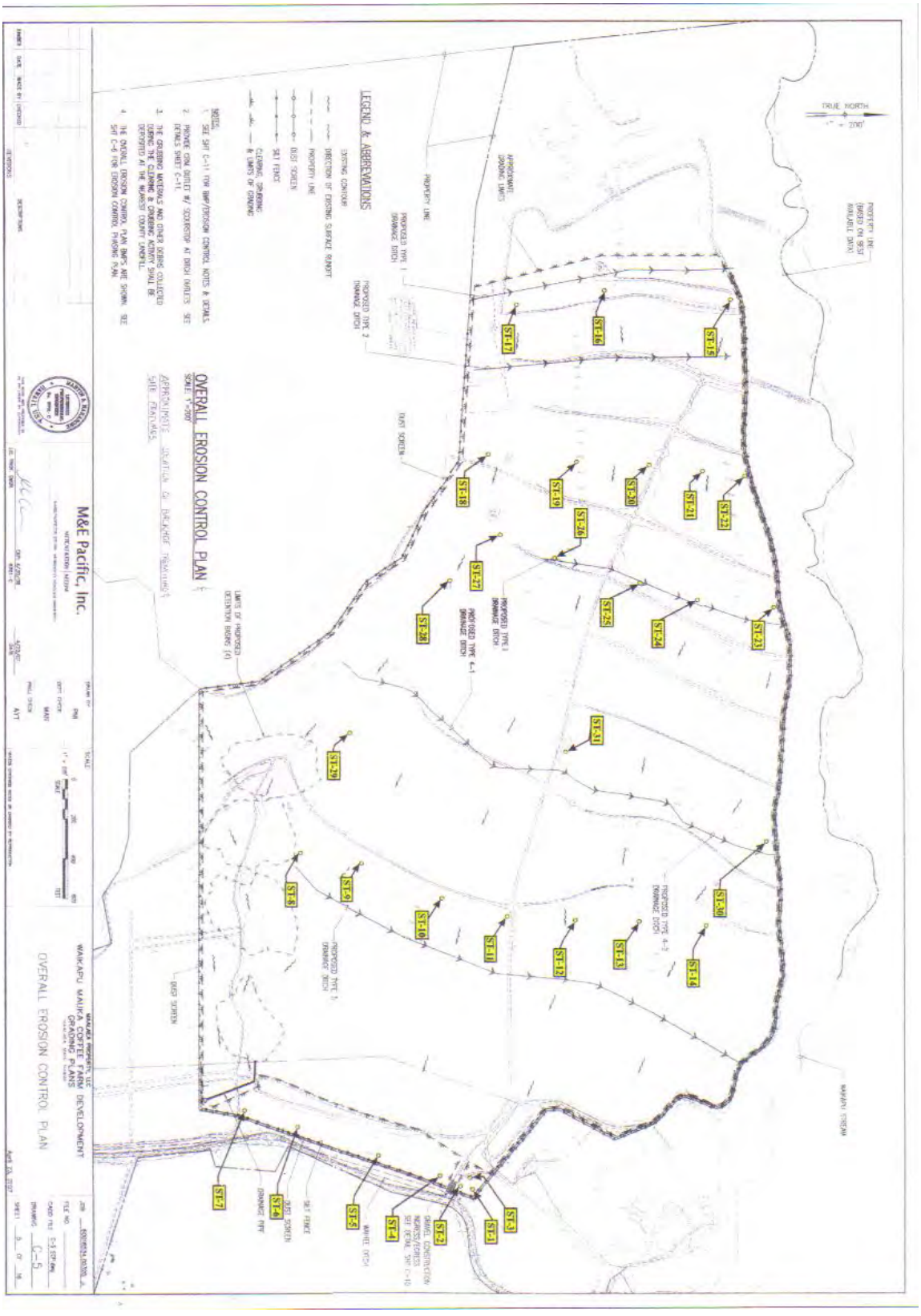


Figure 21. Plan View Map of SCS Project Area Showing Trench Locations ST1-31 within Current Parcel 3 Mauka and Parcel 6

Table X. Previous Archaeological Studies Conducted in the Waikapū *Ahupua`a*

DATE	AUTHOR/COMPANY	LOCATION	NATURE OF STUDY	FINDINGS
1909	Thrum	Maui Island	Coastal *heiau* survey	Study involved recording heiau (religious structures) sites along the coastline. Thrum recorded four *heiau* in the Waikapū *Ahupua*`a, two in the village and two at or near the shore.
1916	Stokes	Maui Island	*Heiau* survey	Added *heiau* sites to Thrum's list
1920	Emory	Maui Island	*Heiau* survey	Added *heiau* sites to Thrum's list
1928 1931	Walker	Maui Island	Reconnaissance Survey	Revisited previously documented sites and recorded new sites (with substantial construction) to produce an island wide survey. In reference to Waikapū , Walker notes an unnamed *heiau* and petroglyphs located "a quarter-mile from the village of Mā`alaeaat the base of the foothills of the West Maui mountains" (Walker 1931:43, 58-60 and 201-206).
1989	Hammatt and Folk (Cultural Surveys Hawai`i)	Waikapū *Ahupua`a* (near Ma`alaea)	A 600 acre archaeological inventory survey	Two sites [historic plantation ditch (50-50-09-2709) and a post-contact cemetery (50-50-09-2708)]
1989/ 1991	Haun (1989)/Brisbin, Haun, and Jensen (1991) (PHRI)	Waikapū Mauka Partners Golf Resort	A 600 acre archaeological inventory survey	Nine sites with more than 46 features were documented and consisted of: agricultural features (clearing mounds, terraces, cleared areas, walls, excavated depressions, and modified outcrops) temporary habitation features (C-shapes and enclosures) and permanent habitation
1991	Kennedy and Maigret (Archaeological Consultants of Hawai`i)	Waikapū Mauka water tank location	Two separate archaeological inventory surveys	Site 2904, Feature-A (a habitation enclosure and a C-shape), Feature-B (two agricultural terraces and four clearing mounds), and Feature-C (an agricultural terrace).
1989 rev. 1992	Kennedy (Archaeological Consultants of Hawai`i)	Waikapū *Ahupua`a* in aparcel of land located directly to the west of the site complexes recorded by Haun (1989) and Brisbin*et al.* (1991).	An archaeological inventory survey	Eleven sites comprised of seventy-four features and sub-features, in addition to seven additional single feature sites. Features consisted of: agricultural, habitation, religious, and burials Radiocarbon dates ranged from A.D. 1040 through 1950.
1994	Moore and Kennedy (Archaeological Consultants of Hawai`i)	Waikapū Ahupua`a Maui Ocean Center located in Ma`alaea	An archaeological inventory survey	The surface survey identified one site of historic significance, the Mā`alaeaEbisuJinja) (State Site 50-50-09-1604). During the sub-surface testing, twenty-five backhoe trenches were excavated and human burials were encountered (State Site 50-50-09-3553 and -3554).
1995	Titchnel (Aki Sinoto Consulting)	Waikapū Ahupua`a WaikoBaseyard	An archaeological inventory survey	Subsurface testing of thirteen backhoe trenches in a parcel which included the proposed Coral Wireless location resulted in negative findings
1997	Eble and Pantaleo (Garcia and Associates)	Waikapū *Ahupua`a* north of Pōhākea Gulch	An archaeological inventory survey of fifteen acres	The survey resulted in the identification of a historic wall segment that was possibly associated with Site 50-50-09-6062 or -6063 originally documented by PHRI in 1988

2003	Dega (Scientific Consultant Services)	Waikapū *Ahupua`a* in the Kehalani Mauka Subdivision	An archaeological inventory survey was conducted for five lots and a proposed road corridor	There were three archaeological sites encountered: the Hopoi Reservoir (50-50-04-5473), the Kama Ditch (50-50-04-5474), and an isolated find basalt adze (50-50-04-5478). Subsurface testing consisted of eighteen trenches that were culturally sterile.
2004	Dega (Scientific Consultant Services)	Waikapū *Ahupua`a* in the Kehalani Mauka Subdivision	An archaeological inventory survey was conducted in the lots not studied during the initial study.	This later research documented six additional archaeological sites that consisted of several plantation clearing mounds (50-50-04-5492), a historic surface scatter (50-50-04-5491), a roadway (50-50-04-5489), previously recorded Waihe`e Ditch (50-50-04-5197), and a series of lesser ditches (50-50-04-5490 and -5493)
2003	Monoham (Scientific Consultant Services)	Waikapū *Ahupua`a* in the Kahalani lands east of the Honoapi`ilani Highway	Archaeological assessment	Subsurface testing resulted in recent agricultural debris located in Stratum II--There were no significant findings reported during this study.
2004 and 2006	Rotunno-Hazuka andPantaleo (Archaeological Services Hawai`i)	Waikapū *Ahupua`a* in the WaikoBaseyard	Prepared two monitoring plansfor the construction of the WaikoBaseyard and a warehouse and associated utilities.	No surface or sub-surface cultural deposits were encountered during ground altering activities.
2006	Morawski, Shefcheck, and Dega (Scientific Consultant Services)	Waikapū *Ahupua*`a in the Kehalani Subdivision along the Waiale Road	Archaeological monitoring	Five sites were recorded and consisted of a historic road bed (50-50-04-5963), a sugarcane flume (50-50-04-5964), an in situ burial (50-50-04-5680), and two areas of isolated human remains (50-50-04-5965 and -5966).
2007	Bassford and Dega (Scientific Consultant Services)	Waikapū *Ahupua`a* (located within boundaries of current study)	208 acre parcel archaeological inventory survey	Surface and subsurface (thirty-one backhoe trenches) study yielded no significant findings
2007	Dagher and Dega (Scientific Consultant Services)	Waikapū *Ahupua`a*	A 60 acre archaeological inventory survey for the proposed Pohakea Rock Quarry expansion	This survey resulted in the re-identification and documenting six sites previously recorded by Paul H. Rosendahl, Inc. (PHRI) in 1988. During the preliminary survey, these sites were only designated temporary site numbers. The present study assigned State Inventory of Historic Properties (SIHP) numbers 50-50-09-6061 through -6065. One of the previously identified sites determined to be natural. The other sites were all documented as historic ranching. Two additional sites were documented [an enclosure (50-50-09-6066) and a modified outcrop (50-50-09-6067)] presumed to be associated with historic ranching activities.
2008	T.S. Dye and Colleagues, Archaeologist	Waikapū *Ahupua`a* in the WaikoBaseyard	Evaluate if the new antenna and equipment would have a negative effect on documented historic properties	No negative effect

SETTLEMENT PATTERNS

The current project area is situated along the foothills of the West Maui Mountains in Waikapū *ahupua`a*. Previous archaeological investigations, coupled with the history of the area focusing on previous land use, topographic features and ethno-historic accounts, can be used to develop a general predictive model for traditional Hawaiian settlement and subsistence patterns for this project area. The general region, including and encompassing the current project area, is referred to and appears to have been part of a large wetland taro production:

> …Spreading north and South from the base of Waikapū to a considerable distance below the valley are the vestiges of extensive wet-taro plantings, now almost obliterated by sugar-cane cultivation; a few here and there are preserved in plantation camps and under house and garden sites along the roads. Among these gardens there were, in 1934, a few patches of dry Japanese taro. Far on the north side, just above the main road and at least half a mile below the entrance to the canyon, an extensive truck garden on old terrace ground showed the large area and the distance below and away from the valley that was anciently developed in terraced taro culture. On the south side there are likewise several sizable kuleanas where, in 1934, old terraces were used for truck gardening. In the largest of these a few old patches were flooded and planted with Hawaiian taro, and there was some dry Japanese taro. Several terraces were used as ponds planted with lotus for their edible seed. There were probably once a few small terraces on the narrow level strip of the valley bottom in the lower canyon… (Handy and Handy 1972:497).

A hypothetical model for traditional Hawaiian settlement was developed by Kirch (1985) and Cordy (1978). According to this postulation, the project area would have been an ideal setting for early Hawaiian permanent habitation. Utilizing dates from other Hawaiian Islands, Cordy postulated that initial pre-Contact settlement in lower valleys and coastal regions occurred from 300 to 600 A.D. and by 1000 A.D. fishponds, protected bays, and religious structures.

The subject area contains a dominant waterway, Waikapū Stream with rich alluvial soils. Traditionally, this stream would have been utilized to create extensive irrigation systems containing numerous pondfields with associated *`auwai*. This stream not only supported the main dietary staple, *lo`i kalo,* but also *mai`a* (bananas), *`uala* (sweet potatoes), *kī* (ti) and trees such as *niu* (coconuts), *wauke* (paper mulberry) and *lau hala*, but was also the freshwater source for the Kealia Ponds. Habitation and religious structures, along with agricultural sites would have been distributed near the *lo`i* patch and down by the shore for marine exploitation, fish pond maintenance and the collection of salt at the salt pans of Mā`alaea and/or Kealia. Historically, the water source would have been important for some of the same reasons but habitation structures would also have been established around towns, railroads and plantation camps. By

reviewing old maps and the Mahele record, the historic settlement patterns can easily be discerned. Conversely, through these archival records and archaeological investigations, the traditional settlement patterns can merely be inferred.

SITE EXPECITABILY

Based on the aforementioned background information and settlement patterns, the type of sites and/or features that may be encountered within the project area would be associated with traditional and historic habitation, as well as agricultural and animal husbandry sites. Due to the extensive grading activities associated with sugarcane cultivation and the construction of the Maui Tropical Plantation commercial buildings, no surface structural remains associated with the pre-Contact and post Contact eras are anticipated; however features associated with sugarcane cultivation are likely. Remnant subsurface historic properties may include rock alignments, buried cultural deposits, pits and human burials. The likelihood of encountering these subsurface features throughout will be dependent upon the depth of the sugarcane till zone.

METHODS AND PROCEDURES

Archaeological procedures were conducted intermittently from February through June 2013 by supervisor Ms. Diane Guerriero (B.A.) and archaeological personnel Ms. Rochelle Barretto. Overall direction and coordination was performed by Ms. Lisa Rotunno-Hazuka (B.A.) and the Principal Investigator was Mr. Jeffrey Pantaleo (M.A).

DOCUMENT REVIEW

Document review included examination of archival sources, historic maps, previous archaeological reports from the SHPD and ASH libraries, historic photographs, the Waihona `Āina online data base and multiple online sources. These references were accessed in order to formulate a predictive model of the types of historic properties that may be encountered in the area, and to ascertain the most productive placement of test trenching.

FIELD METHODOLOGY

The perimeter of the project area was established by comparing current landmarks (streets, access cane field roads, structures, fence lines and water ways), the natural topography and information provided on the TMK map, U.S.G.S., topographic maps and aerial photos. Once the boundaries of each respective parcel were determined, a systematic pedestrian survey was performed in areas that were open and devoid of tall, dense sugarcane. For these open areas, transects were spaced ten meters apart, and for sections with dense, tall sugarcane, the pedestrian survey was only feasible through the cane haul roads. The cane

haul roads were traversed and gaps in the sugarcane were accessed through these roads. As potential historic properties were identified, they were marked with flagging tape and assigned a temporary site number. Once the pedestrian survey was completed, the sites and/or features were recorded by producing scaled plan view drawings utilizing tape and compass, photographs and feature description forms. All features and trenches were located with a hand held GPS.

All backhoe test trench excavations were monitored and recorded by archaeological personnel. Placement of the backhoe trenches was determined utilizing the following protocol. All areas proposed for development within the five subject parcels shall be investigated. The testing method employed was systematic random sampling where the areas to be analyzed are chosen at random with a subsequent pre-determined strategy (Hester et. al. 2009). "Use of this sample technique guarantees more uniform coverage of an area than would likely occur with simple random sampling" (Hester et. al. 2009:29). It allows the investigator to obtain information about the subsurface conditions across a project area that aide in determining future excavation strategies for the project area. All LCA's and Grants if accessible within these areas would be tested in particular those containing house lots. Lastly, testing would be initiated outside the LCA's and Grants to obtain representative sampling of these localities.

The backhoe test trenches were number sequentially per project area moving *mauka* to *makai*. Parcel 3 Mauka were labeled TR's 400-415, Parcel 3 Waena contained TR's 1-27 and 01-015, Parcel 6 was TR's 200-225, Parcel 7 trenches were designated TR's 300-324 and Parcel 3 Makai TR's 100-141. Recording of the trenches consisted of photographs and a stratigraphic profile of a representative column for each trench. Stratigraphic profiles were drawn to scale with soil color and texture recorded utilizing the Munsell color system. During the course of this project, all accepted standard archaeological procedures and practices were followed.

LAB WORK

All soil samples were processed by being accessioned and soil color and texture were recorded utilizing the Munsell color system. All artifacts underwent initial processing through accessioning, sorting, and cleaning. Then following any other pertinent procedures the artifacts were analyzed, catalogued, and photographed. All soil samples, recovered artifacts as well as field notes, maps, and photographs generated in connection with the current project are curated at Archaeological Services Hawaii, LLC, in Wailuku and Makawao Maui.

RESULTS

During the course of the current fieldwork a total of four (4) historic properties designated Sites 50-50-04-7881-7884 (TS 1, 3-5) with eighteen (19) associated features identified during the pedestrian survey in Parcel 3 Mauka and Parcel 3 Waena, one known site, Waihe`e Ditch Site 5197 was present between Parcels 6 and 7 (see Figure 8). Identified sites and features included water catchment, sluice gates, water diversion ditches, a remnant retaining wall, World War II bunker and secondarily deposited historic materials. Most of these features were associated with previous and current sugarcane cultivation and various other agricultural endeavors. Site 7881 Features 1-18 consists of concrete lined ditches, sluice gates, dirt culverts with concrete lined headwalls. 7882 (TS3) is an historic L-shaped retaining wall. Site 7883 (TS3) comprises a World War II structure and Site 7884 (TS 2 and 5) are secondarily deposited historic materials recorded at three localities within the project area. The scatters were designated Site 7884 Features 1- 3. Additionally, several low rock agricultural clearing mounds (TS21- 25) and a historic concrete slab (TS4) were documented in Parcel 3 Mauka and Parcel 3 Waena; however these features did not meet any significance criteria evaluation.

Since the majority of the property has been graded and or is currently cultivated, a total of 150 backhoe trenches were executed within the five zones with nominal findings in Parcel 6 TR 218; Parcel 7 TR's 323 and 324.

SITE 50-50-04-7881 (TS 1)

Site 7881 Features 1-18 are located along the northern boundary of Parcel 3 Mauka and consists of a series of ditches and associated sluice gates (water diversion and overflow) and reservoir (Figures 22 and 23). The vegetation in this area along the northwestern upper slope of Waikapū Valley and Stream is forested with trees that include eucalyptus (*Eucalyptus spp.*), Christmas berry trees (*Schinus terebinthifolius*), guava (*Psidium guajva*), abutilon (*Abutilon grandifolium*), ironwood trees (*Casuarina spp.*), morning glory (*Ipomoea spp.*) and various grasses. Features of this site are either located outside the project area limits, or outside the area of potential effect but have been recorded due to the close proximity to the project area.

Site 7881 Feature 1

Feature 1 is one of two ditches that originates and or intersects from the Waikapū Ditch South in the upper Waikapū Valley (Figures 22-23). The total length of the Waikapū Ditch South from the origin of the water source in the upper valley to Feature 3-reservoir is approximately 1.6 km (1 mile) long. Waikapū Ditch South in the upper valley is an open earthen canal and at the point that it becomes improved and concrete lined, it is designated as Feature 1 (Figures 24 and 25). This improved portion

(Feature 1) flows in a west/southeast direction (J-shaped) down slope towards the reservoir (Feature 3) for a length of 21.2 meters at an elevation of approximately 1017 AMSL. Feature 1 is concrete reinforced along the base of the banks and measures 21.2 m long by 1.6 m wide by 1.0 deep with exterior concrete bank heights of 0.30 m on the west and 1.2 m on the east. The service trail/access road which bounds the project area to the north and is parallel to Waikapū Stream on the north bisects Feature 1 at 15.7 m just before it curves to the south and empties into Feature 3 (reservoir) (Figure 26). The bridge measures 5.3 m in width east/west by 2.44 m in length northeast/southwest with an interior height of 0.30 m and exterior height of 0.55 m. Southeast of this service trail road bridge are three water diversion features (Features 4-6) or sluice gates, which intersect with Feature 1 and are discussed in detail below. Feature 4 is located 2.3 m southeast of the bridge, Feature 4a and Feature 5 are 4.1 m and Feature 6 is 7.7 m southeast of the bridge. Features 5 and 6 are abandoned and no longer divert water; however Features 4 and 4a re-channelize a portion of Feature 1 water east to another *`auwai* designated Feature 2 (see Figure 25). Feature 2 flows east, parallel along the southside of the dirt access trail bounding Parcel 3 Mauka, and Feature 1 continues south emptying into the Feature 3 reservoir (see Figure 23 below).

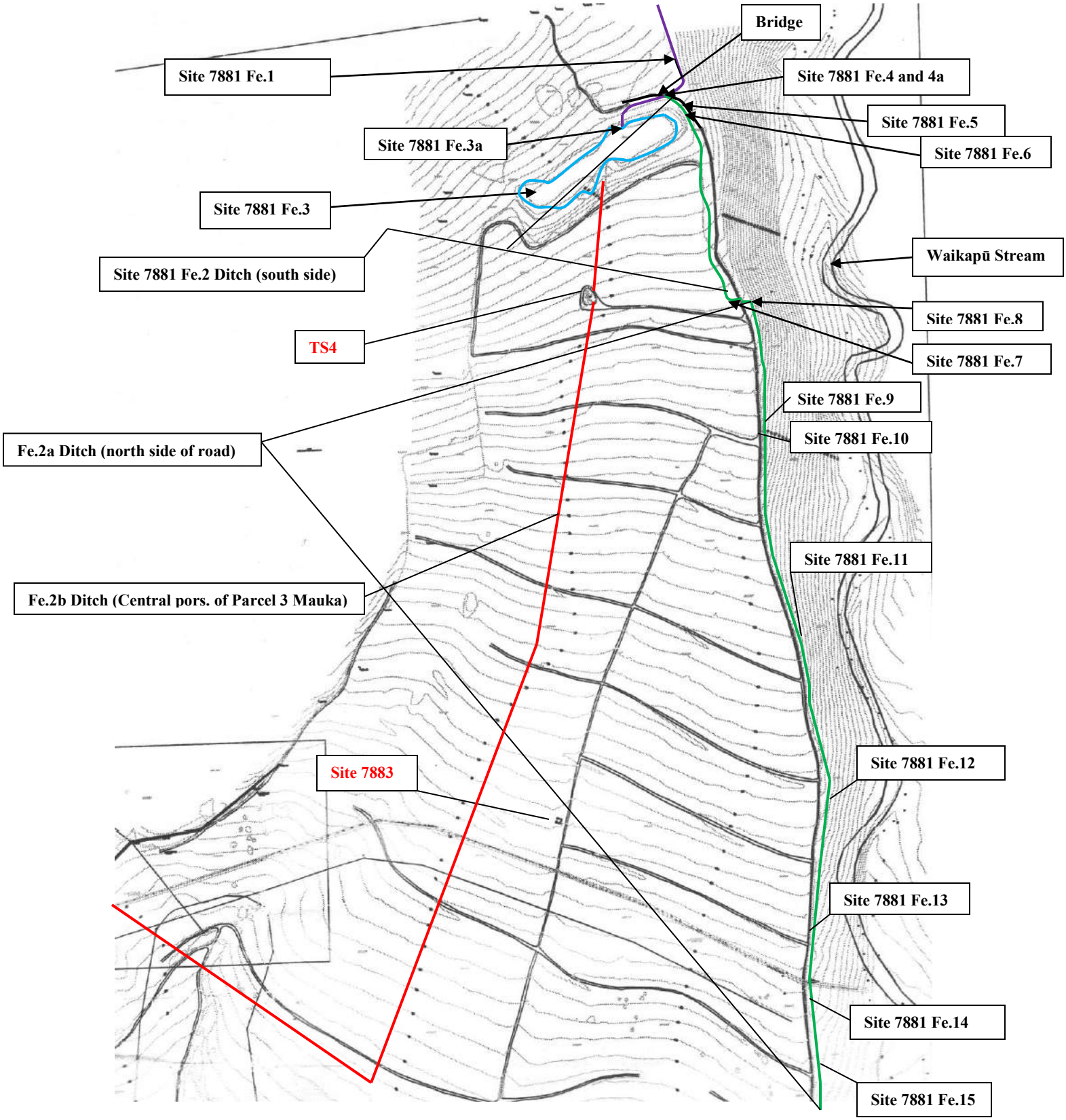


Figure 22. Plan View Map of a portion of Parcel 3 Mauka Showing Location of 7881 Features 1-15 and Site 7883 Features 2 and 3

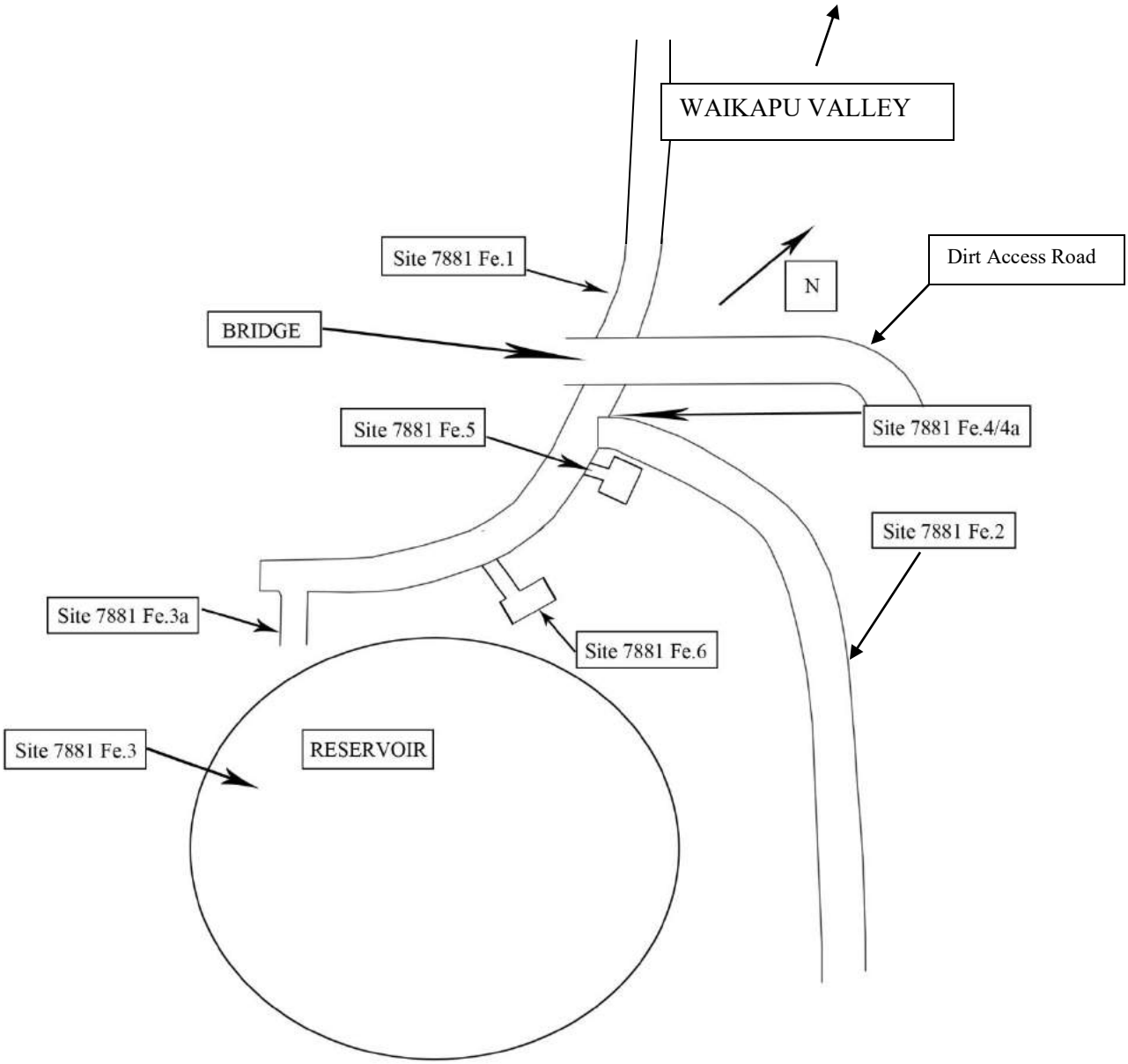


Figure 23. Plan View Map Showing Relationship of Site 7881 Features 1-6

Figure 24. Site 7881 Feature 1 (TS1), View to Northwest towards Upper Valley

Figure 25. Site 7881 Feature 1, View to North with Feature 6 on Right

Figure 26. Site 7881 Feature 1 (TS1) Emptying into Reservoir (Feature 3) thru modernized Chute (Feature 3a) (View to South)

Site 7881 Feature 2

Feature 2 is the second ditch fed from Feature 1 by sluice gate (Feature 4) and water chute (Feature 4a). Feature 2 travels east, parallel to and along the south side of the service trail access road. This ditch appears to be much older and in a dilapidated condition when compared with Feature 1. It is narrower, approximately 0.65 m in width, and comprised primarily of earthen banks with sporadic concrete and mortared rock lining along portions of the banks with concrete partially lining the base of the ditch (Figures 27-28). Feature 2 averages 0.60 m deep and continues for an approximate 214.0 m along the south side of the dirt access road, where it enters another diversion feature, Feature 7 (see Figure 28).

Figure 27. Site 7881 Feature 2 Ditch with Feature 5 in the foreground right (View to West)

Figure 28. 7881 Feature 2 Ditch at juncture with Feature 7 diversion feature in foreground (View to West)

Site 7881 Feature 3

Feature 3 is the reservoir that is located just outside of the project area at the top (western) edge of Parcel 3 Mauka at an elevation of 1017 AMSL (see Figures 22 and 30). Feature 1, the improved portion of Waikapū Ditch South empties into the reservoir on the west (see Figure 26). The water source originates from the upper the Waikapū Valley and flows through various `auwai and sluice gates to provide water to the agricultural endeavors below.

Figure 29. Site 7881 Feature 3 Reservoir, View to South

Site 7881 Feature 3a

Feature 3a is modernized chute that empties directly into (Feature 3) Reservoir from Feature 1 (see Figure 23). This feature utilizes wooden sluice gates with metal chains and locks, reinforced fiberglass chute walls with an 8-inch PVC piping that funnels the ditch (Feature 1) water into the reservoir.

Figure 30. Overview Photograph of Feature 1 (Left) and Feature 3a (Right)

Site 7881 Feature 4

Feature 4 is the water diversion feature which feeds Feature 2 ditch. It is a modern wooden sluice gate located along the northeast side of Feature 1approximately 2.3 m northeast from the bridge (see Figures 22, 23 and 31). Feature 4 is secured into position with chains and a key lock and allows water to flow east through Feature 4a water chute and Feature 2 ditch. Feature 4a is situated along the north side of abandoned water diversion feature (Feature 5) and is further discussed below.

Figure 31. Photograph of Site 7881Features 1 and 2 ditches and diversion structures Features 4, 4a and 5 (View to South)

Site 7881 Feature 4a

Feature 4a is the water chute associated with Feature 4 sluice gate. It is located 1.8 m at 36° NE of Feature 4. It consists of a concrete intake chute and a concrete "box shape" out take chute which formerly connected with the well containment box of Feature 5. The first intake chute connects with Feature 1ditch on the west (see Figure 31) and measure 1.2 m E/W by 1.2 m N/S, with an interior height of 1.35 m N/S and an exterior height of 1.1 to 1.2 m that connects to a "box like" cement capped water well containment box that measures 1.35 N/S by 1.25 m E/W and connects with another off take chute on the east that measures 1.3 m E/W by 1.2 m N/S, with an interior height of 1.0 m N/S and an exterior height of 1.2 m (Figure 32). The out take chute on the east presumably emptied into the reservoir at an earlier time or another ditch for sugarcane irrigation.

Figure 32. Photograph of Site 7881 Features 4, 4a and 5 Water Diversion Features (Bottom)

Figure 33. Site 7881 Feature 1 (ditch), Feature 5 (Water Containment Feature) and Feature 4 (Sluice Gate) (View to North)

Figure 34. Site 7881 Feature 2 ditch Flowing East from Feature 4a with Portion of Feature 5 bottom right (View to East)

Site 7881Feature 5

Feature 5 is an abandoned water diversion and containment feature situated along the southeast side of Feature 4a and exemplified in Figures 31 through 33. It is 4.1 m southeast of the bridge and adjacent to Feature 4a. It is a formed concrete rectangular structure with the containment well feature abutting Feature 1 channel which measures 1.20 m long by 1.2 m wide by 1.0 m high on the interior and 1.1 to 1.2 m on the exterior. The concrete top or lid measures 1.35 m long by 1.25 m wide by 1.2 m high. If operational, Feature 5 would have diverted water into Feature 2, the down slope eastern channel.

Site 7881 Feature 6

Feature 6 is the last abandoned water diversion feature also situated along the east side of Feature 1. It is an L-shaped structure similar to the other water features made of formed concrete which contains large aggregate gravel inclusions (Figures 35 and 36). The intake and out take walls range from 0.96 to 1.2 m long by 0.62 m to 1.1 m wide by 1.0 m to 1.4 m high with a concrete cap measuring 0.90 m long (north/south) by 0.80 wide m wide and 1.1 m high. Incised into the concrete out take walls are metal railroad rails in which the sluice gate could slide up and down along the rails to control the flow of water. The embedded rails were observed within several sluice gate or water diversion features in the area. Feature 6 would have diverted water east into another *`auwai* (ditch) that flowed further down slope to irrigate sugarcane.

Figure 35. Photograph of Site 7881 Feature 6 foreground with Feature 1 ditch background (View to North)

Figure 36. Photograph of Site 7881 Feature 1-Ditch (left) and Feature 6-Water Diversion (right) (View to North)

Site 7881 Feature 7

Feature 7 is one of two sluice gates associated with Feature 2 ditch. It is located 214 m east of the juncture from Features 2 and 4 (sluice gate). Feature 7 has concrete lined walls with two chutes, one is open and water flows under the service road to Feature 8 on the north side of the service access road. The other chute is closed with a metal sluice gate and appears to have been closed for some time (Figure 37).

Figure 37. Site 7881 Feature 7 Sluice Gate in Foreground and Feature 8 Background (View to Northeast)

Site 7881 Feature 8

Feature 8 is another sluice gate associated with Features 2 and 7 located along the north side of the service access trail. It is an L-shaped structure comprised of formed concrete walls with large cobble inclusions and a modern sluice gate which empties towards Waikapū Stream. Indentions for former railroad rails are present along the out take chute to the east (Figures 38 and 39).

Figure 38. Photograph of Site 7881 Feature 8 showing Two Channels, Feature 2 Ditch continues East and Overflow beyond Sluice Gate to Waikapū Stream (View to North)

Figure 39. Up-Close Photograph of Feature 8 (View to east)

Site 7881Features 9-18

Features 9 through 18 are a series of culverts along the north side of the service access road which continue to divert water underground within the Feature 2 ditch system along the north side. These features, like Features 1-8 are either outside of the project area or area of potential effect (A.P.E.) and will not be disturbed during the development of the property. These features are briefly described below.

Site 7881 Feature 9

Feature 9 is a culvert associated with Feature 2 ditch. The intake chute on the west contains a 12" metal pipe, reinforced at the opening by the construction of a rock and mortared faced wall. The wall is comprised of basalt water-worn and sub-angular cobbles held together with mortar and concrete containing large grained sand and large angular gravel approximately 1.5 m wide and 0.95 m deep. Along the east side is an open earthen ditch which intersects with Feature 2 on the north and directs any excess flow of water into the Waikapū Stream.

Figure 40. Photograph of Site 7881 Feature 9 Intake on West side (View to East)

Figure 41. Photograph of Site 7881 Feature 9 Out take on East (View to North)

Site7881 Feature 10

Feature 10 is another culvert associated with Feature 2 east flowing ditch on the north side of the access service road. The water flows into an underground culvert on the west, approximately 15.5 long, and emerges on the east. It is constructed similarly to Feature 9 with a 12" metal pipe, and concrete basalt water-worn and sub-angular cobbles placed against the wall around the pipe and measures 1.4 m long by 0.90 m deep. Another earthen ditch, like Feature 9, is present along the west side for overflow of water which will be directed to Waikapū Stream.

Figure 42. Photograph of Site 7881 Feature 10 Intake on West (View to East)

Figure 43. Site 7881 Feature 2 Ditch along the north side of access road are remnant retention walls, mortar and water-worn cobbles and Sub-angular basalt cobbles, section before Site 7881 Feature 10, View to North

Figure 44. Feature 2 Ditch flowing into Site 7881 Feature 10 Culvert (View to West)

Site 7881 Feature 11

Feature 11 is another culvert on the north side of the access road constructed similarly to Features 9 and 10. The water from the west flows into an underground 12” metal pipe culvert approximately 14.5 long and emerges on the east (Figures 45 and 46). The intake (west) side contains the same reinforced wall of basalt water-worn and sub-angular cobbles with concrete faced 1.2 m wide and 1.0 m deep. An open earthen ditch is present on the east for overflow of high volume water which will empty into the Waikapū Stream.

Figure 45. Photograph of Site 7881 Feature 11 Intake on West (View to East)

Figure 46. Photograph of Site 7881 Feature 11 Out-take (View to West)

Site 7881 Feature 12

Feature 12 culvert is approximately 15.5 m long and comprised of a 12" metal pipe. The intake (west) side opening is faced with concrete and basalt water-worn and sub-angular cobbles which measures 1.4 m wide and 0.90 m deep (Figure 47). The overflow earthen ditch is present along the east out-take side and directs the high volume of water into the Waikapū Stream on the north.

Figure 47. Overview Photographs of Site 7881 Feature 12 Intake (View to East) left and Feature 12 Out-take (View to West) right

Site 7881 Feature 13

Feature 13 culvert for Feature 2 ditch on the north side of the access service road consists of a 12" PVC pipe which measures approximately 13.5 m long and emerges on the east (Figure 48). The pipe on the west side contains a concaved, concrete faced lining which measures 1.3 m wide by 0.70 m deep. The earthen open ditch is present on the east side and utilized for all excess water which will be re-directed to Waikapū Stream.

Figure 48. Photographs of Site 7881 Feature 13 Intake (View to East) left; Feature 13 Out-take (View to West) right

Site 7881 Feature 14

Feature 14 is another culvert situated along the north side of the dirt access road. This culvert, like Feature 13 is comprised of a 12" PVC pipe which runs underground for approximately 13.5 m. At the opening around the intake, the earth is reinforced and lined with concrete which measures 1.6 m wide and 0.80 m deep (Figure 49). The open earthen ditch is present along the east side and re-directs high volume water flow to the north into Waikapū Stream.

Figure 49. Overview Photographs of Site 7881 Feature 14 Intake (View to East) left; Feature 14 Out-take (View to West) right

Site 7881 Feature 15

Feature 15 culvert is situated on the north side of the service access road and runs underground for approximately 18.0 m. The culvert consists of a 12” PVC pipe with concrete and rock facing along the west intake side (Figure 50). The reinforced wall around the opening measures 1.4 m wide by 1.0 m deep. The out take side contains the open earthen ditch for overflow of excess water.

Figure 50. Photographs of Site 7881 Feature 15 In-take (View to East) left and Feature 15 Out-take View to West (right)

Site 7881 Feature 16

Feature 16 culvert is larger and comprised of a 24" metal pipe which runs underground for approximately 6.2 m and emerges on the east (Figure 51). This culvert does not contain a reinforced faced wall along the intake west side, but may have at one time. An open earthen ditch is present on the east for the over flow of water which will empty into Waikapū Stream.

Figure 51. Photographs of Site 7881 Feature 16 Intake, View to Southeast (left) Out-Take, View to West

Site 7881 Feature 17

Feature 17 is another culvert comprised of two intake PVC pipes, a 6' and 12' approximately 3.3 m long which emerges on the east into an open rectangular concrete drainage box that measures 1.55 m E/W long by 1.4 m wide N/S by 0.65 m high. Adjacent to the drainage box, the water is further channelized by aligned hollow-tile block walls which extend from the drainage box 1.27 m long by 1.3 m wide 0.25 m high (Figures 52 and 53). Approximately 5.0 m east from the out take east side are two 2 inch pipes with valves which are present within the ditch (Figure 54).

Figure 52. Overview Photographs of Site 7881 Feature 17 Intake (View to East) left and Feature 17 Out-take (View to East)

Figure 53. Photograph of Site 7881 Feature 17 Out-take (View to South)

Figure 54. Photograph of Site 7881 Feature 17 Valves (View to South)

Site 7881 Feature 18

Feature 18 is the last culvert in a series of underground drainage ditches associated with Feature 2 open ditch along the north side of the service access road. This culvert is comprised of a 12" metal pipe which runs approximately 11.0 m long emerging on the east. Feature 18 culvert also contains a 4-inch PVC pipe which extends from the west and goes through the metal pipe and extends out on the east side. The PVC pipe follows Feature 2 ditch for some distance and then extends out over the south bank of the ditch (Figure 55). The ditch and culvert on the west side are reinforced with a concrete, basalt water-worn and sub-angular cobbles faced wall that measures 1.4 m wide and 0.70 m deep. No open earthen overflow ditch was apparent and the PVC pipe may assist in excess flow. Atop the culvert is an access road utilized to cross Waikapū Stream.

Figure 55. Overview Photographs of Site 7881 Feature 18 and Faced Wall (left photo) (View to Northeast); Feature 18 East side (right photo) (View to East)

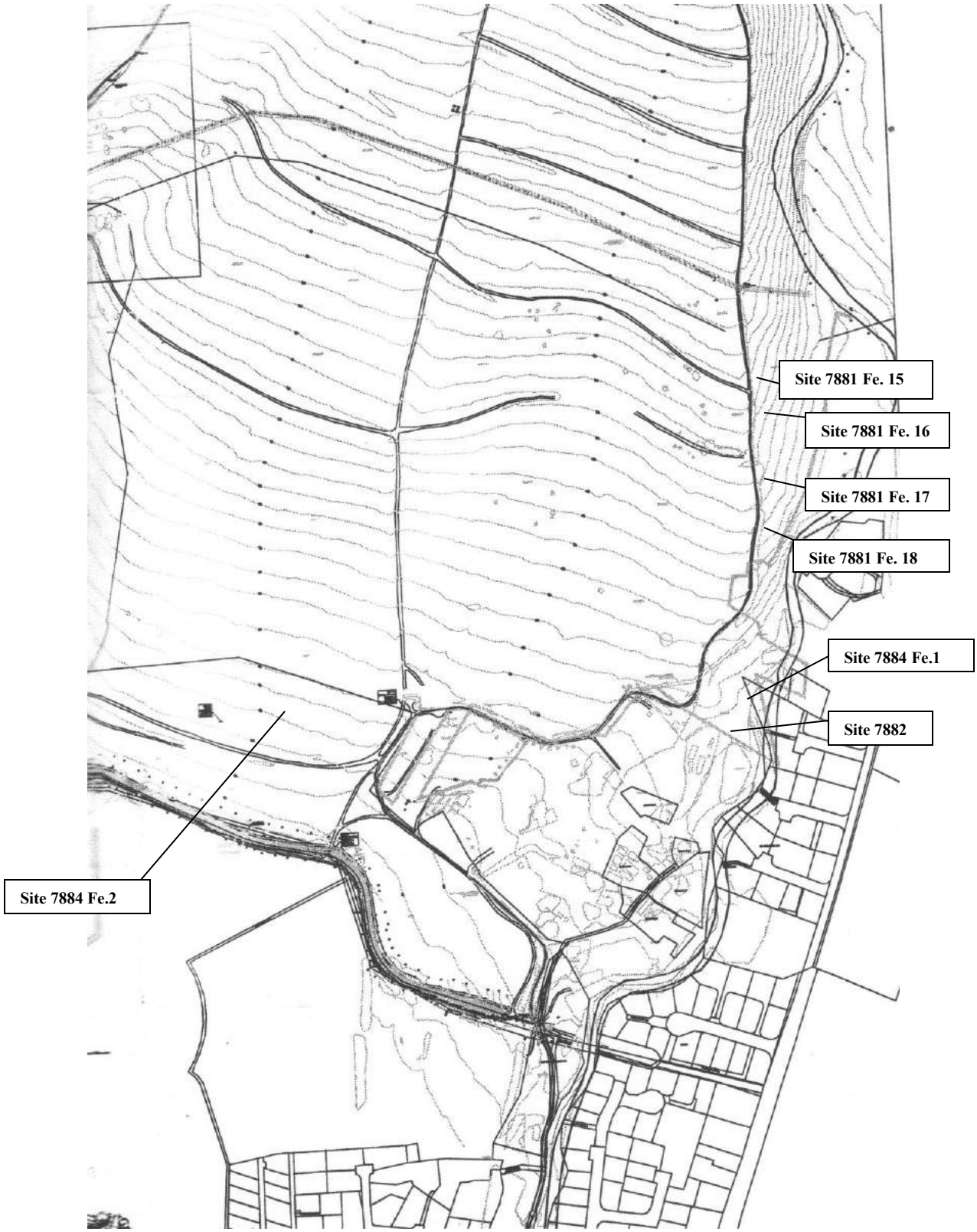


Figure 56. Plan View Map of Parcel 3 Mauka and Portions of Parcel 6 and 7 Showing Location of 7881 Features 15-18, Site 7882, 7883 Feature 2 and 3 and Site 7884 Features 1-2

SITE 7884 (TS2) FEATURE 1

Site 7884 Feature 1 is one of three secondarily deposited historic refuse scatters located adjacent to; south and west of Feature 2 ditch near the northeastern corner of Parcel 3 Mauka. The refuse deposit covers an area of approximately 4.0 m and appears to have been re-deposited by anthropomorphic or alluvial forces (Figures 56-59). Thus, the materials may have been tossed down slope from the dirt access road or it may have been washed down during heavy flow re-depositing the materials along the sides and within the ditch. Historic materials included bottle glass fragments and ceramic plate sherds. Features 2 and 3 of this Site number are discussed further below within sections Parcel 6 and Parcel 7.

Figure 57. Site 7884 Feature 1 Historic Scatter along Feature 2 Ditch, View to West

Figure 58. Site 7884 Feature 1 (TS2) Secondary Deposit of Historic Refuse

Figure 59. Overview Photograph of Site 7884 Feature 1 Historic Material

Figure 60. Photograph of Ceramic Assemblage

SITE 7882 (TS3)

Site 7882 is a remnant L-shaped retaining wall or rock-faced, soil-filled terrace located 5.0 m north of Site 7881 Feature 2 ditch and south of the Waikapū Stream near the boundary between Parcel 6 and Parcel 3 Mauka within LCA 2522. As presented in Table I, LCA 2522 claimed land use of kula and *lo`i kalo* (wetland taro). Site 7882 is constructed along the contour of the slope and retains a small level surface area to the north (Figures 61-64). It incorporates the outcrop into its construction on the east, and is stacked and faced, 6 courses high (1.5 m) with water-worn basalt small boulders and cobbles. The longer leg measures 4.0 m and is oriented east/west and the shorter leg is 1.5 m north/south retaining a level surface area measuring from 0.80 m to 1.0 m. Collapse is present on the east adjacent to the outcrop. Based on the former land use presented in Table I, Site 7882 is likely a remnant terrace formerly utilized during the historic period for the cultivation of taro. Additionally, this site may have initially been constructed during the pre-Contact period, and renovated during historic times.

Similar to Site 7881, Site 7882 is outside the currently proposed area of potential effect (A.P.E) and will not be adversely affected during development. Regardless, this historic property has been adequately documented and requires no further inventory level work. Archaeological monitoring will be performed in the area if future development occurs.

Figure 61. Overview Photograph of Site 50-50-04-7882 an L-shaped Retaining Wall, View to Southeast

Figure 62. Overview Photograph of Cross-Section of Site 7882, View to East

Figure 63. Site 7882 foreground and Site 7881 Feature 2 background, View to Southwest

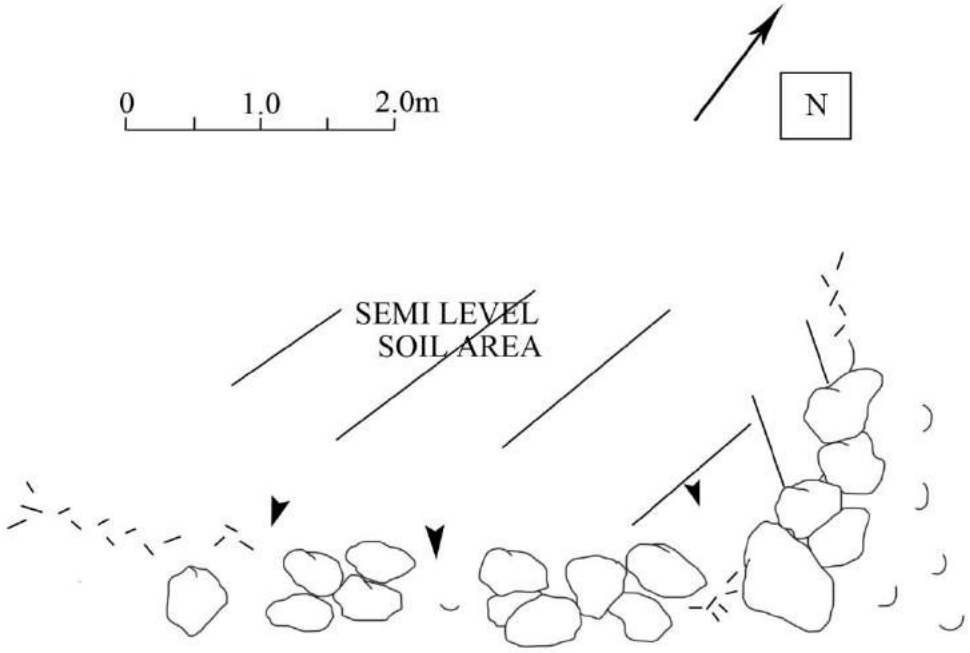


Figure 64. Plan View Map of Site 50-50-04-7882

Site 50-50-04-7883 (TS3)

Site 7883 consists of a World War II bunker situated mid-slope at approximately 740 AMSL along the south side of the main access road that bisects Parcel 3 Mauka east/west (see Figure 22). Site 7883 is a square-shaped enclosure constructed of formed concrete walls atop a concrete foundation and roof (Figures 65 and 66). The concrete contains large aggregate gravel inclusions and is reinforced with metal re-bars. The bunker is partially buried into the slope, with the eastern side nearly level with the existing ground surface, and the western portion almost completely buried. It appears that soil from the immediate area was pushed up around the exterior walls of the structure versus complete excavation for the foundation. Site 7883 measures 5.35 m (E/W) by 5.35 (N/S) along the exterior, with a height of 1.58 m above the existing surface on the northeast, 1.45 m on the southeast, 1.1 m along the northwest, and 0.8 m above surface on the southwest. The walls are 0.23 m thick bounding an interior area of 4.89 m^2 with an interior ceiling height of 3.0 m. Centered atop the roof is a square concrete base measuring 0.50 m^2 by

0.13 m thick with a threaded metal pipe 0.15m (diameter) extending through the center, 0.37 m above the concrete pedastal. The metal pipe also extends thru the roof to the interior and was possibly utilized to mount a firearm atop the roof of the bunker. The internal end of the pipe is threaded and contains large corroded bolts.

Along the eastern exterior wall is a narrow opening or embrasure (opening for gun fire) that measures 0.91 m long by 0.23 m wide and 1.7 m above the existing surface (Figure 67). The architectural design and function of an embrasure allows weapons to be fired out from the interior while providing maximum coverage for the rifleman. Running along the northern edge of the embrasure is a concrete encased metal pipe, 0.22 m in diameter and 0.90 m above the existing surface and 0.18 m below the top of the roof. The pipe extends subterranean into the interior of the structure may have functioned as a possible intake/out-take vent.

Access to the interior of the structure is atop the southwest corner of the roof, measuring 0.75 m² square, and 0.80 m above the exterior existing surface, the interior floor is 2.5 m below the opening (Figure 68). The concrete hatch/door belonging to the opening has collapsed inside the bunker; however it was designed to be inset into the roof (Figure 66) and therefore level and or flush with the exterior roof. Presently the interior contains modern trash, the foundation is deteriorated and the interior walls contain modern graffiti.

Pursuant to discussions with former landowner Mr. Avery Chumbley, the bunker was constructed at this locality as it has commanding views and or a good vantage point of the isthmus and most importantly Kahului and Ma`alaea Bays (Figure 69). It is indeterminate whether Site 7883 was constructed before the December 7, 1941 attack on Pearl Harbor, after the invasion of Kahului Harbor on December 15, 1941, or during the years of 1943-44 when military presence on Maui was estimated to be 100,000+.

Figure 65. Overview Photograph of Site 7883 (TS3), View to West (top) View to East (bottom)

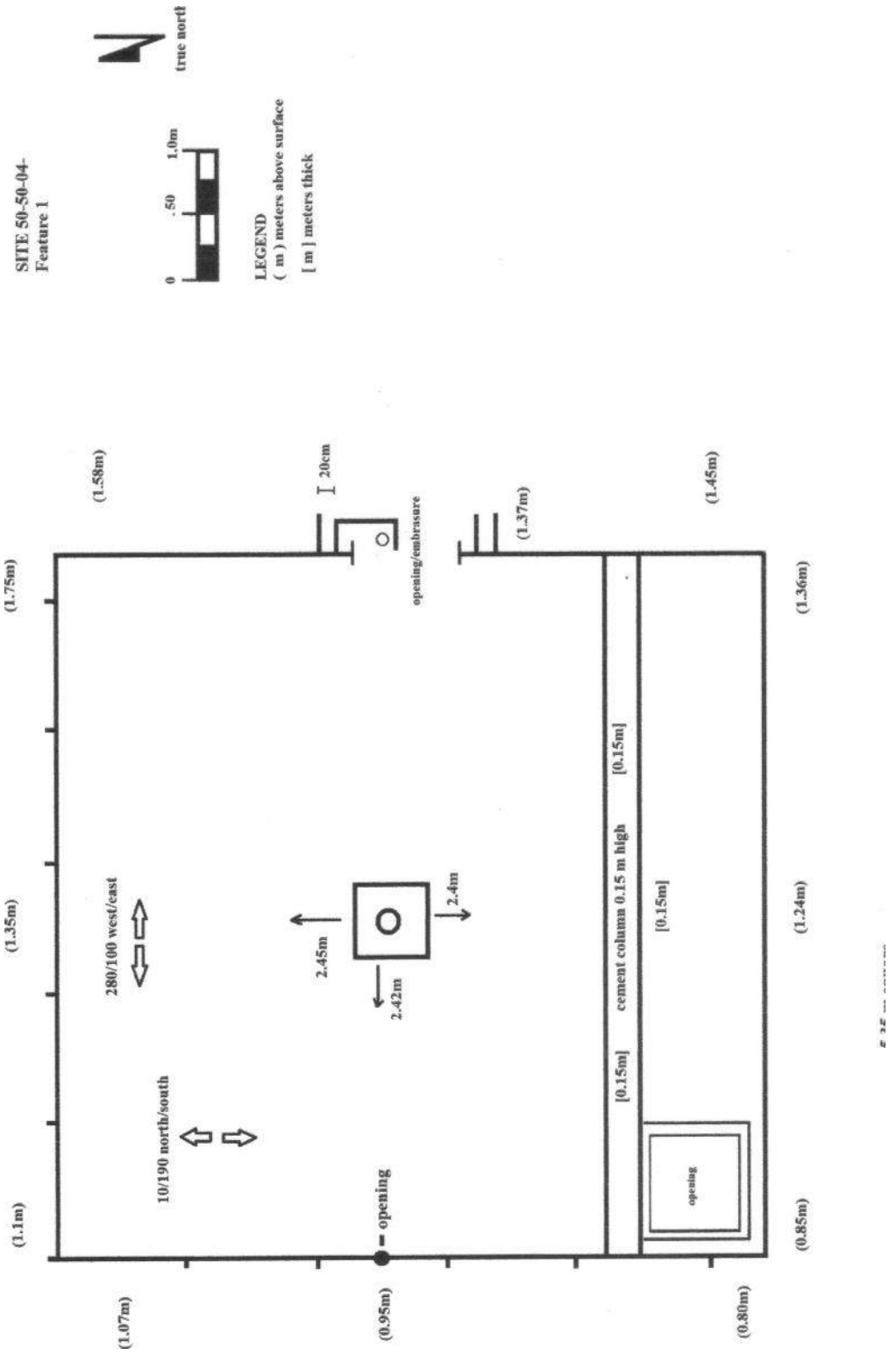


Figure 66. Plan View Map of Site 7883 World War II Bunker

Figure 67. Overview Photograph of Embrasure with Concrete Encased Pipe to Right (top) View to West; Photograph of Access into Site 7883 (TS3) (bottom) View to West

Figure 68. Overview Photograph of Isthmus from Site 7883 (TS3), View to East

Temporary Site 4

Temporary Site 4 is located within the subject parcel along the western portion of Parcel 3 Mauka at an elevation of 1017 AMSL orientated at 76° by and positioned 81.0 m east, *makai* of the reservoir (Site 7881 Feature 3) and west (*mauka*) of Site 7883. It consists of a rectangular shaped concrete slab atop CMU blocks on the downslope (east) side and flush with ground surface on the upslope (west) side (Figures 70 and 71). The slab is constructed of concrete with large aggregate gravel inclusions and likely dates to the early to mid-1900's (see Figures 9 and 22). TS4 measures 8.8 m long by 6.1 m wide by 0.53 high (east side) by 161 degrees. To the west and east of the slab are recent, add-on structures which contain CMU block encasing and encircling PVC piping and metal valves. The western modern structure is a circular enclosure and to the east is an additional slab. Discarded historic and modern materials were observed in the area and atop the concrete slab and consist of tar shingles, a "coke" bottle, metal pipe fittings and PVC pipe fragments (Figures 72 and 73). The shingles may represent the remains of a former roof although no indication of perimeter walls were evident within the slab. TS4 is centered atop the presumed, or former Site 7881 Feature 2b (Waikapū Ditch South) and may have housed a former water diversion structure; however this supposition is indeterminate as no structural remains are extant.

No formal SIHP number was assigned to TS4, an historic concrete slab, as it does not meet any of the significance criteria. TS4 has been adequately documented and requires no further work beyond construction monitoring if removed.

Figure 69. Overview Photograph of Site 7883 Feature 1, View to West

Figure 70. Overview Photograph of Site 7883 Feature 1 with Modern PVC Valves

Figure 71. Site 7883 Feature 1 Pipe Fittings

Figure 72. Photograph of Coca-Cola Bottle

Temporary Sites 21 and 22

Temporary Sites 21 and 22 are situated within Parcel 3 Mauka and consists of small and large rock and soil mounds presumed to be push/clearing piles for agricultural activities. Other rock mounds assigned Temporary Sites 23-25 are located within Parcel 3 Waena and are discussed further below. These mounds were not assigned a State site number as they do not meet any of the significance evaluations. Temporary Sites 21 and 22 appear to have been recently altered as exposed soil with no vegetation growth is present and pushed up against the rock mounds perimeter (Figures 73 and 74). These mounds are located within GR1704; however no land use information was available for this Grant. One backhoe trench, TR 401, was executed in close proximity to these mounds and contained a three layer stratigraphic sequence which was negative for cultural remains.

Temporary Site 21

Temporary Site 21 is one of two rock mounds associated with sugarcane clearing. It measures 13 m in diameter by 2.8 m in height and is comprised primarily of large and small boulders with soil and several small. The rocks are concentrated within the center of the pile and along the base of the rock mound, pushed up soil with discarded irrigation drip-lines and PVC pipes are mixed throughout (Figures 73 and 74). During the initial survey, discussions were undertaken in the field with a leasee of land in close proximity to the project area, Mr. Ron Riechers pointed in the direction of the rock mounds and stated that burials were located “over there” near the rock mounds. Further inquiries with local residents and the landowner ascertained that burials were present in the general vicinity of the rock mounds; however they were situated further east outside the subject parcel within private land. TS21 clearing pile is located at the eastern border of Parcel 3 Mauka near Parcel 6 western boundary approximately 2.0 m west of the access road and 10.0 m southeast of TS 22 rock mound. As previously discussed, these rock mounds are located within a portion of Grant 1704, yet no land use was available.

Temporary Site 22

Temporary Sites 22 is the second rock mound presumed to be a sugarcane clearing/push pile comprised primarily of large basalt boulders, cobbles and pushed soil (see Figure 75). This feature is smaller than TS21 and measures 8.0 m in diameter by approximately 1.5 m high.

Figure 73. Photograph of Temporary Site 21 Rock Mound and Temporary Site 22 in background within Parcel 3 Mauka, View to Northwest

Figure 74. Overview Photograph of Temporary Sites 21 and 22 within Parcel 3 Mauka, View to Northwest

Figure 75. Photograph of Temporary Site 22 Rock Mound within Parcel 3 Mauka, View to Northwest

PARCEL 3 MAUKA DISCUSSION

Parcel 3 Mauka contained four historic properties designated Sites 7881 Features 1-18, 7882, 7883 and Site 7884 Feature 1. Site 7881 Features 1-18 is comprised of agricultural water retention (reservoir), water transportation (concrete lined ditches, earthen ditches and culverts) and water diversion features (sluice gates) situated along the northern boundary of Parcel 3 Mauka. The water is transported through gravity flow and as such Features 1-4 begin at the uppermost, northwest (*mauka)* portion, outside Parcel 3 Mauka boundaries, and continue sequentially along the slope and northern property line terminating near the northeastern corner. Although these features are outside the proposed development boundaries, they were documented due to the close proximity to the subject parcel. Since Site 7881 is currently utilized by the landowner and lessees for continuing agricultural production; these water diversion and containment features shall remain in place. Site 7881 has been adequately recorded and requires no further inventory level work. In the event, that future alterations are planned for Site 7881, monitoring is warranted at those features situated within an LCA. Specifications pertaining to monitoring procedures and localities which will undergo monitoring will be presented in a detailed Monitoring Plan. Site 7882 is an L-shaped retaining wall or remnant rock-faced, soil-terrace situated within the northeastern corner of the subject parcel. It is within an LCA utilized for *kula* lands and *lo`i kalo.* Kula lands are generally referred to as open space which may be planted, and *lo`i kalo* for irrigated taro. Since this feature is located near Waikapū Stream and concrete lined ditch Site 7881 Feature 2, it likely functioned as a terrace for taro. Site 7882 is located outside the proposed development boundaries however it has been documented and requires only monitoring during development (if applicable). Site 7883 is a former WWII bunker which

may or may not be affected during development. Although this historic property has been adequately documented and may be removed, it is recommended that the development plan be re-reviewed to ascertain if the structure may be preserved in place with an interpretive plaque. In the event the bunker cannot remain in place, a bronze plaque commemorating the site should be erected. Site 7884 Feature 1 (scatter of historic materials) is situated along the northern edge of the parcel outside of the proposed development boundaries. It has been adequately documented and requires no further work.

BACKHOE TESTING RESULTS

During the subsurface testing, a total of 150 trenches were excavated, photographed and stratigraphically recorded within the five zones. Only one historic property was recovered during the trenching and assigned Site 7884. Site 7884 is comprised of secondarily deposited historic materials recorded at three localities (Features 1-3); Site 7884 Feature 1 is within Parcel 3 Mauka by the concrete ditch, Feature 2 is at Parcel 6 around Trench 218, Site 7884 and Feature 3 within Parcel 7 at Trenches 323 and 324. At Parcel 3 Mauka (pors. of TMK 3-6-004:003) situated within the north western portion of the project area, fifteen (15) trenches were executed within the eastern end and designated TR 400 -414. Within Parcel 3 Waena, also located within TMK 3-6-004:003 in the west central portion of the project area and bisected north-south by Site 5197 (Waihe`e Ditch) a total of forty-two (42) trenches, where twenty-seven (27) assigned TR 1-27 were located *mauka* (west) of Waihe`e Ditch and fifteen (15) designated TR 01-015 were located *makai* (east) of the ditch. For Parcel 6 located within TMK 3-6-004:003 in the north central section of the project area, twenty-six (26) trenches designated TR 200-225 were performed and for Parcel 7 at TMK 3-6-005:007 which is the Maui Tropical Plantation site, twenty-five (25) trenches assigned TR300-324 were excavated. Lastly, in Parcel 3 Makai within a portion of TMK 3-6-002:003, a total of forty (40) trenches designated TR 100-139 was executed. As discussed in the methods and procedures section, the placement of the trenches was determined by utilizing a combination of random and pre-determined sampling strategies. The goal of the testing was to sample the LCA's and Grants in the area while collecting information about the subsurface conditions across the project area, and not necessarily within the LCA's and Grants. The trenches averaged 4.8 m in length, by 1.45 m in width by 1.7 m in depth, and all terminated upon decomposing bedrock (saprolytic), and/or sterile sub-strata. A summary of the trench descriptions is presented below within each of the five (5) zones (Tables XI-XX).

PARCEL 3 MAUKA

Parcel 3 Mauka is comprised of approximately 210-acres of fallow sugarcane and currently utilized as pastureland for cattle. In 2007, SCS excavated thirty-one (31) stratigraphic trenches (ST), all of which were negative for cultural remains (see Figure 21). ST's 8-31 were located within Parcel 3 Mauka, and

ST's 1-7 were placed within Parcel 6. For the current undertaking, fifteen (15) trenches (TR 400-414) were excavated within the northeastern portion of the subject parcel as this area contained the majority of LCA's and Grants within Parcel 3 Mauka and was not subjected to intensive testing during the prior investigations by SCS (Figures 76 and 77).

TR's 400-411 were excavated within the eastern fenced portion of the parcel and TR 412-TR 414 were excavated within an open level fallow field outside the fenced area along the south side of Waikapū Stream (Figures 78-79 and Table XI). Most of the trenches exhibited a similar soil profile, TR's 400-402 and TR 405-410 contained a clay loam soil, and TR's 403, 404 and 411-414 consisted of a silty loam. A two to three layer stratigraphic sequence and Layer I was commonly the agricultural plow/till zone. The general stratigraphic sequence recorded at Parcel 3 Mauka is presented below.

OVERALL STRATIGRAPHY

Layer I consisted of an upper loamy silt layer, usually a dark brown, or a clay loam, usually a dark reddish brown (2.5YR 3/3) and varied from 60 to 70 cm thick. This was the plow zone from previous cultivation activities, currently the parcel is utilized as pastureland. Layer I was typically a disturbed layer with mixed with deteriorated black plastic drip-lines, plastic PVC irrigation pipes, and concrete with gravel aggregate pieces that had been used during the previous commercial sugarcane cultivation era. There was a low density of rocks in this layer and varied from high density to low density of roots from surface vegetation.

Layer II generally consisted of a silty clay or a clay loam and in a few identified trenches contained decomposing bedrock, and varied from a brown (7.5YR 4/4), to a dark reddish brown (5YR 3/4) with a low density of roots and a medium to high frequency of rocks, decomposing bedrock and saprolytic.

Layer III consisted of a clay loam to a silty clay and in a few identified trenches contained decomposing bedrock, and varied from a brown to strong brown (7.5YR 4/4-4/6) to a dark reddish brown (5YR 3/3-3/4) with the absence of roots and a medium to high frequency of rocks, decomposing bedrock and saprolytic bedrock.

Representative stratigraphic profiles with photos exemplifying the subsurface conditions are presented below for Trenches TR 400, TR 406, TR 409, and TR 412 of Parcel 3 Mauka.

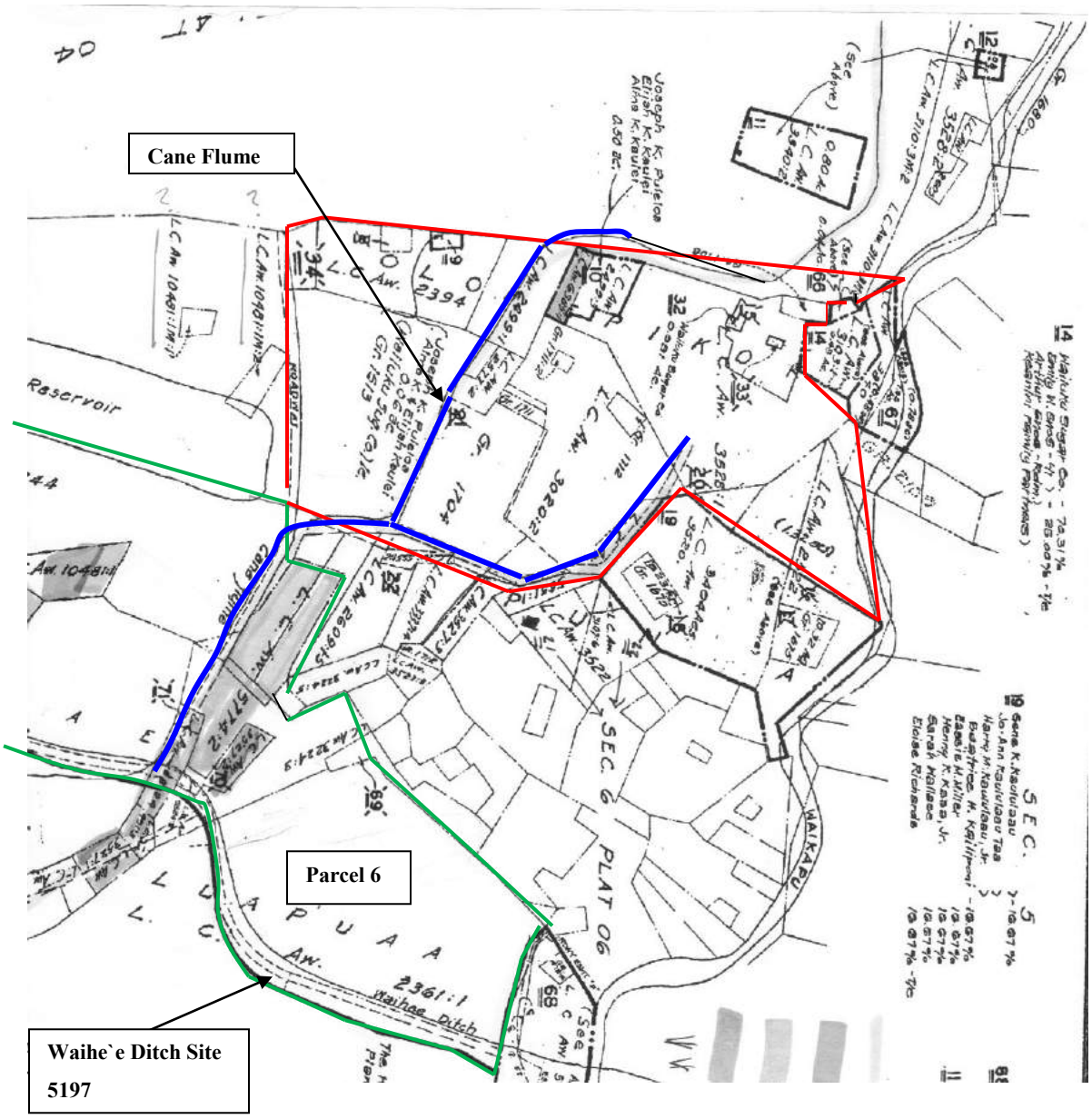


Figure 76. Plan View Map Showing Northeast Portion (Red) of Parcel 3 Mauka and LCA's and Grants

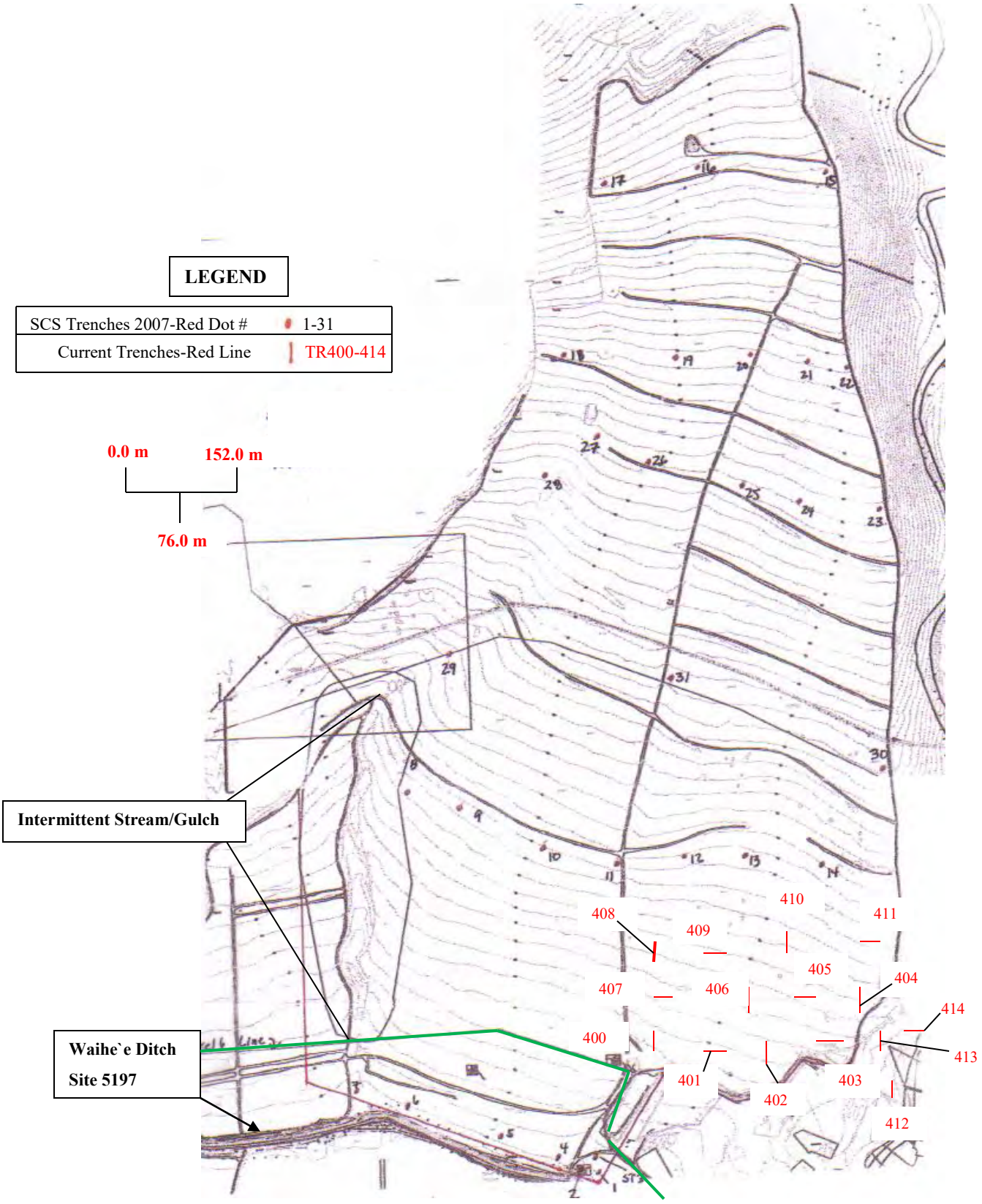


Figure 77. Plan View Map Showing Parcel 3 Mauka Northeast Portion and Trench Locations

Figure 78. Overview of Parcel 3 Mauka North from TR-401, View to Northeast

Figure 79. Overview Parcel 3 Mauka North, View to East

Table XI. Summary of Summary of Backhoe Trenches Parcel 3 Mauka North

TRENCH	LOCATION	DIMENSIONS	ORIENTATION	STRATIGRAPHY	COMMENTS
400	Base of Slope	4.9m x 1.45m x 1.81m	270° x 90°	Layer I-III	Non-Cultural
401	Base of Slope, within Grant 1704	4.8m x 1.44m x 1.76m	270° x 90°	Layer I-III	Non-Cultural
402	Base of Slope, within LCA 3020:2	4.8m x 1.45m x 1.77m	270° x 90°	Layer I-II	Non-Cultural
403	Base of Slope, within LCA 3520	4.9m x 1.43m x 1.75m	270° x 90°	Layer I-II	Non-Cultural
404	South of Waikapū Stream within LCA 3528:1	4.9m x 1.4m x 1.8m	270° x 90°	Layer I-III	Non-Cultural
405	Base of Slope, Grant 1712	4.8m x 1.45m x1.78m	360° x 180°	Layer I-II	Non-Cultural
406	Base of Slope, within LCA 3020:2 & Grant 1711	4.8m x 1.4m x 1.75m	270° x 90°	Layer I-II	Non-Cultural
407	Base of Slope	4.8m x 1.4m x 1.75	360° x 180°	Layer I-II	Non-Cultural
408	Along Slope, Western Portion of Test Area	4.9m x 1.45m x m	360° x 180°	Layer I-II	Non-Cultural
409	Along Slope, Near Grant 1513	4.8m x 1.41m x 1.8m	360° x 180°	Layer I-III	Non-Cultural
410	West of Waihe'e Ditch, within LCA 3528:1	4.6m x 1.4m x 1.75m	360° x 180°	Layer I-II	Non-Cultural
411	Within Grant 1708 and LCA 3109:1	4.6m x 1.45m x 1.75m	360° x 180°	Layer I-II	Non-Cultural
412	Within LCA 2522	4.9m x 1.44m x 1.81m	360° x 180°	Layer I-II	Historic clear glass bottle fragment found in Layer I
413	Within Grant 1675	4.7m x 1.45m x 1.86m	270° x 90°	Layer I-II	Non-Cultural
414	Within Grant 2109 LCA 2522 or LCA 3840	4.8m x 1.4m x 1.8m	360° x 180°	Layer I-II	Historic ceramics (2) found on surface

Trench 400

Trench 400 was positioned in the southeast corner of Parcel 3 Mauka at the base of the slope and south of Waikapū Stream (see Figure 77). No LCA or Grant designation information was present on the TMK map; thus no land use data was available. As exemplified on Figure 76, GR 1513 appears to fall within this area but is actually pointing to a smaller 0.06 acre lot near TR 409. TR 400 measured 4.9 m long by 1.4 m wide by 1.81 m deep and was oriented at 90°. It contained a tripartite stratigraphic sequence with

excavations terminating in sterile soil and saprolytic bedrock (Figure 80). No cultural materials were observed within TR 400.

Layer I (0-56cmbs): is a dark reddish brown (2.5yr 3/3), clay loam, pastureland and previous agricultural plow zone, with deteriorated drip-lines, slightly-plastic, slightly-sticky, weak, fine to medium grain, slightly hard, blocky, with a low frequency of roots. Boundary was clear and wavy overlying Layer II. No cultural materials were observed in this layer.
Layer II (56-158cmbs): is a dark reddish brown (2.5yr 3/4), clay loam, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky, slightly hard. No cultural materials were observed in this layer.
Layer III (158-BOE) consisted of a clay loam strong brown (7.5YR 4/4) overlying decomposing bedrock.

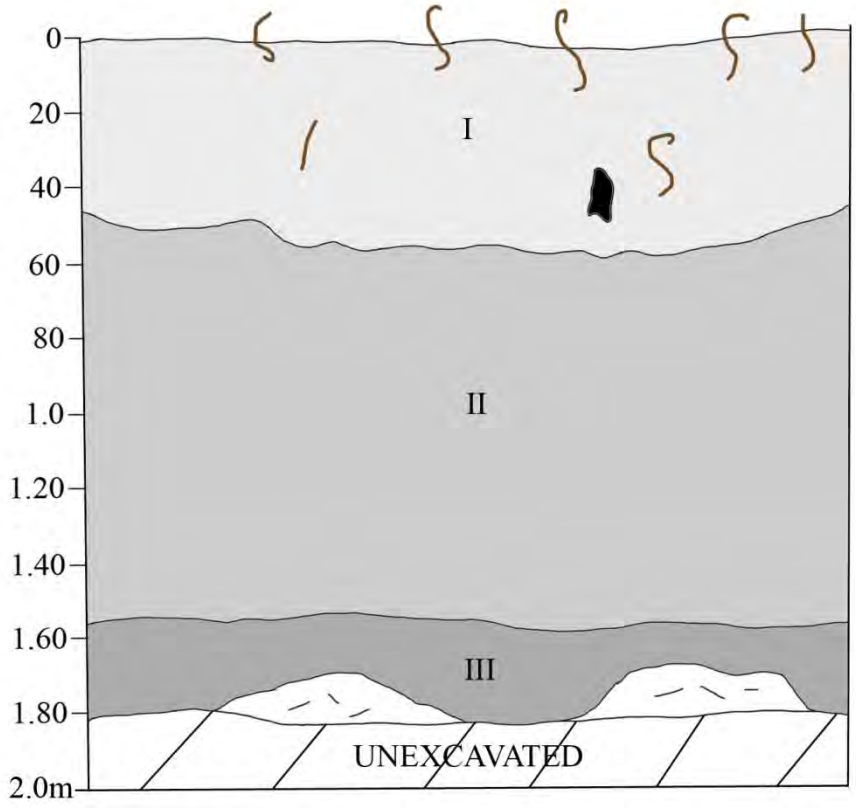


Figure 80. Stratigraphic Profile of TR 400 North Wall

Trench 406

Trench 406 was centrally located at the base of the slope in Parcel 3 Mauka, south of Waikapū Stream (see Figure 77). It was placed within LCA 3202:2 and possibly within GR 1711 (see Figure 76 and Table XI). LCA 3202:2 claimed land use of kula and *lo`i kalo*.; however no evidence of this land use was observed within the trench. TR 406 contained a two-layer stratigraphic sequence with excavations terminating in sterile soil (Figure 81). It measured 4.8 m long by 1.4 m wide by 1.75 m deep, and was oriented at 90°. No cultural materials were observed within TR 406.

Layer I (0-62cmbs): is a dark reddish brown (2.5yr 3/3), clay loam, pastureland and previous agricultural plow zone, with deteriorated drip-lines, slightly-plastic, slightly-sticky, weak, fine to

medium grain, slightly hard, blocky, with a low frequency of roots. Boundary was clear and wavy overlying Layer II. No cultural materials were observed in this layer.
Layer II (59-175cmbs): is a dark reddish brown (2.5yr 3/4), clay loam, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky, slightly hard. No cultural materials were observed in this layer.

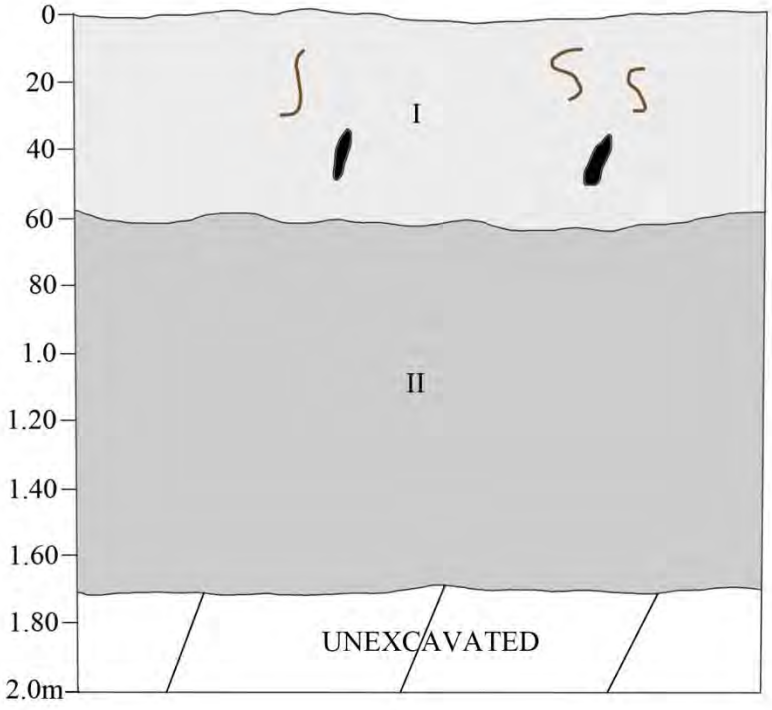


Figure 81. Photograph of TR406 South Wall (Top); Stratigraphic Profile of TR406 South Wall (Bottom)

Trench 409

Trench 409 was located in the southwest portion of Parcel 3 Mauka within GR 1513; south of Waikapū Stream (see Figures 76, 77). No land use data was available for this Grant, thus trench excavations were performed to ascertain presence/absence of cultural materials. TR 409 measured 4.8 m long by 1.4 m wide by 1.80 m deep and was oriented at 180°. It contained a three layer stratigraphic sequence with excavations terminating in sterile soil and saprolytic bedrock (Figure 82). No cultural materials were observed within TR 400.

Layer I (0-42cmbs): is a dark reddish brown (2.5yr 3/3), clay loam, pastureland and previous agricultural plow zone, with deteriorated drip-lines, slightly-plastic, slightly-sticky, weak, fine to medium grain, slightly hard, blocky, with a low frequency of roots. Boundary was clear and wavy overlying Layer II. No cultural materials were observed in this layer.
Layer II (42-121cmbs): is a dark reddish brown (2.5yr 3/4), clay loam, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky, slightly hard. No cultural materials were observed in this layer.
Layer III (121 cmbs-BOE) consisted of a clay loam strong brown (7.5YR 4/4) overlying decomposing bedrock.

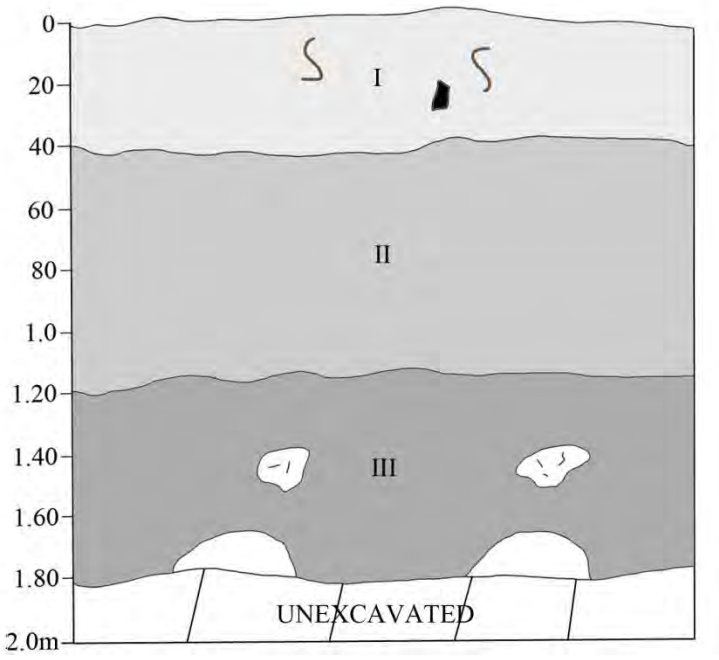


Figure 82. Stratigraphic Profile of TR 409 East Wall

Trench 412

Trench 412 (TR 412) was located in the northeastern portion of Parcel 3 Mauka, south of Waikapū Stream, within LCA 2577:2 and GR 1675 (see Figures 76, 77, 82 and Table XI). This section contained a

two layer stratigraphic sequence with excavations terminating within sterile soils containing medium and large sized boulders (Figures 83 and 84). A 4.9 m long by 1.44 m wide by 1.81 m deep, oriented 180° by 360° section of this area was recorded and is further described below. A single clear glass bottle fragment was recovered approximately 30 cmbs within TR 412.

Layer I (0-78cmbs): is a dark brown (7.5yr 3/3), silt loam, previous agricultural plow zone, with deteriorated drip-lines, slightly-plastic, slightly-sticky, weak, fine to medium grain, slightly hard, blocky, with a high frequency of roots. Boundary was clear and wavy overlying Layer II. A clear glass fragment was recovered.
Layer II (60-181cmbs): is brown (7.5yr 3/4), silt loam, slightly-plastic, slightly-sticky, friable, fine to medium grain, blocky, slightly hard. High frequency of decomposing bedrock and large boulders were noted at base of Layer II. No cultural materials were observed in this layer.

Figure 83. Overview of TR 412 within Parcel 3 Mauka, View to East

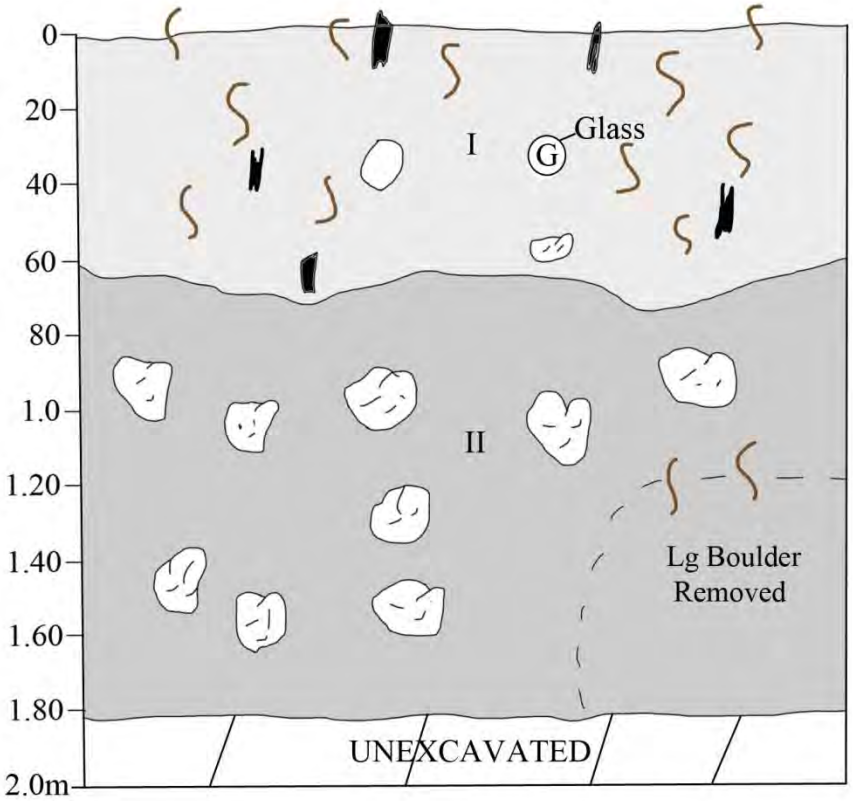


Figure 84. Photograph of TR 412 South Wall (top); and Stratigraphic Profile of TR 412 South Wall (bottom)

DISCUSSION PARCEL 3 MAUKA BACKHOE TRENCHING

Several LCA's and Grants were documented within this northeastern portion of Parcel 3 Mauka. Thus, eleven (11) trenches were excavated to ascertain presence/absence of buried remains. All trenches were negative for cultural materials with the exception of TR's 412 and 414, which contained sparse historic materials on the surface or close to the surface (TR 414) within Layer I (TR 412) and did not constitute a feature designation. Although the testing was negative within this locality of Parcel 3 Mauka, archaeological monitoring during future development is warranted for this northeastern section, and within other LCA's further west, if improvements occur within these small LCA's.

PARCEL 3 WAENA

Parcel 3 Waena (TMK 3-6-004:003 pors.) is comprised of approximately 72-acres and is situated adjacent to Honoa`pi`ilani Highway with Site 5197 (Waihe`e Ditch) bisecting this zone north-south, creating eastern and western sections (see Figures 6 and 7). The portion of land to the east of Waihe`e Ditch (eastern section) is comprised of fallow cane fields and small agricultural plots leased by individuals for various fruit and vegetable cultivation (Figure 85). A total of twenty-seven (27) trenches (TR 1-27) were excavated and stratigraphically recorded within this eastern section (Figure 86 and Tables XII and XIII). Since no LCA's and or Grants were noted in the eastern or western sections of Parcel 3 Waena, backhoe test trenches were spaced to provide a representative sample. Scattered fragments of concrete with large gravel aggregate inclusions were identified throughout the surface area and likely represent demolished foundations and/or irrigation ditches that were utilized during prior sugarcane operations by HC&S. These concrete fragments are the same material that was used in the construction of Site 7883 (pump houses). Three clearing piles Site 7884 Features 3-5 were noted in the eastern (Fes. 4 and 5) and the western (Fe.3) sections (Figure 87). The western section also contains a reservoir and is currently utilized for active sugarcane cultivation (Figure 88). A total of fifteen (15) trenches (TR 01-015) were excavated and stratigraphically recorded in this eastern portion (see Figure 86 and Table XIV).

Figure 85. Overview Photograph of Parcel 3 Waena Eastern Section with Clearing Pile Site 7884 Feature 3 in the background, View to Northwest

Temporary Sites 23-25

TS 23-25 are a continuation of the rock piles identified within Parcel 3 Mauka. TS 23 is a rock pile situated near the northwestern corner of Parcel 3 Waena western (*mauka*) section. It measures 38.10 m (125 ft.) long (E/W) by 27.45 m (90 ft.) wide (N/W) and is comprised of pushed cobbles, boulders soils and vegetation. TS 24 is located in the eastern (*makai*) section within the southwestern corner along the cane haul road. This feature measures 61.0 m (200 ft.) long (NE/SW) by 45.75m (150 ft.) wide and is comprised of the same materials as TS 23. TS 25 is an elongated rock pile consisting of two mounds pushed together. It is situated along the southern boundary of the western section and measures 500 ft. long and ranges from 15.24 m (50 ft) to 30.48 m (100 ft.) wide.

TS 23-25 are agricultural clearing/push mounds associated with sugarcane cultivation. As previously discussed, these rock piles do not meet any of the criteria under significance evaluations, and were not assigned a State site number.

Figure 86. Plan View Topographic Map Showing Trench`s 1-27 and 01-015 and TS 23-25 within Parcel 3 Waena

Figure 87. Overview Photograph of Parcel 3 Waena from TR 22 with Temporary Site 23 Rock Mound, View to Southeast

Figure 88. Overview Photograph of Parcel 3 Waena (Western Section) from Reservoir, View to South

During the testing program, the trenches within the eastern and western sections exhibited a similar stratigraphy. For the eastern portion, a two to seven layer/lens stratigraphic sequence was observed, and for the western section, a three to six layer/lens soil profile was recorded. Representative stratigraphic sequences are presented below for each section.

OVERALL STRATIGRAPHY FOR EASTERN SECTION OF PARCEL 3 WAENA

Layer I consisted of an upper loamy silt layer, that varied from a dark brown, brown or a very dark gray brown (7.5YR 3/2, 3/3 or 10YR 4/3), and varied from 50 to 60 cm thick. This was the plow zone from previous cultivation activities. Layer I was typically mixed with torn black plastic drip-lines, PVC plastic irrigation hoses, and concrete aggregate pieces that had been used during the previous commercial sugarcane cultivation. There was a low frequency of rocks in this layer, but a high frequency of roots from surface vegetation.

Layer II generally consisted to be a silt loam and/or stony silt loam, brown, dark brown, very dark gray brown (10YR 3/2, 4/3, 7.5YR 3/3, 3/4), and varied from 44-127 cm thick, with a low density of roots and a medium frequency of rocks and/or decomposing bedrock. Trenches excavated towards the northwestern end of the project area exhibited a color that tended to be browner or more yellow second layer, which ranged in color from dark brown (7.5 YR 3/4 loam to mottled dark (7.5YR 3/4) and dark reddish brown (5 YR 3/4) silt loam. There was usually a distinct transition between this layer and the plow zone above, as this layer never had any materials from commercial sugarcane cultivation mixed within it and generally appeared less disturbed and contained saprolytic rock.

Layer III was present in two of the trenches. Layer III generally ranged in color from brown to dark yellowish brown (7.5 YR 4/3, 4/4) to dark grayish brown (10 YR 4/2) silt loam, streambed gravel with silt, to gravel with a higher density of pebbles than the upper layers as a result of decomposing bedrock. Layer III has a low density of roots and with a higher density of pebbles than the upper layers as a result of streambed and storm-wash inclusions, along with decomposing bedrock mixed with saprolytic bedrock. No cultural materials were observed in this layer.

Six of the trenches exhibited a two layer profile, two (2) exhibited a tripartite sequence, thirteen (13) trenches contained a four layer sequence, seven (7) trenches a five layer sequence, and one (1) trench exhibited six strata. Representative stratigraphic profiles with associated photographs for TR's 1 are presented below to exemplify the results.

Table XII. Summary of Trench Description for Eastern Section of Parcel 3 Waena

TRENCH	LOCATION	DIMENSIONS	ORIENTATION	STRATIGRAPHY	COMMENTS
1	In the extreme southwest corner	4.7m x 1.4m x 1.4 m	360° x 180° x	I-IV/sand	Non-Cultural
2	In the extreme southern portion	4.6m x 1.41m x 1.66m	270° x 90° x	I-IV	Non-Cultural
3	In the extreme southwest corner	4.7m x 1.41m x 1.9m	360° x 180° x	I-IV	Non-Cultural Charcoal Flecks in Layer IV
4	In the extreme southeast corner	4.6m x 1.42m x 1.8m	270° x 90°	I-IV	Non-Cultural
5	In the western portion	4.6m x 1.42m x 1.9m	360° x 180°	I-IV Layer IV on the east	Non-Cultural
6	In the south central portion	4.7m x 1.41m x 2.3m	270° x 90°	I-V	Non-Cultural
7	In the south central portion	4.7m x 1.42m x 2.0m	360° x 180°	I-V	Non-Cultural
8	In the southeastern central portion	4.7m x 1.43m x 2.3m	270° x 90°	I-IV	Non-Cultural
9	In the southeastern portion	4.7m x 1.41m x 1.4m	360° x 180°	I-V	Non-Cultural
10	In the southwestern portion	4.6m x 1.45m x 2.24m	270° x 90°	I-IV	Non-Cultural
11	In the central southwestern portion	4.7m x 1.42m x 2.32m	270° x 90°	I-IV	Non-Cultural
12	In the central portion	4.6m x 1.42m x 2.08m	270° x 90°	I-IV	Non-Cultural
13	In the central portion	4.6m x 1.45m x 2.24m	360° x 180°	I-IV	Non-Cultural
14	In the eastern central portion	4.6m x 1.42m x 2.3m	270° x 90°	I-VI	Non-Cultural
15	In the northwestern portion	4.7m x 1.45m x 2.34m	360° x 180°	I-V	Non-Cultural
16	In the northwestern central portion	4.6m x 1.44m x 2.2m	270° x 90°	I-IV	Non-Cultural
17	In the northwestern central portion	4.7m x 1.45m x 2.0m	360° x 180°	I-IV	Non-Cultural
18	In the northeastern central portion	4.6m x 1.43m x 1.84m	270° x 90°	I-IV	Non-Cultural
19	In the northeastern portion	4.6m x 1.43m x 1.92m	360° x 180°	I-III	Non-Cultural
20	In the northeastern portion	4.6m x 1.45m x 2.2m	360° x 180°	I-IV	Non-Cultural

Table XIII. cont'd Summary of Trench Description for Eastern Portion of Parcel 3 Waena

TRENCH	LOCATION	DIMENSIONS	ORIENTATION	STRATIGRAPHY	COMMENTS
21	In the north central portion	4.6m x 1.45m x 1.96m	270° x 90°	I-III	Non-Cultural
22	In the northwestern portion	4.7m x 1.42m x 1.84m	270° x 90°	I-II	Non-Cultural
23	In the northwestern portion	4.7m x 1.4m x 1.76m	360° x 180°	I-II	Non-Cultural
24	In the northwestern portion	4.6m x 1.41m x 1.84m	360° x 180°	I-II	Non-Cultural
25	In the extreme northwestern portion	4.7m x 1.42m x 1.12m	360° x 180°	I-II	Non-Cultural
26	In the north central portion	4.7m x 1.41m x 1.85m	270° x 90°	I-II	Non-Cultural
27	In the extreme northeastern portion	4.7m x 1.42m x 1.84m	360° x 180°	I-II	Non-Cultural

Trench 1

Trench 1 (TR 1) was situated in the extreme southwestern portion of Parcel 3 Waena, east of Kamehameha Golf Course and north of the abandoned rock quarry (see Figure 86). It contained deep soil deposits consisting of a four layer soil profile with excavations terminating in sterile soils (Figure 89-91 and Tables XII and XIII). At 1.10mbs a sand lens was identified on the north and east wall directly below Layer III, the deposit was discontinuous and appears to be a previous disturbance or import. No buried pipes were in the vicinity which would utilize sand for pipe bedding. TR 1 measured 4.7 m long by 1.4 m wide by 1.4 m deep and was oriented 360°. No cultural materials were observed within TR 1.

> **Layer I** (0-52cmbs): is a very dark grayish brown (10yr 3/2), silt loam, currently a fallow cane field and previous agricultural plow zone, with deteriorated drip-lines, slightly-plastic, slightly-sticky, weak, fine to medium grain, slightly hard, blocky, friable, with a medium frequency of roots. Boundary was clear and wavy overlying Layer II. No cultural materials were observed in this layer.

Layer II (41-88cmbs): is a very dark grayish brown (10yr 3/2), stony silt loam, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky, slightly hard, friable with a medium frequency of rocks, cobbles and gravel. No cultural materials were observed in this layer.
Layer III (82-117cmbs): is a dark yellowish brown (10yr 4/4), riverbed stony silt, weakly coherent, non-plastic, non-sticky, loose, single grain to fine to medium grain, with a high frequency of rocks, cobbles and medium to large boulders. Boundary was clear and wavy overlying Layer IV and Layer IIIa along the north, northwest and west section (Figures 90 and 92) overlying Layer IV. No cultural materials were observed in this layer.
Lens/Layer IIIa at 110cmbs a light yellowish brown (10yr 6/4) a fine to medium grain sand deposit was observed in a disturbed context in the north/northeast corner, overlying a sandy gravel extending 1.5 mbs on the north and east, overlying Layer IV on the north, northwest, non-plastic, non-sticky, loose, single grain, structureless, boundary abrupt and broken. No cultural materials were observed in this layer.
Layer IV (115-140cmbs): is a dark yellowish brown (10yr 4/6), gravel silt, observed on the northwestern portion and western portion of trench profile (Figure 92), loose, structureless. No cultural materials were observed in this layer.

Figure 89. Overview Photograph of TR 1 North Wall Profile

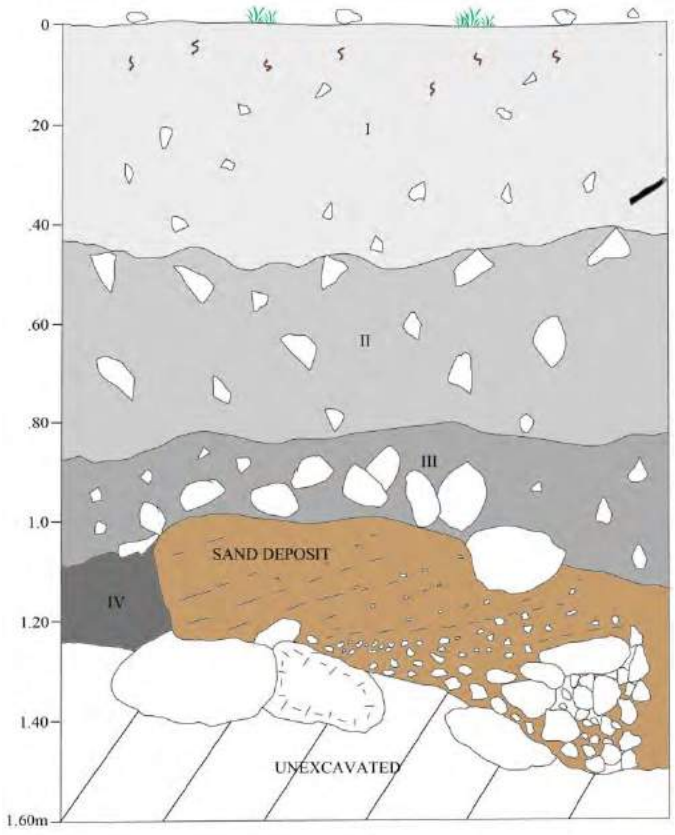


Figure 90. Stratigraphic Profile of TR 1 North Wall Profile

Figure 91. Up Close Photograph of Sand Deposit within TR 1, View to North

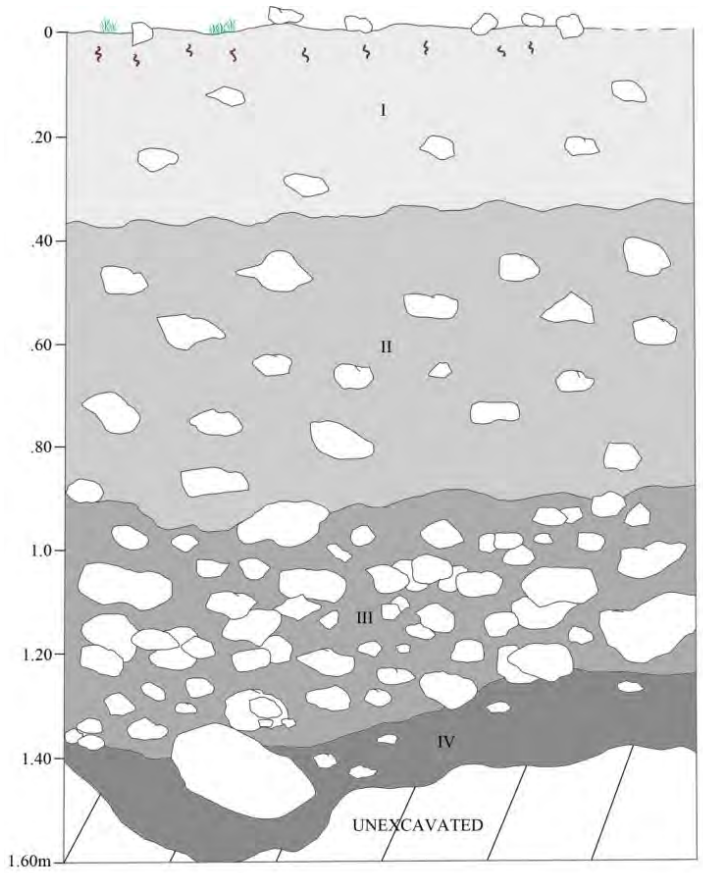


Figure 92. Stratigraphic Profile of TR 1 West Wall Profile

Trench 11

Trench 11 (TR 11) was situated in the central southwestern portion of Parcel 3 Waena, east of Kamehameha Golf Course and west of Site 5197 (Waihe`e Ditch) in an area currently utilized for individual agricultural pursuits. It contained a four layer stratigraphic sequence with excavations terminating within sterile streambed soils (Figure 93 and 94). TR 11 measured 4.7 m long by 1.42 m wide by 2.32 m deep, oriented 190°. No cultural materials were observed within Trench 11 (TR 11).

Layer I (0-60cmbs): is a dark brown (7.5yr 3/2), silt loam, currently a fallow cane field and previous agricultural plow zone, with deteriorated drip-lines, slightly-plastic, slightly-sticky, weak, fine to medium grain, slightly hard, blocky, with a medium frequency of roots and rocks. Boundary was clear and wavy overlying Layer II. No cultural materials were observed in this layer.
Layer II (58-121cmbs): is a dark brown (10yr 3/3), silt loam, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky, slightly hard, friable, with a medium frequency of rocks, cobbles and gravel. Boundary was clear and smooth overlying Layer III. No cultural materials were observed in this layer.
Layer III (116-212cmbs): is a brown (10yr 4/3), silt loam, weak, slightly hard, slightly-plastic, slightly-sticky, single grain with a high frequency of medium to large boulders. Boundary was clear and wavy overlying Layer IV streambed. No cultural materials were observed in this layer.
Layer IV (202-232cmbs): is a dark grayish brown (10yr 4/2), streambed, gravel silt, loose, fine to large grain, structureless, cobbles, pebbles and gravel. No cultural materials were observed in this layer.

Figure 93. Photograph of Stratigraphic Profile of TR 11 South Wall

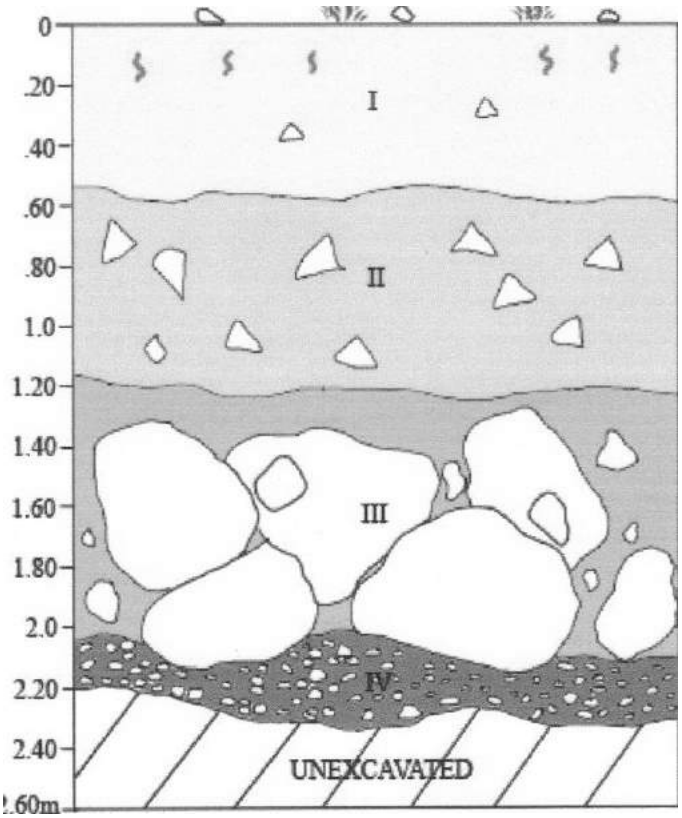


Figure 94. Stratigraphic Profile of TR 11 South Wall

Trench 14

Trench 14 (TR 14) was situated along the eastern boundary of Parcel 3 Waena, west of Waihe`e Ditch and the associated access road (see Figure 86). It contained a six layer/lens stratigraphic sequence with excavations terminating in sterile soils (Figures 95 and 96). Storm wash episodes were identified between 0.65-1.46 mbs and designated Layers Va-Vc. TR14 measured 4.6 m long by 1.42 m wide by 2.3 m deep, oriented 270°. No cultural materials were observed within Trench 14.

Layer I (0-25cmbs): is a dark brown (7.5yr 3/3), silt loam, currently a fallow cane field and previous agricultural plow zone, with deteriorated drip-lines, slightly-plastic, slightly-sticky, weak, fine to medium grain, slightly hard, blocky, friable with a medium frequency of roots. Boundary was clear and wavy overlying Layer II. No cultural materials were observed in this layer.

Layer II (24-48cmbs): is a brown (10yr 4/3), silt loam, slightly-plastic, slightly-sticky, weak, very fine to fine grain, blocky, slightly hard, friable with a medium frequency of rocks, cobbles and gravel. Boundary was abrupt and wavy overlying Layer III. No cultural materials were observed in this layer.

Layer III (44-56cmbs): is a dark grayish brown (10yr 4/2), stony silt, storm wash, weakly coherent, non-plastic, non-sticky, loose, fine to medium grain, with a high frequency of rounded cobbles, pebbles and gravel. Boundary was abrupt and wavy overlying Layer IV. No cultural materials were observed in this layer.

Layer IV (52-70cmbs) is a brown (10yr 4/3) silt loam, slightly-plastic, slightly-sticky, very fine grain, non-plastic, non-sticky, loose, single grain, structureless, boundary was abrupt and wavy overlying Layer Va. No cultural materials were observed in this layer.

Layer/lens Va (65-98cmbs): is a dark grayish brown (10yr 4/2), riverbed stony silt, weakly coherent, non-plastic, non-sticky, compact, medium to coarse grain, structureless, with a low to medium frequency of bedded rounded cobbles, pebbles and gravel overlying Layer Vb storm wash episode. Boundary was clear and wavy. No cultural materials were observed in this layer.
Layer Vb (90-130cmbs): is a dark grayish brown (10yr 4/2), riverbed stony silt, non-plastic, non-sticky, structureless, with medium frequency of bedded rounded cobbles, pebbles and gravel overlying Layer Vc storm wash episode, boundary was clear and wavy. No cultural materials were observed in this layer.
Layer Vc (106-146cmbs): is a dark grayish brown (10yr 4/2), riverbed stony silt, non-plastic, non-sticky, structureless, with a high frequency of bedded rounded cobbles, pebbles and gravel overlying Layer VI. Boundary was abrupt and wavy. No cultural materials were observed in this layer.
Layer VI (138-230cmbs): At 110cmbs is a brown (10yr 4/3), silt loam, weak, blocky, slightly-plastic, slightly-sticky, compact, fine grain. No cultural materials were observed in this layer.

Figure 95. Photograph of Stratigraphic Profile of TR 14 South Wall

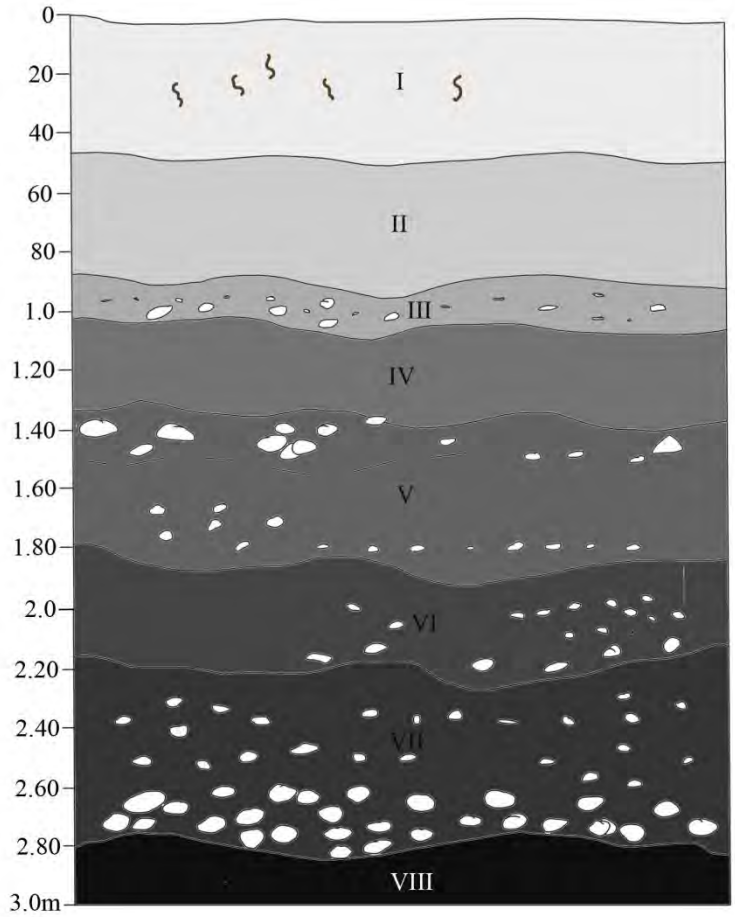


Figure 96. Stratigraphic Profile of TR 14 South Wall

Trench 23

Trench 23 (TR 23) was situated in the extreme northeastern portion of Parcel 3 Waena, juxtaposed by Parcel 3 Mauka and Parcel 6 to the north (see Figure 86). It contained a two layer stratigraphic sequence with excavations terminating in decomposing bedrock (Figures 97 and 98). Trench 23 measured 4.7 m long by 1.4 m wide by 1.76 m deep, oriented 360° by 180° section of this area was recorded and is further described below. No cultural materials were observed within Trench 23 (TR 23).

> **Layer I** (0-64cmbs): is a dark brown (7.5yr 3/3), silt loam, within a previous agricultural plow zone, with deteriorated drip-lines, slightly-plastic, slightly-sticky, weak, fine to medium grain, slightly hard, blocky, friable with a medium frequency of roots. Boundary was clear and wavy overlying Layer II. No cultural materials were observed in this layer.
>
> **Layer II** (64-184cmbs): is a dark brown (7.5yr 3/4), stony silt, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky, slightly hard, friable with a medium frequency of rocks, and decomposing bedrock. No cultural materials were observed in this layer.

Figure 97. Photograph of Stratigraphic Profile of TR 23 East Wall

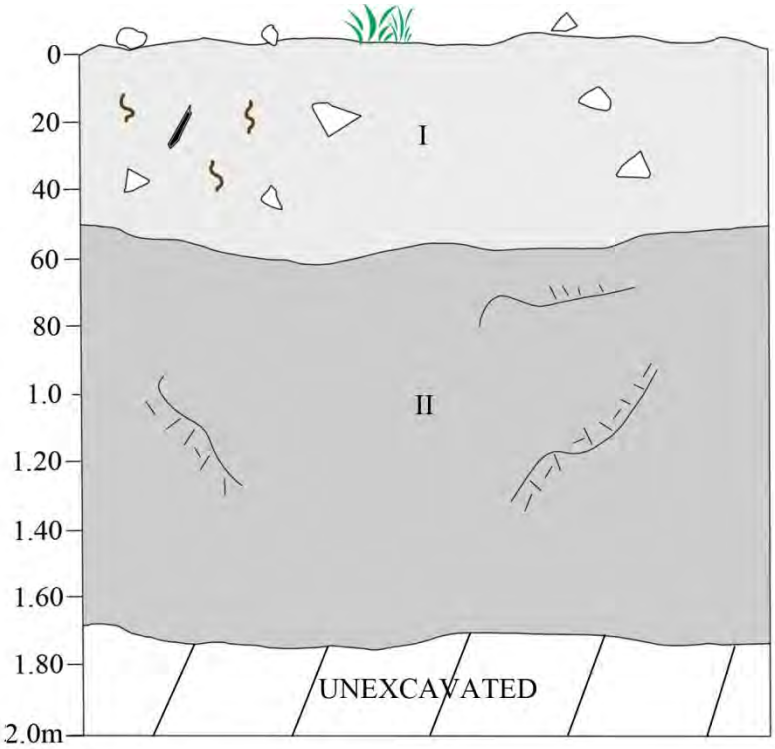


Figure 98. Stratigraphic Profile of TR 23 East Wall

OVERALL STRATIGRAPHY FOR WESTERN SECTION OF PARCEL 3 WAENA

Layer I generally consisted of an upper loamy silt layer, usually a dark brown, or a very dark grayish brown (10 YR 3/3, 3/2), and varied from 30 to 40 cm thick. This was the plow zone from current and previous sugarcane cultivation activities. Layer I was typically a disturbed layer mixed with deteriorated black plastic drip-lines, plastic PVC irrigation pipes, and concrete with gravel aggregate pieces that had been used during the previous commercial sugarcane cultivation era. There was a low frequency of rocks in this layer, but a high frequency of roots from surface vegetation.
Layer II generally consisted of a silt loam, silt or a storm wash stony silt layer, usually a brown to dark brown (7.5yr 4/2, 3/2), and varied from 20 to 140 cm thick and in a few identified trenches contained a dark brown (10YR 2/2 to 7.5YR 3/2) stony silt deposit that varied 60 to 150 cm thick, to a dark reddish brown (5YR 3/3, 3/4) with a low density to absence of roots and a medium to high frequency of rocks. These trenches exhibited the same stratigraphy with a few trenches exhibiting slight variations in color hues.
Layer III ranges from a grayish brown (10YR5/2), silt loam, slightly-plastic, slightly-sticky, blocky, slightly hard, fine to medium grain, with a low frequency of rounded pebbles and gravel. No cultural materials observed in this layer. To a streambed, non-plastic, non-sticky, medium to coarse grain, with a low frequency of roots. structureless, weakly coherent with a high frequency of rounded cobbles, pebbles and gravel No cultural materials observed in this layer.

Table XIV. Summary of Trench Description for Western Portion of Parcel 3 Waena

TRENCH	LOCATION	DIMENSIONS	ORIENTATION	STRATIGRAPHY	COMMENTS
01	Southeast Portion	4.7m x 1.42m x 1.76m	360° x 180°	I-IV	Non-Cultural
02	North of TR-01	4.6m x 1.41m x 1.52m	270° x 90°	I-IV	Non-Cultural
03	North of TR-01 & TR-02	4.6m x 1.42m x 1.8m	360° x 180°	I-III	Non-Cultural
04	East of Reservoir	4.6m x 1.42m x 1.86 m	270° x 90°	I-II	Non-Cultural
05	East of Reservoir	4.6m x 1.41m x 2.04m	270° x 90°	I-II	Non-Cultural
06	South of Reservoir	4.7m x 1.51m x 1.7m	360° x 180°	I-II Terminated / Irrigation Lines	Non-Cultural 8" H2O PVC Irrigation Line Present
07	East of Rock Quarry	4.6m x 1.42m x 1.08m	360° x 180°	I-II	Non-Cultural
08	East of Reservoir	4.6m x 1.43m x 1.58m	360° x 180°	I-IV	Non-Cultural
09	East of Reservoir	4.7m x 1.65m x 1.48m	360° x 180°	I-III	Non-Cultural 12" H2O PVC Irrigation Line Present
010	East of Waihe'e Ditch	4.6m x 1.4m x 1.84m	360° x 180°	I-III	Non-Cultural
011	East of Waihe'e Ditch	4.6m x 1.41m x 1.8m	270° x 90°	I-III	Non-Cultural
012	East of Waihe'e Ditch	4.6m x 1.4m x 1.74m	270° x 90°	I-III	Non-Cultural

013	West of State Highway 30	4.7m x 1.42m x 1.6m	270° x 90°	I-III	Non-Cultural
014	West of State Highway 30	4.6m x 1.41m x 1.83m	270° x 90°	I-II	Non-Cultural
015	West of State Highway 30	4.6m x 1.41m x 1.8m	270° x 90°	I-IV	Non-Cultural

Trench 08

Trench 08 (TR 08) was centrally located within the project area and contained a four layer/lens stratigraphic sequence with an alluvium layer noted at Layer II (Figures 86, 99 and 100). It measured 4.6 m long by 1.41 m wide by 1.8 m deep and was oriented at 270°. Excavations were terminated within a sterile stratum and no cultural materials were observed within TR 08.

Layer I (0-36cmbs): is a dark brown (7.5yr 3/2), silt loam, agricultural plow zone, slightly-plastic, slightly-sticky, blocky, fine to medium grain, with a medium frequency of roots. No cultural materials were observed in this layer. Boundary was clear and broken overlying Layer IIa on the north and Layer III on the south.

Layer IIa (29-56cmbs): is a brown (7.5yr 3/2), streambed, non-plastic, non-sticky, medium to coarse grain, with a low frequency of roots, structureless, weakly coherent with a high frequency of rounded cobbles, pebbles and gravel. No cultural materials observed in this layer. Boundary was clear and broken overlying Layer III.

Layer IIb (60-104cmbs): is a brown (7.5yr 3/2), streambed, non-plastic, non-sticky, medium to coarse grain, with a low frequency of roots. structureless, weakly coherent with a high frequency of rounded cobbles, pebbles and gravel . No cultural materials observed in this layer. Boundary was clear and broken overlying Layer III on the north and Layer IV on the south.

Layer III (24-100cmbs): is a brown (7.5yr 3/2), streambed, non-plastic, non-sticky, medium to coarse grain, with a low frequency of roots. structureless, weakly coherent with a high frequency of rounded cobbles, pebbles and gravel . No cultural materials observed in this layer. Boundary was clear and a plane overlying Layer IV.

Layer IV (92-160cmbs): is a brown (7.5yr 4/2), silt, slightly-plastic, slightly-sticky, blocky, slightly hard, medium grain, with a low frequency of rock and the absence of roots. No cultural materials observed in this layer.

Figure 99. Photograph of Stratigraphic Profile of TR 08 West Wall

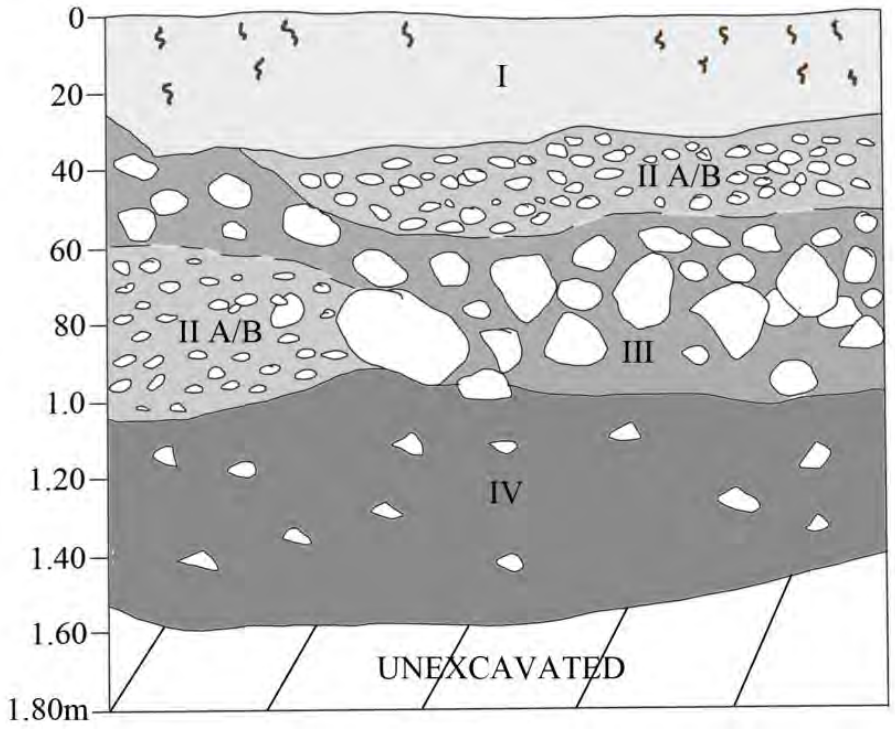


Figure 100. Stratigraphic Profile of TR 08 West Wall

Trench 011

Trench 011 (TR 011) was situated within the central portion of the project area and contained a tripartite stratigraphic sequence (see Figures 86, 101, 102 and Table XIV). It measured 5.0 m long by 1.41 m wide by 1.8 m deep, oriented at 270° where no cultural materials were observed. A section along the south wall was recorded and further described below.

> **Layer I** (0-30cmbs): is a dark brown (7.5yr 3/2), silt loam, agricultural plow zone, slightly-plastic, slightly-sticky, blocky, fine to medium grain, with a medium frequency of roots. No cultural materials were observed in this layer. Boundary was clear and broken overlying Layer IIa on the north and Layer III on the south.
> **Layer II** (28-157cmbs): is a brown (7.5yr 4/2), silty loam, slightly-plastic, slightly-sticky, blocky, slightly hard, medium to coarse grain, with a high frequency of rounded pebbles and gravel. No cultural materials observed in this layer. Boundary was clear and wavy overlying Layer III.
> **Layer III** (157-180cmbs): is a brown (7.5yr 3/2), streambed, non-plastic, non-sticky, medium to coarse grain, with a low frequency of roots. structureless, weakly coherent with a high frequency of rounded cobbles, pebbles and gravel . No cultural materials observed in this layer.

Figure 101. Photograph of Stratigraphic Overview of TR 011 South Wall

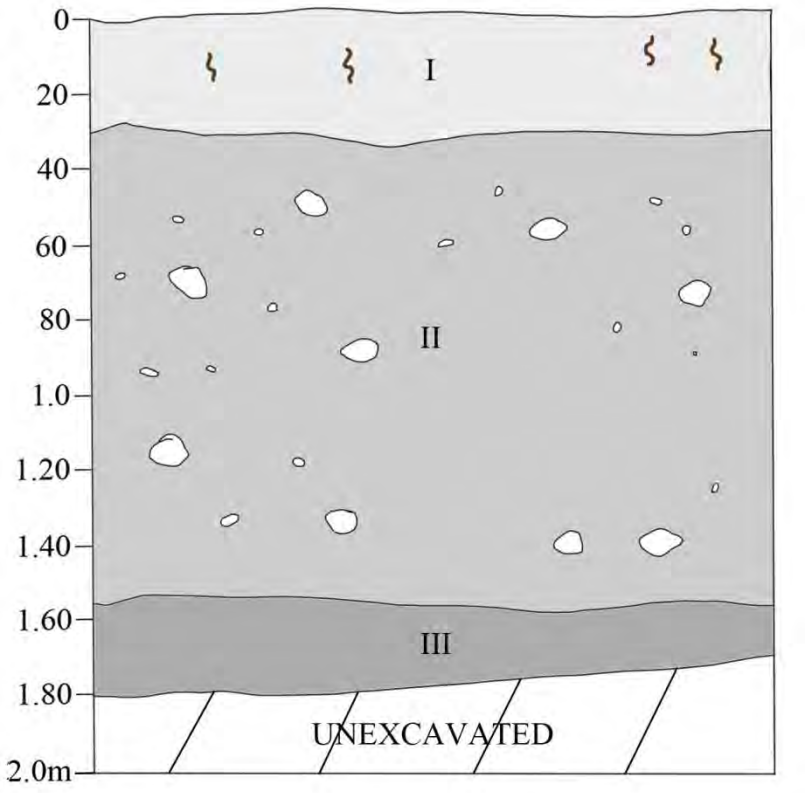


Figure 102. Stragraphic Profile of TR 011 South Wall

Trench 015

Trench 015 (TR 015) was situated within the northwestern portion of the project area adjacent to the western edge of an active sugarcane field (see Figure 86). A four layer stratigraphic sequence which contained alluvial episodes and sterile soils was recorded for TR 015. It measured 4.8 m long by 1.41 m wide by 1.8 m deep and was oriented at 270°.

Layer I (0-32cmbs): is a very dark brown (7.5yr 2.5/2), silt loam, agricultural plow zone, slightly-plastic, slightly-sticky, blocky, fine to medium grain, with a medium frequency of roots. No cultural materials were observed in this layer. Boundary was clear and wavy overlying Layer III on the north and Layer III on the south.
Layer IIa (24-90cmbs): is a brown (7.5yr 4/2), silty loam, slightly-plastic, slightly-sticky, blocky, friable, fine grain, with a low frequency of rounded pebbles and gravel. No cultural materials observed in this layer. Boundary was clear and a plane overlying Layer IIb.
Layer IIb (90-110cmbs): is a dark grayish brown (10yr 4/2), streambed, non-plastic, non-sticky, medium to coarse grain, with an absence of roots, structureless, with a high frequency of rounded cobbles, pebbles and gravel. No cultural materials observed in this layer. Boundary was clear and a plane overlying Layer III.
Layer III (100-180cmbs): is a grayish brown (10yr 5/2), silt loam, slightly-plastic, slightly-sticky, blocky, slightly hard, fine to medium grain, with a low frequency of rounded pebbles and gravel. No cultural materials observed in this layer. No cultural materials observed in this layer.

Figure 103. Photograph of Stratigraphic Profile of TR 015 North Wall Profile

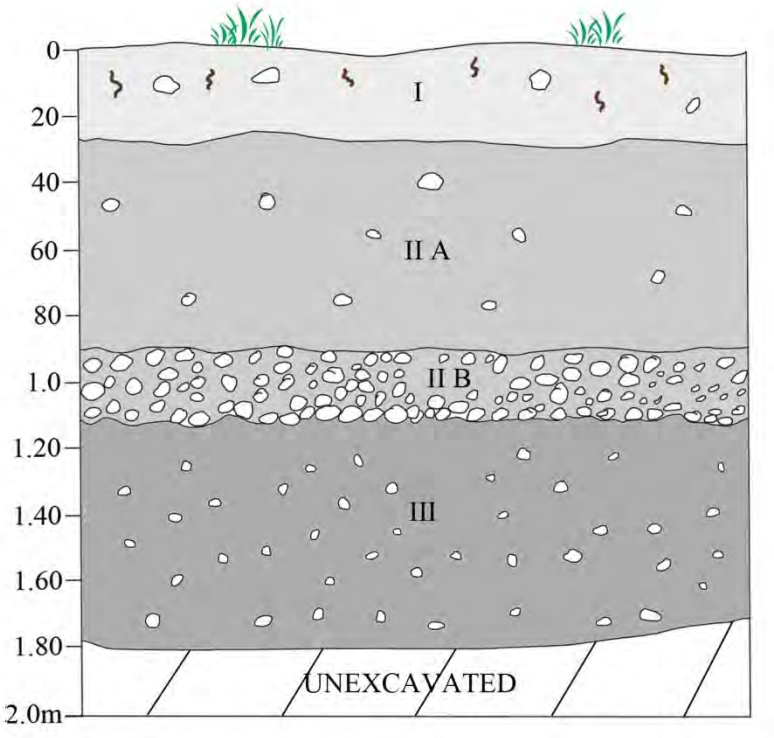


Figure 104. Stratigraphic Profile of TR 015 North Wall Profile

DISCUSSION PARCEL 3 WAENA BACKHOE TRENCHING

No cultural materials were recovered within the 27 trenches excavated within the eastern half of Parcel 3 Waena. Although the absence of material is noteworthy, most of the information is geologically related. Ten (10) trenches exhibited an alluvium stratum (water deposited layer and/or lens). TR`s 5, 6, 11 in the southern portion and TR`s 15, 16, 18 located to the north contained a deep streambed layer. TR`s 9, 10, 12, and 14 contained episodic storm wash activity or periodic flood episodes in the form of water affected pebbles and gravel layers and/or lens, juxtaposed by silt layers above and below. These trenches are located in the central portion of the parcel between the identified streambed trenches, and are oriented west/east. Six (6) trenches (TR 22-27) excavated along the northwestern portion of the project area, adjacent to large agricultural clearing piles exhibited a distinct stratigraphy consisting of a much grayer colored, extremely rocky Layer I and Layer II, particularly within the lower undisturbed stratum. Although these trench profiles show an upper plow-zone layer and a distinct lower layer, these layers consist of mainly of decomposing bedrock and/or saprolytic rock. These trenches are probably in areas that have either been very extensively bulldozed or previously mined of topsoil, leaving the underlying layers closer to the surface. Additionally, these trenches are located near a fairly deep ravine or gulch that was devoid of water. The remaining eleven (11) trenches, (TR 1-4, TR 7, TR 8, TR 13, TR 17, TR 19, TR 21, and TR 2) contained a deep soil deposit, with TR 1 containing a fairly thick sand deposit approximately 1.0 mbs (see Figure 86). No buried utility lines were noted in the area where the sand would be interpreted as pipe bedding. Although, the sand layer does not appear to be native, it contained the cross-bedding lines indicative of aeolian deposition.

A total of 15 trenches were undertaken on the western side of the parcel, which were also negative for buried remains. Five (5) trenches (TR 07-010 and TR 015) excavated along the western boundary, parallel with Site 5197 (Waihe`e Ditch) exemplified storm wash episodes in the form of water-affected basalt cobbles, pebbles and gravel, identified as a layer and/or lens (see Figure 86). Five (5) trenches (TR 01-03, TR 012 and TR 013) excavated along the eastern boundary, parallel with State Highway 30 (RT30) exhibited a high frequency of rock in both Layers II and Layer III silty loam. Trenches (TR 04-06, and TR 011) contained a deep soil deposit. Underground irrigation utilities were encountered in Trenches (TR0 6 and TR 09) and exhibited previous disturbances.

PARCEL 3 MAKAI

Parcel 3 Makai (TMK 3-6-002:003) comprises a total of 250 acres that is bounded on the east by Honoa`pi`ilani Highway (RT 30). Waikapū Stream and Waiko Road are located on the north and an active sand mining borrow pit and Kuihelani Highway (RT 380) are located on the east. Parcel 3 Makai is

currently cultivated in HC&S commercial sugarcane cultivation. One Grant formerly utilized for sugarcane, and a former reservoir were also noted in the central portion of the project area (Figure 105). Six trenches (TR's 110, 113, 116, 119, 127 and 140) were excavated within the Grant, and a total of forty-two (42) trenches (TR 100-141) were excavated and documented (Figure 105 and Tables XV and XVI). Most of the trenches excavated exhibited a similar stratigraphy. Generally, a three to four stratigraphic layer sequence was observed throughout the parcel with Layer I being the agricultural plow zone. All trenches were non-cultural.

OVERALL GENERAL STRATIGRAPHY

Layer I generally consisted of an upper loamy silt layer, usually a dark brown, or a very dark grayish brown (10 YR 3/3, 3/2), and varied from 50 to 80 cm thick. This was the plow zone from previous cultivation activities. Layer I was typically a disturbed layer mixed with deteriorated black plastic drip-lines, plastic PVC irrigation pipes, and concrete with gravel aggregate pieces that had been used during the previous commercial sugarcane cultivation era. There was a low density of rocks in this layer, but a high density of roots from surface vegetation.

Layer II generally consisted of a fine silt, loamy silt, and in a few identified trenches contained a silt clay and/or a silt gravel, and varied from a brown, dark brown, very dark grayish brown, and a dark grayish brown (10YR 4/3, 3/2, 3/2, 4/2) or a dark reddish brown (5YR 3/3) and/or brown, dark brown, strong brown (7.5YR 3/2, 3/4, 4/3,4/6) with a low density of roots and medium-sized cobbles to medium-sized boulders.

Layer III generally consisted to be very fine silt loam and/or clay with a low density of roots and medium-sized cobbles to large-sized boulders. Trenches excavated along the north eastern end of the project area exhibited an orange or strong brown layers, which ranged in color from dark brown (7.5YR 3/4, 5/6, 4/6) that may be a result of soil oxidation or chemicals used in sugarcane cultivation.

Eleven (11) trenches exhibited a two layer sequence, sixteen (16) trenches exhibited a three layer sequence, ten (10) trenches exhibited a four layer sequence, four (4) trenches exhibited a five layer sequence and one (1) trench exhibited a six layer sequence.

Representative stratigraphic profiles with photos for Trenches 100, 102, 110, 116, 121, 125 and 137 are presented below to exemplify the results.

Table XV. Summary of Backhoe Trenches Parcel 3 Makai East of State Highway 30

TRENCH	LOCATION	DIMENSIONS	ORIENTATION	STRATIGRAPHY	COMMENTS
100	Northeastern Boundary	4.7m x 1.41m x 1.5m	270° x 90°	Layer I-IV	Non-Cultural
101	Northeastern Boundary	4.7m x 1.40m x 1.36m	270° x 90°	Layer I-III	Non-Cultural
102	Northeastern Portion	4.7m x 1.42m x 1.5m	270° x 90°	Layer I-III	Non-Cultural
103	Northeastern Portion	4.7m x 1.41m x 1.8m	360° x 180°	Layer I-III	Non-Cultural
104	East of TR-103	4.6m x 1.43m x 1.5m	270° x 90°	Layer I-III	Non-Cultural
105	Northeastern Boundary	4.7m x 1.42m x 1.32m	270° x 90°	Layer I-III	Non-Cultural
106	North Central	4.6m x 1.41m x 0.92m	270° x 90°	Layer I-II	Non-Cultural
107	East of TR-106	4.7m x 1.42m x 1.2m	270° x 90°	Layer I-II	Non-Cultural
108	Northeastern Portion	4.7m x 1.41m x 1.8m	270° x 90°	Layer I-III	Non-Cultural
109	Northeastern Boundary	4.6m x 1.42m x 2.0m	270° x 90°	Layer I-III	Non-Cultural
110	Central	4.7m x 1.43m x 1.6m	270° x 90°	Layer I-IV	Non-Cultural
111	East of TR-110	4.7m x 1.42m x 1.64m	270° x 90°	Layer I-IV	Non-Cultural
112	Central Eastern Boundary	4.7m x 1.41m x 1.76m	270° x 90°	Layer I-III	Non-Cultural
113	Central	4.7m x 1.43m x 1.8m	270° x 90°	Layer I-II	Non-Cultural
114	East of TR-113	4.7m x 1.45m x 1.7m	270° x 90°	Layer I-VI	Non-Cultural
115	Central Eastern Boundary	4.6m x 1.44m x 1.6m	270° x 90°	Layer I-II	Non-Cultural
116	Central Southern Grant 2747:2	4.7m x 1.45m x 2.0m	360° x 180°	Layer I-III	Non-Cultural
117	East of TR-116	4.7m x 1.46m x 1.8m	270° x 90°	Layer I-IIa	Non-Cultural
118	Southeastern Boundary	4.7m x 1.43m x 1.6m	270° x 90°	Layer I-IV	Non-Cultural
119	South Central	4.6m x 1.45m x 1.6m	270° x 90°	Layer I-III	Non-Cultural
120	East of TR-119	4.7m x 1.44m x 1.6m	270° x 90°	Layer I-III	Non-Cultural

Table XVI. cont'd Summary of Backhoe Trenches Parcel 3 Makai East of State Highway 30

TRENCH	LOCATION	DIMENSIONS	ORIENTATION	STRATIGRAPHY	COMMENTS
121	Southeastern Boundary	4.7m x 1.44m x m	270° x 90°	Layer I-IV	Charcoal Lens in Layer III
122	Southeastern Boundary	4.8m x 1.43m x m	270° x 90°	Layer I-V	Non-Cultural
123	Southeastern Boundary	4.7m x 1.44m x m	270° x 90°	Layer I-V	Non-Cultural
124	Southern Boundary	4.8m x 1.44m x m	360° x 180°	Layer I-V	Non-Cultural
125	Southern Boundary	4.9m x 1.43m x m	360° x 180°	Layer I-IV	Non-Cultural
126	Southwestern Boundary	4.9m x 1.45m x m	270° x 90°	Layer I-IIa	Non-Cultural
127	Western Boundary	4.7m x 1.43m x m	270° x 90°	Layer I-II	Non-Cultural
128	West of TR-110	4.8m x 1.44m x m	270° x 90°	Layer I-IV	Non-Cultural
129	East of TR-138	4.8m x 1.42m x 1.62m	270° x 90°	Layer I-III	Non-Cultural
130	East of TR-137	4.7m x 1.41m x 1.45m	270° x 90°	Layer I-III	Non-Cultural
131	Southeast of TR-133	4.8m x 1.42m x 1.31m	270° x 90°	Layer I-II	Non-Cultural
132	Northern Boundary	4.8m x 1.45m x 1.75m	270° x 90°	Layer I-V	Charcoal lens in Layer II
133	Northern Boundary	4.6m x 1.41m x0.81 m	270° x 90°	Layer I-II	Non-Cultural
134	South of TR-135	4.7m x 1.42m x 1.41m	270° x 90°	Layer I-II	Non-Cultural
135	Northern Boundary	4.7m x 1.41m x 1.21m	270° x 90°	Layer I-III	Non-Cultural
136	Northwestern Boundary	4.8m x 1.43m x 1.39m	270° x 90°	Layer I-II	Non-Cultural
137	Southeast of TR-138	4.8m x 1.44m x 1.52m	270° x 90°	Layer I-IV	Non-Cultural
138	Western Boundary	4.7m x 1.41m x 1.17m	360° x 180°	Layer I-III	Non-Cultural
139	Western Boundary	4.8m x 1.40m x 1.65m	270° x 90°	Layer I-IV	Non-Cultural
140	Western Boundary	4.8m x 1.45m x 1.29m	270° x 90°	Layer I-IV	Non-Cultural
141	East of TR-40	4.9m x 1.44m x 1.8m	270° x 90°	Layer I-III	Non-Cultural

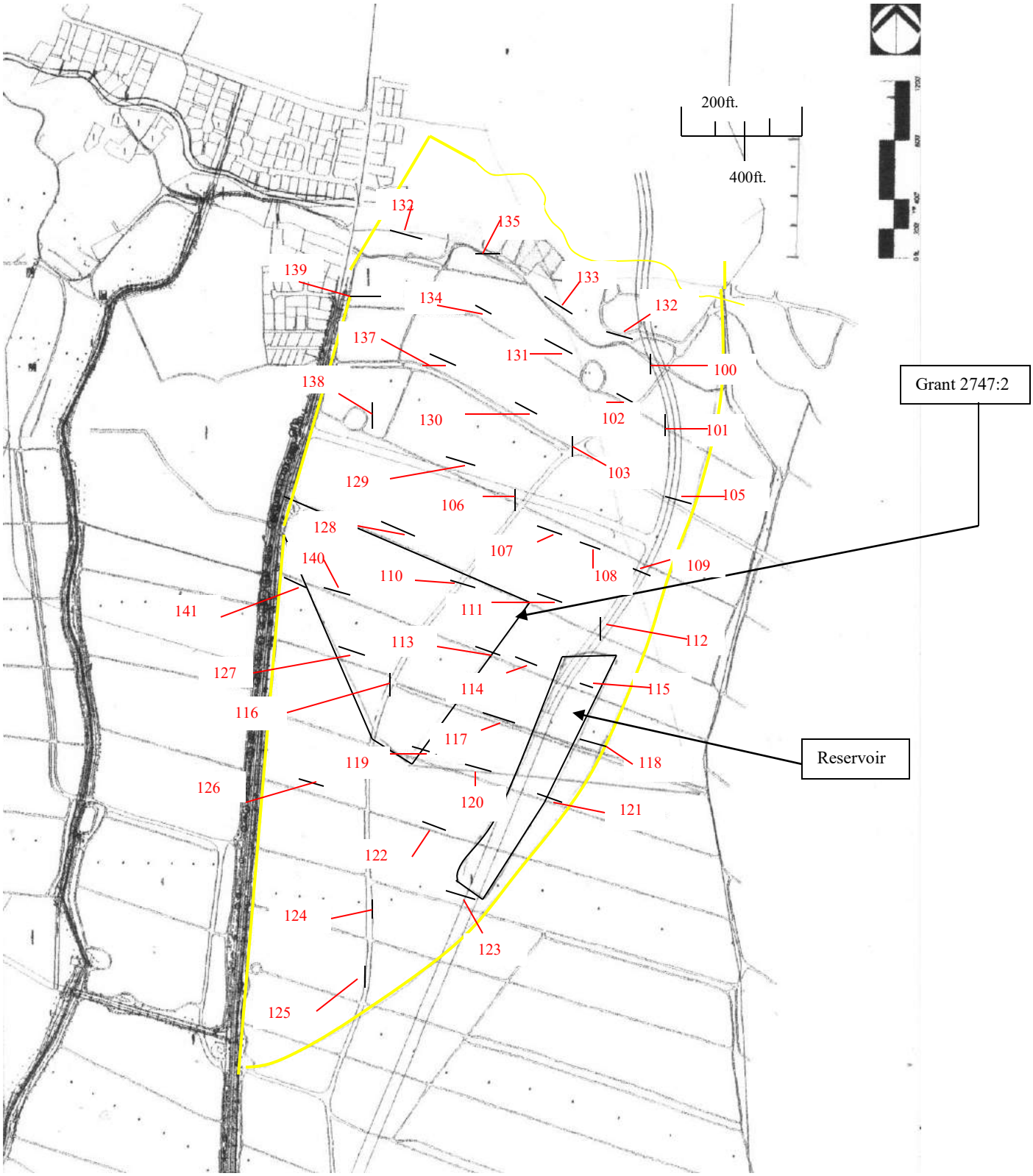


Figure 105. Plan View Topographic Map of Parcel 3 Makai (Yellow) Showing Location of Trenches 100-141, Grant and Reservoir

Trench 100

Trench 100 (TR 100) was situated in the northeastern portion of the project area along the western edge of a cultivated sugarcane field (see Figure 86). This section contained a four layer stratigraphic sequence with excavations terminating in sterile streambed soils (Figures 106 and 107). No cultural materials were observed within TR 100 which measured 4.7 m long by 1.41 m wide by 1.5m deep.

Layer I (0-68cmbs): is a dark brown (10yr 3/3), loamy silt, plow zone, non-plastic, non-sticky, fine to medium grain, with a medium frequency of roots. No cultural materials were observed in this layer. Boundary was clear and wavy overlying Layer II on the east and Layer III streambed on the west.
Layer II (33-132cmbs): is a very dark brown (10yr 3/2-3/3), silty loam, non-plastic, slightly-sticky, very fine grain. No cultural materials observed in this layer. Boundary was clear and abrupt overlying Layer IV on the east and Layer III on the west.
Layer III (58-150cmbs): is a dark yellowish brown 10 YR 3/6), imported gravelly silt, non-plastic, slightly-sticky, medium to coarse grain. No cultural materials observed in this layer. Boundary was clear and abrupt overlying Layer II.
Layer IV (130-150cmbs): is a dark brown (7.5yr 3/3) sandy loam with sub-rounded small basalt cobbles and lithified sand stone peds, non-plastic, slightly-sticky, fine to medium grain, with a low frequency of roots. No cultural materials were observed in this layer. Boundary was clear and broken abutting Layer III on the west.

Figure 106. Photograph of Stratigraphic Profile of Trench 100 South Wall with Streambed Deposit

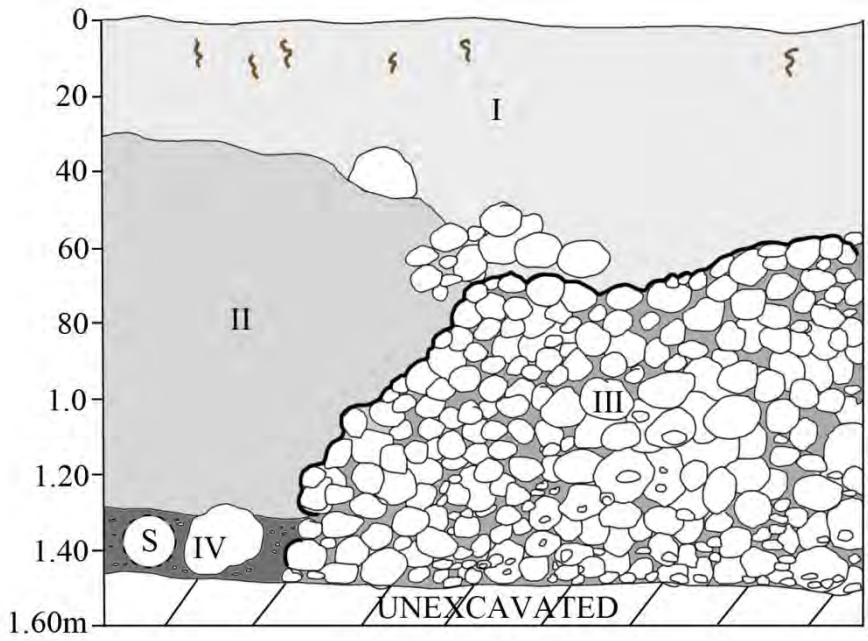


Figure 107. Stratigraphic Profile of Trench 100 South Wall

Trench 102

Trench 102 (TR 102) was located in the northeastern portion of the project area within an access road and the edge of a cultivated sugarcane field (see Figure 86). This trenched contained a three layer stratigraphic sequence with excavations terminating in sterile silty soil (Figures 108 and 109). Trench 102 was non-cultural and measured 4.7 m long by 1.42 m wide by 1.5m deep.

Figure 108. Photograph of Stratigraphic Profile of Trench 102 with Streambed Deposit, View to West

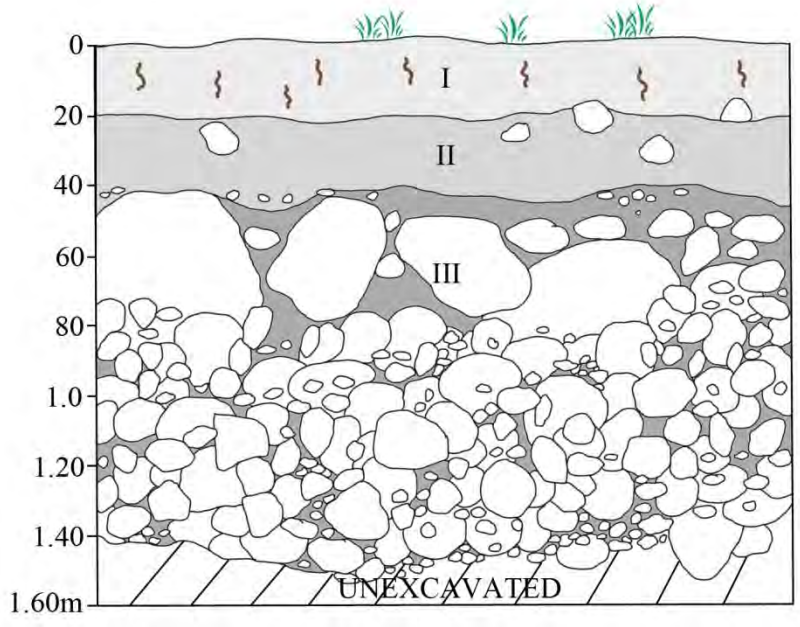


Figure 109. Stratigraphic Profile TR 102 South Wall

Trench 110

Trench 110 (TR 110) was situated in the central portion of the project area within Grant 2747:2 to Eugene Bal (see Figure 86 and Table IX). Land use for the grant was listed as sugarcane and a reservoir. The stratigraphic record for TR110 contained four layers which were the similar to TR's 108-109 (Figures 110 and 111). No cultural materials or evidence of the reservoir were observed within the trench which measured 4.7 m long by 1.43 m wide by 1.6 m deep.

Layer I (0-38cmbs) is the till zone it is a dark grayish brown (10YR5/2), loamy silt, non-plastic, non-sticky, fine to medium grain, with medium frequency of roots, and black plastic irrigation. No cultural materials were observed in this layer. Layer I has a clear, smooth boundary with underlying Layer II.
Layer II (38-78 cmbs) consisted of a dark grayish brown (10YR5/2), loamy silt with cobble inclusions, non-plastic, non-sticky, fine to medium grain, low frequency of fine roots. Layer II is similar to Layer I but contains small cobble sub angular rocks and devoid of irrigation piping. Layer II is non-cultural. Boundary is abrupt and smooth.
Layer III (78-101/118 cmbs) is a reddish brown silty clay (5YR3/3), compact, non-plastic slightly sticky, with gravel inclusions. Layer III is non-cultural and has an abrupt, smooth boundary.
Layer IV (118-BOE cmbs**)** is a dark reddish brown (7.5YR4/6) gravelly silty clay with mottling of Layer III saprolytic rock. No roots, linear gravel inclusions and sub angular rock. Layer IV is non-cultural and excavations terminated within this layer.

Figure 110. Photograph of South Wall of Trench 110

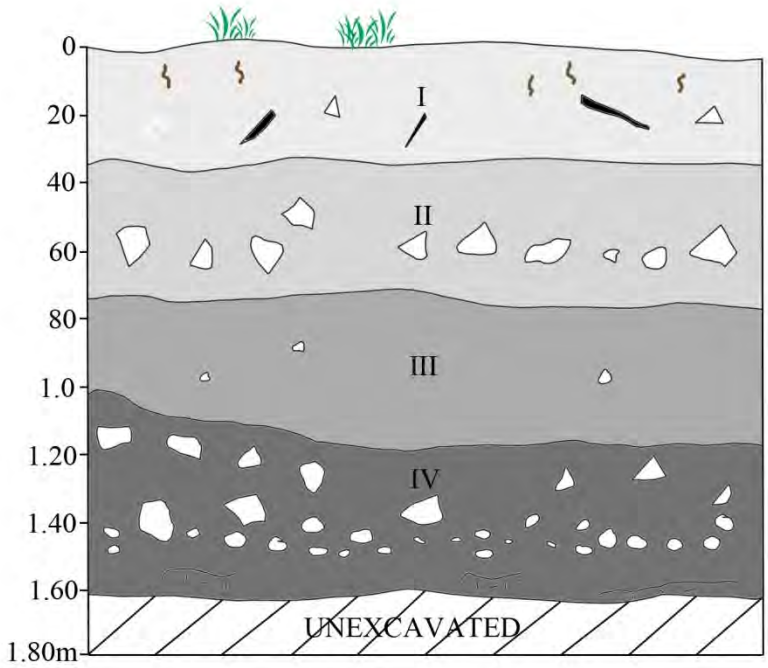


Figure 111. Stratigraphic Profile of South Wall of Trench 110

Trench 116

Trench 116 (TR 116) was situated in the central portion of the project area also within Grant 2747:2 which was formerly utilized as sugarcane and a reservoir (see Figure 86 and Table IX). The stratigraphic record for TR116 contained four layers including one sand lens which interrupted the upper portion of Layer II (Figures 112 and 113). No cultural materials were observed within this trench which measured 4.7 m long by 1.45 m wide by 2.0m deep.

> **Layer I** (0-25cmbs) is a light grayish brown (10YR5/2), loamy silty clay with gravel for access road, non-plastic, non-sticky, fine to medium grain, with low to medium frequency of roots. No cultural materials were observed in this layer. Layer I has abrupt clear boundary with underlying sand lens (Layer Ia).
> **Layer II** (25-160) generally consisted of a fine silty clay, dark reddish brown (5YR 3/3) with grayish brown and gravel inclusions, non-plastic, non-sticky, fine to medium grain, low quantity of fine roots with clay ped inclusions. Layer II is non-cultural. Boundary is clear and wavy and overlies Layer III.
> **Layer IIa** (42/45-55/57 cmbs) is a sand lens which was likely aeolian deposited. Layer IIa is non-cultural.
> **Layer III (**150-200 cmbs**)** is a dark brown, strong brown (7.5YR3/2, 4/3, 4/6) very fine silt loam, non-plastic, non-sticky, fine to medium grain, with a low density of roots. Layer III is non-cultural and excavations terminated within this layer.

Figure 112. Photograph of West Wall of Trench 116, View to West

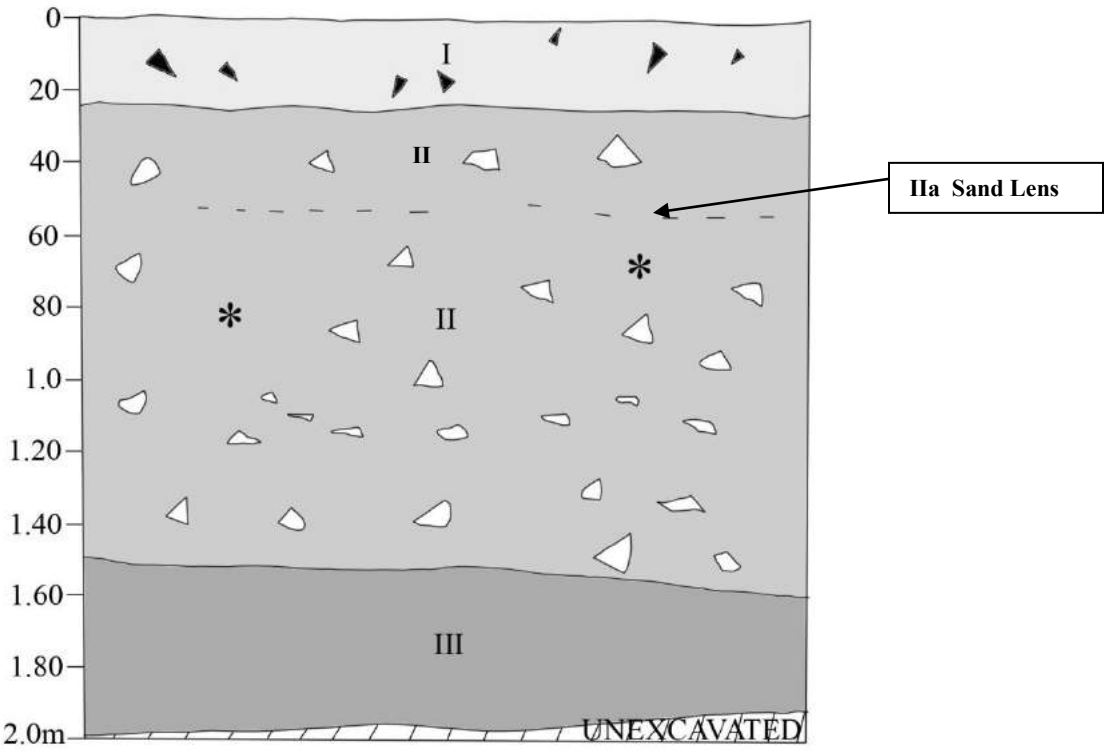


Figure 113. Stratigraphic Profile TR 116 West Wall

Trench 121

Trench 121 (TR 121) was located along the eastern edge of the parcel in the southeast portion along an east-west trending cane haul access road (see Figure 86 and Tables XV and XVI). This trench contained a four-layer stratigraphic sequence with a gravel lens indicative of alluvial deposition, as well as a charcoal stained lens near the base of the trench (Figures 114-116). All layers were non-cultural with the charcoal staining likely due to past cane burning activities. Excavations terminated within Layer IV and TR 121 measured 4.7 m long by 1.45 m wide by 1.66 m deep.

Layer I (0-22 cmbs) consisted of the till zone and is a grayish brown (10YR5/2) loamy silt layer, non-plastic, non-sticky, fine to medium grain. It is disturbed with deteriorated black plastic drip-lines. Layer I contains medium density of rootles with few rocks. Layer I was non-cultural with clear, smooth boundary overlying Layer II.
Layer II (22-60/75 cmbs) comprised of a loamy silt, brown (10YR 4/3) non-plastic, non-sticky, fine to medium grain, with sparse gravel and a low density of roots and medium-sized cobbles to medium-sized boulders. Layer II is non-cultural and contains a clear wavy boundary overlying Layer III.
Layer III (60/75-148) is a very fine silt, dark brown (10YR 4/2. 4/3) few to no roots, non-plastic, non-sticky, fine to medium grain, with gravel lenses identified at 90, 100 and 140 cmbs. No cobble inclusions. Near the bottom of Layer III, the soil becomes finer with depth and charcoal stained lens is apparent at 144 to 148 cmbs, which is the beginning of Layer IV. Layer III is non-cultural with a clear abrupt boundary.
Layer IIIa (148-BOE) is similar to Layer III but appears to be a finer material. It is comprised of dark brown (10YR 4/2.5) very fine silt and contains the linear charcoal staining at the transition with Layer III. Layer IIIa is non-cultural.

Figure 114. Overview Photograph of Trench 121, View to South

Figure 115. Close-up Photograph of South Wall of TR 121 Showing Charcoal Staining

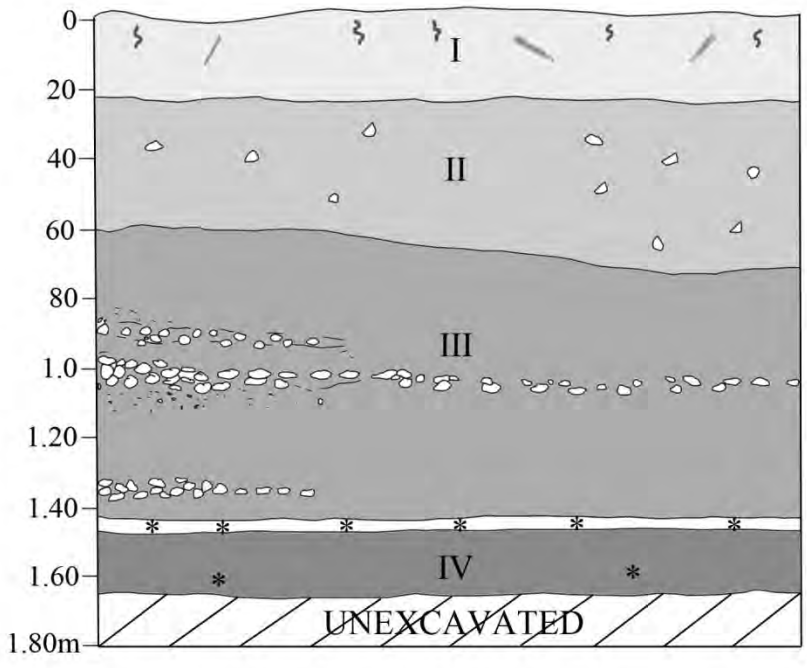


Figure 116. Stratigraphic Profile of South Wall of Trench 121

Trench 125

Trench 125 (TR 125) was located in the southeastern corner the northern side of a cane haul access road (see Figure 86 and Tables XV and XVI). It contained a four-layer stratigraphic sequence with a storm/flood wash layer represented in stratum 2 (Figures 117 and 118). TR 125 was oriented at 360 and measured 4.9 m long by 1.43 m wide by 1.80 m deep and was non cultural.

Layer I (0-20/30 cmbs) is the edge of roadbed and consisted of a light gray imported (10YR5/2) gravel layer. Layer I was non-cultural with clear, smooth boundary overlying Layer II.
Layer II (20/30-60/70 cmbs) is a light grey, non-plastic, non-sticky, fine to medium grain, alluvial deposit comprised of silt and rounded pebbles and small cobbles. Layer II appears to be an *in situ* alluvial deposit which has been utilized as the sub-base for the road bed. It is non-cultural and has an abrupt, smooth boundary overlying Layer III.
Layer III (60/70-142/160 cmbs) is a reddish brown (7.5YR4/6) compact silty clay, non-plastic, slightly-sticky, fine to medium grain, with a few sub-angular and rounded small cobbles. Layer III is non cultural with no roots and has a clear, smooth boundary with Layer IV.
Layer IV (142/160-BOE) is similar to Layer III but is more compact, and comprised of a very fine, reddish brown silt which is devoid of rock inclusions. Layer IV is non-cultural and B.O.E. is at 180 cmbs.

Figure 117. Photograph of West Wall of Trench 125, View to West

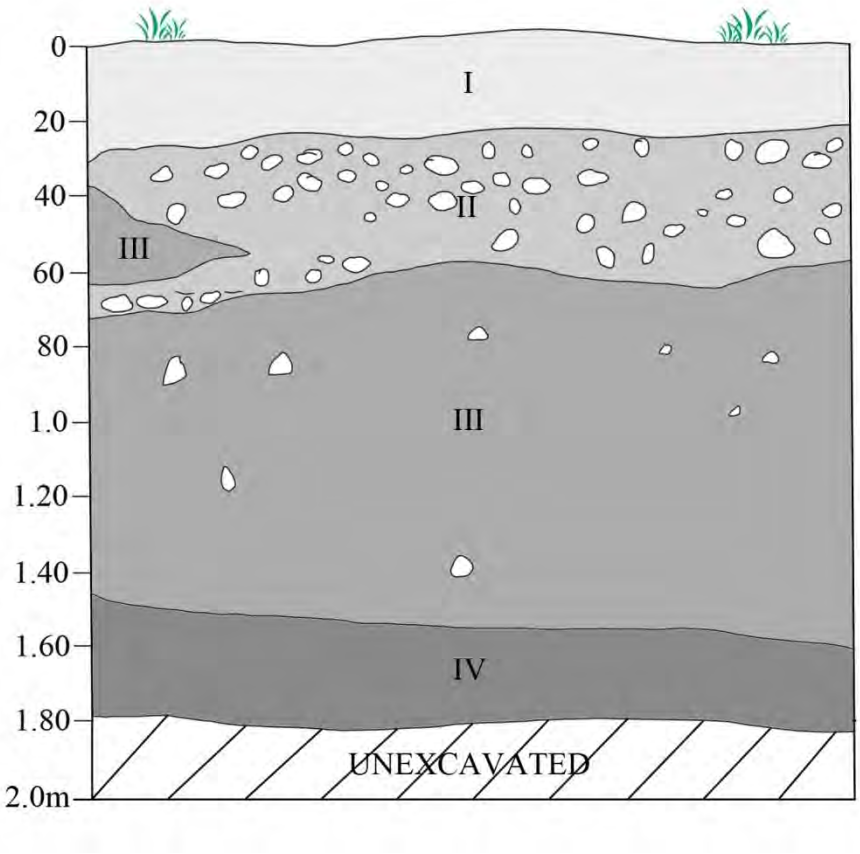


Figure 118. Stratigraphic Profile of West Wall of Trench 125

Trench 137

Trench 137 (TR 137) was located in the northwestern corner near a utility storage shed along the northern side of an access road (see Figure 86 and Tables XV and XVI). It contained a four-layer stratigraphic sequence comprised of alluvial deposition that terminated in decomposing basalt (Figures 119 and 120). TR 137 measured 4.8 m long by 1.44 m wide by 1.50 m deep and was non cultural.

Layer I (0-18/22 cmbs) is the till zone and consisted of a grayish brown (10YR5/2) loamy silt layer with a few rounded pebble and cobbles inclusions. It is disturbed and contains few roots and Layer I was non-cultural with clear, smooth boundary overlying Layer II.
Layer II (22-30/60 cmbs) comprised of a dark reddish brown (5YR 3/3) (7.5YR 3/2, ¾) loamy silt non-plastic, slightly sticky, fine to medium grain, with large cobble inclusions. Layer II is non-cultural and contains a clear wavy boundary overlying Layer III.
Layer III (30/60-122) is a yellowish brown (10YR4/3) gravelly silt with pockets of reddish brown silty clay. Many small and large cobbles with a few medium sized boulders and saprolytic rock, non-plastic, non-sticky, fine to medium grain. Layer III is non cultural with no roots. Layer III is non-cultural has a clear, smooth boundary with Layer IV.
Layer IV (122-BOE) is comprised of decomposing bedrock and smaller cobbles and pebbles with yellowish brown (10YR4/3) fine silt.

Figure 119. Photograph of South Wall of Trench 137

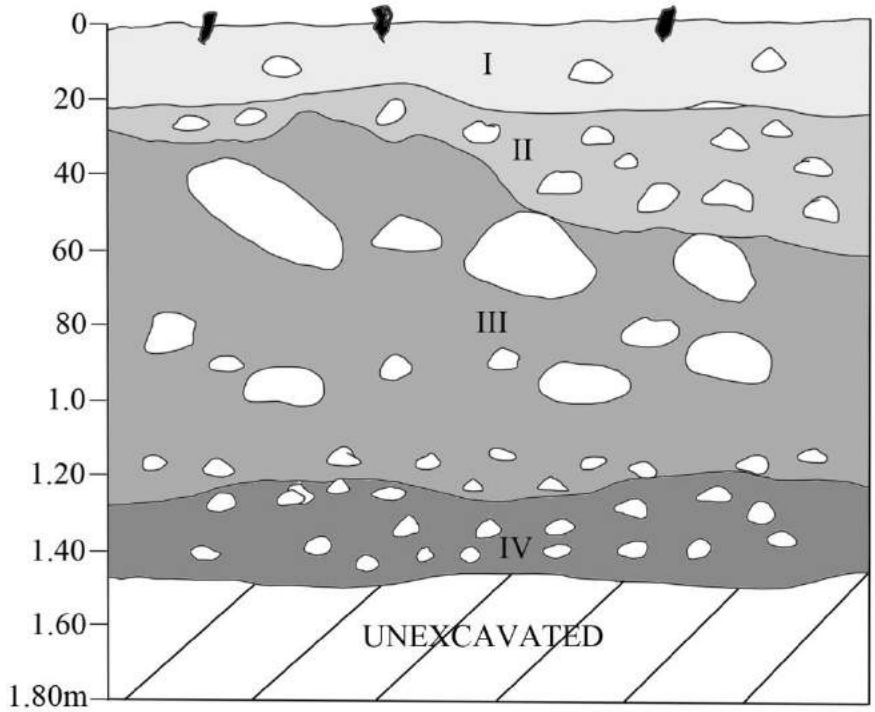


Figure 120. Stratigraphic Profile of Trench 137 South Wall

DISCUSSION PARCEL 3 MAKAI BACKHOE TRENCHING

Trenches (TR 100 and TR 102) excavated in the extreme northeastern portion of the parcel exhibited sand inclusions intermixed within a streambed. The US Soil Survey identified a (PZUE) Pu`uone sand deposits in the adjacent property towards the east and, although no intact sand deposits (only the inclusions in TR's 100 and 102) were encountered during testing, sand was observed on the surface along the eastern boundary of the project area. Twenty-three (23) trenches excavated exhibited a alluvium deposited strata and/or lenses. Trenches (TR 100-102, TR 105, TR 111, TR 114, TR 122, TR 124, TR 128-133, TR 135 and TR 137-139) contained a thick alluvial deposit, likely from a meandering Waikapū Stream as the majority of these trenches were located in the northern portion, in close proximity to the Waikapū Stream. TR's 120, TR 121, TR 123, TR 125, and TR 26 are located in the southern portion of the parcel and exhibited storm wash episodes in the form of water affected pebbles and gravel layers and/or lens identified imbedded in Layer III silt, above and below. Eight (8) trenches, (TR-104, TR-106-108, TR-112, TR-134, TR-136 and TR-141) exhibited bedrock in either Layer II or III. The remaining trenches exhibited a deep silt deposit with depth and/or overlying large boulders.

PARCEL 6

Parcel 6 (TMK 3-6-004:006) contains a total of 52-acres that are located within the central portion of the overall project area (see Figure 1, 2 and 6). It is an L-shaped parcel which is partially bounded to the east by Site 5197 (Waihe`e Ditch) and Parcel 7-Maui Tropical Plantation (see Figure 6). To the north are undeveloped and developed agricultural lands, to the south and southwest is Parcel 3 Waena, and to the west is Parcel 3 Mauka. Parcel 6 was once cultivated entirely in sugarcane; however portions of the north and west are currently fallow with small scale commercial agricultural activities and the southern portion is in active sugarcane by HC&S (Figures 121-123). The subject parcel is slated for small residential lots less than 10,000 sq. ft. in size (see Figure 7).

During the course of the current fieldwork, a total of twenty-six (26) trenches (TR's 200-225) were excavated and stratigraphically recorded (Figure 124 and Tables XVII and XVIII). The trenches exhibited a similar stratigraphy ranging from three to four layers with Layer I being the agricultural till zone. Trenches 200 (TR 200 -203) were placed within the active sugarcane along the southern portion of the parcel and TR's 204-225 (TR 204-225) were situated across the parcel to provide a representative sample of the subsurface conditions, and to test areas that contained LCA's, Grants and flumes (Figure 125 and Tables V, VI, XVII and XVIII) along the western and northern portion of the project area.

OVERALL GENERAL STRATIGRAPHY

Layer I generally consisted of an upper loamy silt layer, usually dark brown, a very dark grayish brown (10 YR 3/3,7.5 YR 3/3, 4/3) that varied from 30 to 60 cm thick. This was the plow zone from previous cultivation activities and current agricultural activities. Layer I was typically a disturbed layer with mixed with deteriorated black plastic drip-lines, plastic PVC irrigation pipes, and concrete with gravel aggregate pieces that had been used during the previous commercial sugarcane cultivation era. There was a low density of rocks in this layer, but a high density of roots from surface vegetation.
Layer II generally consisted of a dark brown (10YR 2/2 to 7.5YR 3/2) to a dark reddish brown (5YR 3/3, 3/4) stony silt loam and clay loam deposit that varied 60-150 cm thick with a few trenches containing decomposing bedrock, with a low density of roots and a medium frequency of rocks.
Layer III generally consisted of a very fine clay loam to a silty clay and varied from a brown to strong brown (7.5YR 4/4-4/6), dark grayish brown (10YR 3/2) and dark reddish brown (5YR 3/3-3/4) with the absence of roots and contained a gravelly stony silt with decomposing bedrock, and medium-sized cobbles with decomposing bedrock.

Four (4) trenches exhibited a two layer sequence, twenty (20) trenches exhibited a three layer sequence, and two (2) trenches exhibited a four layer sequence. All trenches were culturally sterile with the exception of Trench 221(TR 221) where an isolated clear bottle glass fragment was found on the surface. Representative stratigraphic profiles and photographs are presented below and exemplified in TR's 202, 208, 218 and 222 are (see Figure 121).

Figure 121. Overview Photograph of Parcel 6 Showing Commercial Agricultural Activities, View to Northeast

Figure 122. Overview Photograph of Parcel 6 Showing Fallow Sugarcane and Proposed Location of TR 212, View to East

Figure 123. Overview Photograph of Parcel 6 after Mature Sugarcane was Removed, View from TR 223 and to Northwest

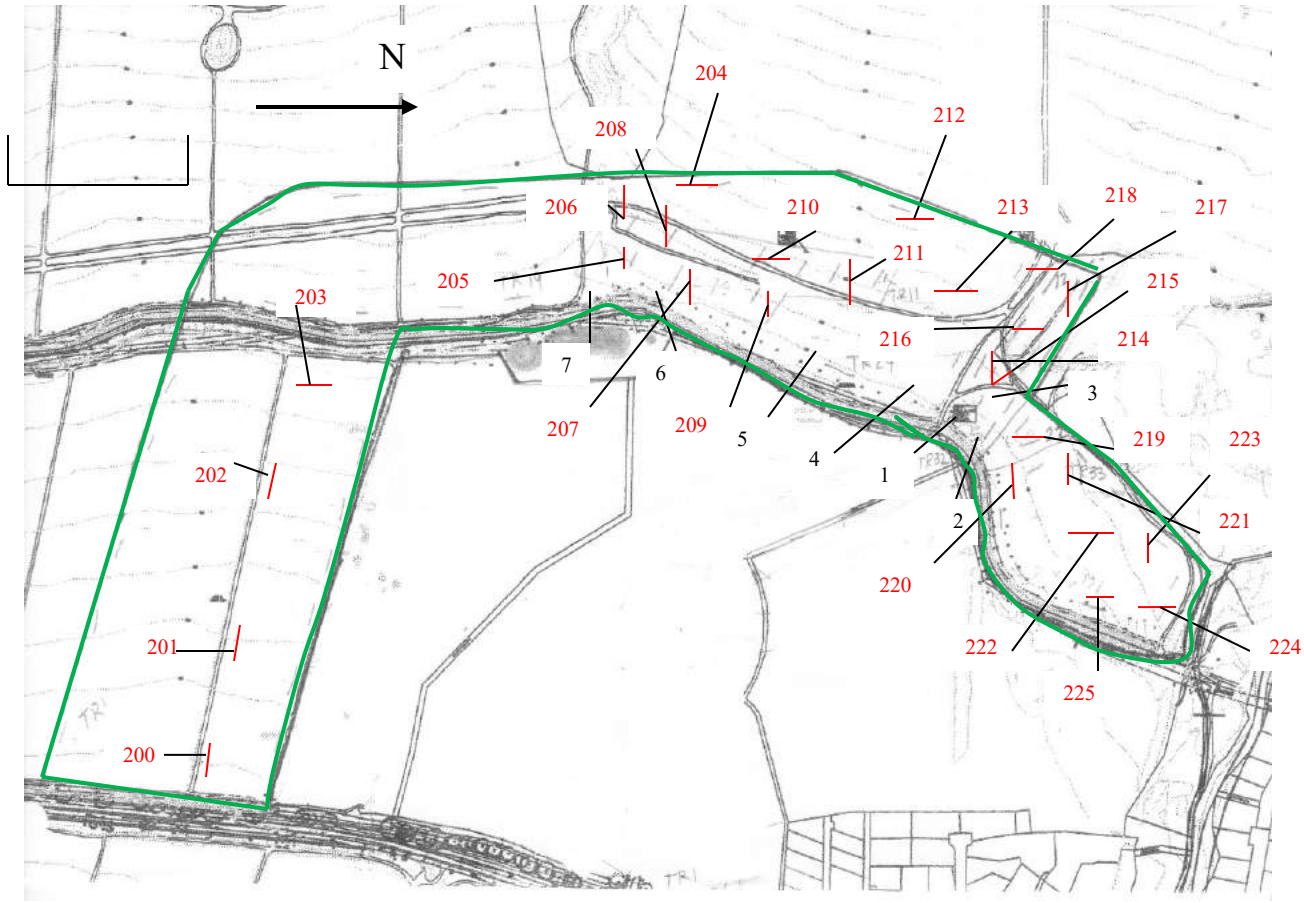


Figure 124. Topographic Map Showing Location of Former Trenches 1-7 (Black), Current Backhoe Test Trenches 200-225 (Red) within Parcel 6 (Green)

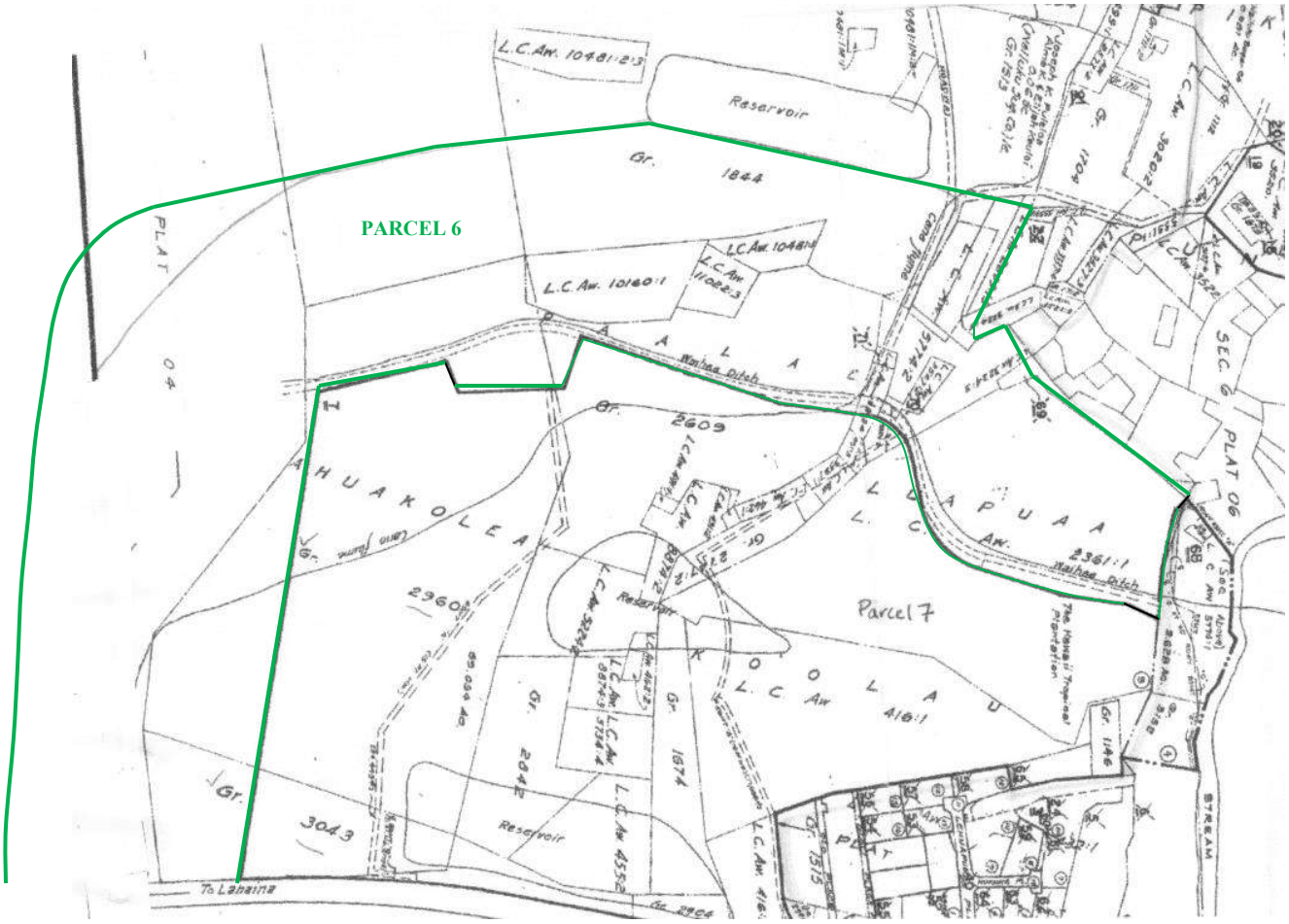


Figure 125. Enlarged Topographic Map of Parcel 6 Showing location of LCA's and Grants

Table XVII. Summary of Backhoe Trenches Parcel 6

TRENCH	LOCATION (Land Use)	DIMENSIONS	ORIENTATION	STRATIGRAPHY	COMMENTS
200	West of State Highway 30	4.6m x 1.4m x 2.0m	270° x 90°	I-III	Non-Cultural
201	East of Waihe'e Ditch in cane field	4.6m x 1.41m x 1.8m	270° x 90°	I-III	Non-Cultural
202	Grant 2960 for sugarcane	4.6m x 1.4m x 2.0m	270° x 90°	I-III	Non-Cultural
203	East of Waihe'e Ditch in cane field	4.7m x 1.41m x 1.6m	360° x 180°	I-III	Non-Cultural
204	West of Waihe'e Ditch, within Grant1844	4.9m x 1.45m x 1.86m	360° x 180°	I-III	Non-Cultural
205	West of ditch, LCA 10160:1 (house lot, kula, lo`i)	4.9m x 1.44m x 1.78m	270° x 90°	I-III	Non-Cultural
206	West of ditch, LCA 10160:1 ((house lot, kula, lo`i)	4.8m x 1.44m x 1.75m	270° x 90°	I-III	Non-Cultural
207	West of ditch, LCA 10160:1 (house lot, kula, lo`i)	4.9m x 1.43m x 1.81m	270° x 90°	I-III	Non-Cultural
208	Grant 1844 poss, within LCA 10160:1	4.8m x 1.44m x 1.81m	270° x 90°	I-IV	Non-Cultural
209	West of ditch, LCA 11022:3(house lot, kula, lo`i)	4.8m x 1.45m x 1.81m	270° x 90°	I-V	Non-Cultural
210	West of Waihe'e Ditch, within LCA 11022:3	4.9m x 1.44m x 1.71m	360° x 180°	I-III	Non-Cultural
211	West of Waihe'e Ditch, within LCA (house lot, kula, lo`i) 10481:1	4.8m x 1.42m x 1.7m	360° x 180°	I-III	Clear glass bottle fragment recovered from surface pre-excavation
212	West of Waihe'e Ditch, Grant1844(sugarcane)	4.9m x 1.44m x 1.79m	360° x 180°	I-III	Non-Cultural
213	West of Waihe'e Ditch, Grant1844 (sugarcane)	4.8m x 1.45m x 1.4m	360° x 180°	I-III	Non-Cultural
214	Within LCA 5774:2 for Lo`i	4.9m x 1.44m x 1.78m	270° x 90°	I-III	Non-Cultural
215	West of ditch, within LCA 5774:2 (lo`i)	4.9m x 1.45m x1.78 m	270° x 90°	I-II	Non-Cultural
216	West of the ditch, LCA 5774:2 (lo`i)	4.8m x 1.44m x 1.81m	360° x 180°	I-III	Non-Cultural
217	West of ditch, within LCA 5774:2 (lo`i)	4.8m x 1.43m x 1.78m	270° x 90°	I-III	Non-Cultural

Table XVIII. cont'd Summary of Backhoe Trenches Parcel 6

TRENCH	LOCATION (Land Use)	DIMENSIONS	ORIENTATION	STRATIGRAPHY	COMMENTS
218	West of Waihe'e Ditch, Cane Flume Esmnt LCA 5774:2 claimed for lo`i	4.9m x 1.45m x 1.79m	360° x 180°	I-III	Ceramic Sherd 2ndry Deposit surface Site 7884Fe2
219	West of ditch, LCA 3527:3 (kula, taro)	4.8m x 1.44m x 1.58m	360° x 180°	I-III	Non-Cultural Concrete frag. LI
220	West of Waihe'e Ditch, within LCA 3527:3	4.9m x 1.45m x 1.79m	360° x 180°	I-III	Non-Cultural
221	West of Waihe'e Ditch, within LCA 2361:1 (no info)	4.6m x 1.4m x 1.81m	270° x 90°	I-III	Non-Cultural
222	West of Waihe'e Ditch, within LCA 2361:1	4.6m x 1.41m x 1.75m	360° x 180°	I-II	Non-Cultural
223	West of Waihe'e Ditch, within LCA 2361:1	4.8m x 1.44m x 1.4m	360° x 180°	I-II	Non-Cultural
224	West of Waihe'e Ditch, within LCA 2361:1	4.9m x 1.45m x 1.75m	360° x 180°	I-II	Non-Cultural
225	West of Waihe'e Ditch, within LCA 2361:1	4.9m x 1.44m x 1.76m	360° x 180°	I-III	Non-Cultural

Trench 202

Trench 202 (TR 202) was situated within the south, central portion of Parcel 6 along a cane access road within an area currently utilized for sugarcane (see Figures 121 and 125). TR 202 was placed within Grant 2960 which was granted to Boardman for Sugarcane (see Table VIII and Figure 125). This section contained a tripartite stratigraphic sequence terminating on saprolytic bedrock (Figures 126 and 127). TR 202 was oriented east/west and measured 4.6 m long by 1.40 m wide by 2.00 m deep. No cultural materials were observed within Trench 202 which is further presented below.

> **Layer I** (0-21 cmbs) is a loamy silt, very dark grayish brown (10 YR 3/3,7.5 YR 3/3, 4/3) till zone. Low to medium density of rootlets from surface vegetation and subangular rocks, non-plastic non sticky. Layer I is non-cultural and has an abrupt smooth boundary overlying Layer II.
> **Layer II** 21-88/140 cmbs) compact very fine silt clay yellowish to dark brown (10YR 4/3 and 3/2), low density of roots and a low frequency of subangular and rounded rocks. Layer II is non-plastic, slightly

sticky, non-cultural. Layer II boundary is abrupt and wavy overlying Layer III.
Layer III (88/140-1.80/194 cmbs) very fine silty clay, dark reddish brown (5YR 3/3-3/4). No roots medium frequency of subangular cobbles with decomposing bedrock at the base. Excavations terminated on the discovery of saprolytic rock (Layer IV).

Figure 126. Photograph of North Wall near Base of Excavation of Test Unit 202

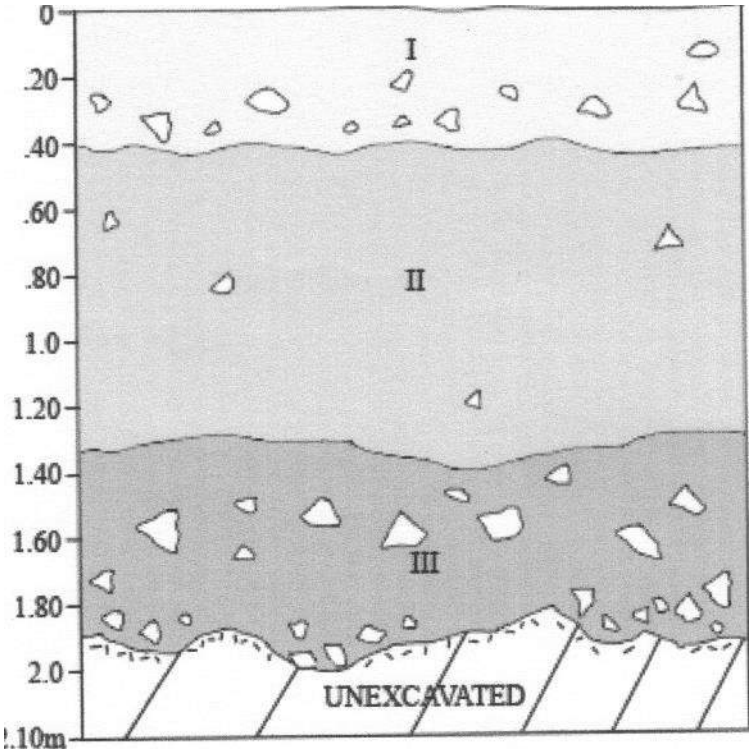


Figure 127. Stratigraphic Profile of North Wall of Test Unit 202

Trenches 205, 207 and 209

TR's 205, 207 and 209 were placed within LCA's 10160:1, 11022:3 and 10481:1 utilized as house lots (10160:1 and 10481:1), *lo`i kalo* and *kula* lands. The trenches contained a similar three layer stratigraphic sequence, yet TR's 207 and 208 contained more yellowish brown mottling (Figures 128-130). One glass fragment was found on the surface of TR 208 but was secondarily deposited. Thus, no clear evidence of domestic or agricultural activities (beyond sugarcane) was recorded.

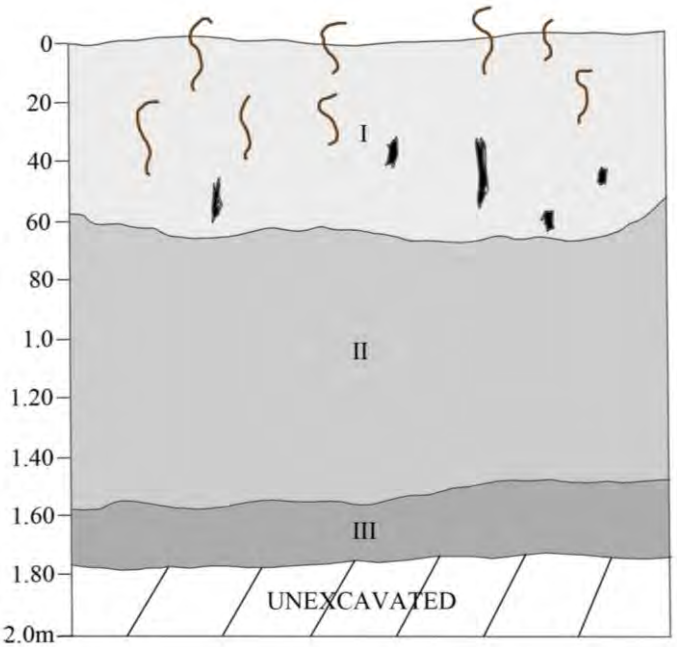


Figure 128. Photograph of South Profile of TR 205 (top); Stratigraphic Profile of South Wall TR 205

Figure 129. Photograph of South Wall of TR 207

Figure 130. Photograph of South Wall of TR 209

Trench 208

Trench 208 (TR 208) was situated within the central portion of Parcel 6 within Grant 1844 and possibly within LCA 10160:1 currently utilized for small scale commercial agriculture (see Figures 121, 125 and 128 and Table XVII). The grant was used for sugarcane and the LCA House lot, kula, *lo`i*) This section contained a four layer stratigraphic sequence with excavations terminating within sterile soils (Figures 131 and 132). A 4.8 m long by 1.44 m wide by 1.81m deep, oriented 270° by 90° section of this area was recorded and is further described below. No cultural materials were observed within TR 208.

Layer I (0-62cmbs): is a dark reddish brown (2.5yr 3/3), silt loam, agricultural plow zone, with deteriorated black drip-lines, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky, with a medium frequency of roots. No cultural materials were observed in this layer. Boundary was clear and wavy overlying Layer II.
Layer II (58-160cmbs): is a very dark brown to dark reddish brown (2.5yr 3/3), clay loam, disturbed layer, mottled with decomposing bedrock inclusions, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky. No cultural materials observed in this layer. Boundary was clear and wavy overlying Layer III.
Layer III (110-160cmbs): is a dark brown (7.5yr 3/3), clay loam, mottled with yellowish brown (10YR4/3), slightly-plastic, slightly-sticky, medium to coarse grain, slightly hard, and friable. No cultural materials observed in this layer. Boundary was clear and wavy overlying Layer IV.
Layer IV (119-181cmbs): is a strong brown (7.5yr 4/6) silty clay, weak, fine to medium grain, blocky, slightly hard, friable, slightly-plastic, slightly-sticky, with a low frequency of decomposing bedrock. No cultural materials were observed in this layer.

Figure 131. Overview Photograph of Trench 208 Pre-excavation within Parcel 6, View to East

Figure 132. Photograph of Stratigraphic Profile of Trench 208 (TR 208), North Wall

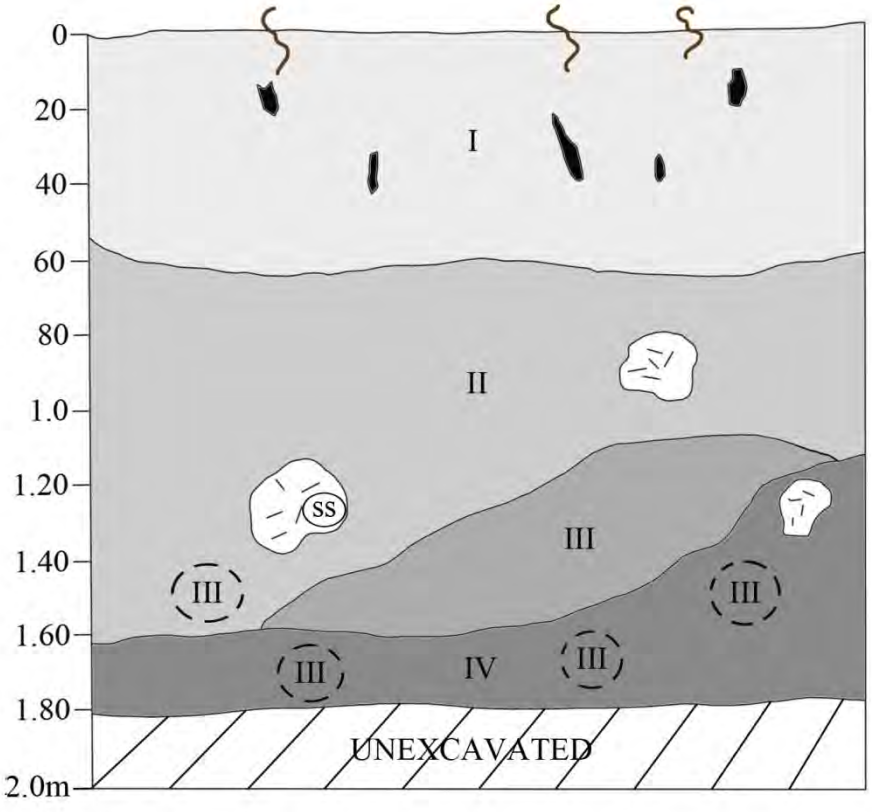


Figure 133. Stratigraphic Profile of North Wall of Trench 208 (TR 208)

Trench 218

Trench 218 (TR 218) was situated within the extreme northwestern portion of Parcel 6, within LCA 5774:2 award, utilized for *lo`i kalo,* and a portion of the cane flume easement (see Figures 121, 125 and Table XVIII). TR 218 measured 4.9 m long by 1.45 m wide by 1.79m deep and was oriented 360° by 180°. No *in situ* cultural materials were observed; however secondarily deposited domestic items were recovered from the surface area around TR 218 and assigned Site 7884 Feature 2 (Figure 134). These materials may have been from the house lots LCA's to the south where TR's 205, 207 and 209 were placed. Trench 218 contained a tripartite stratigraphic sequence with excavations terminating in sterile soils and decomposing bedrock (Figure 135).

> **Layer I** (0-52cmbs): is a dark reddish brown (2.5yr 3/3), silt loam, agricultural plow zone, with deteriorated drip-lines, slightly-plastic, slightly-sticky, weak, fine to medium grain, slightly hard, blocky, with a medium frequency of roots. Boundary was clear and wavy overlying Layer II. No cultural materials were observed in this layer.
> **Layer II (**41-138cmbs): is a dark red (2.5yr 3/6), clay loam, mottled with a high frequency of decomposing bedrock inclusions, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky. Boundary was clear and wavy overlying Layer III. No cultural materials were observed in this layer.
> **Layer III** (138-179cmbs): is a brown (7.5yr 4/4) silty clay, weak, fine to medium grain, blocky, slightly hard, weakly coherent, slightly-plastic, slightly-sticky, with a high frequency of medium and large boulders. No cultural materials were observed in this layer.

Figure 134. Photograph of Site 7884 Feature 2 Secondarily Deposited Historic Materials around TR 218

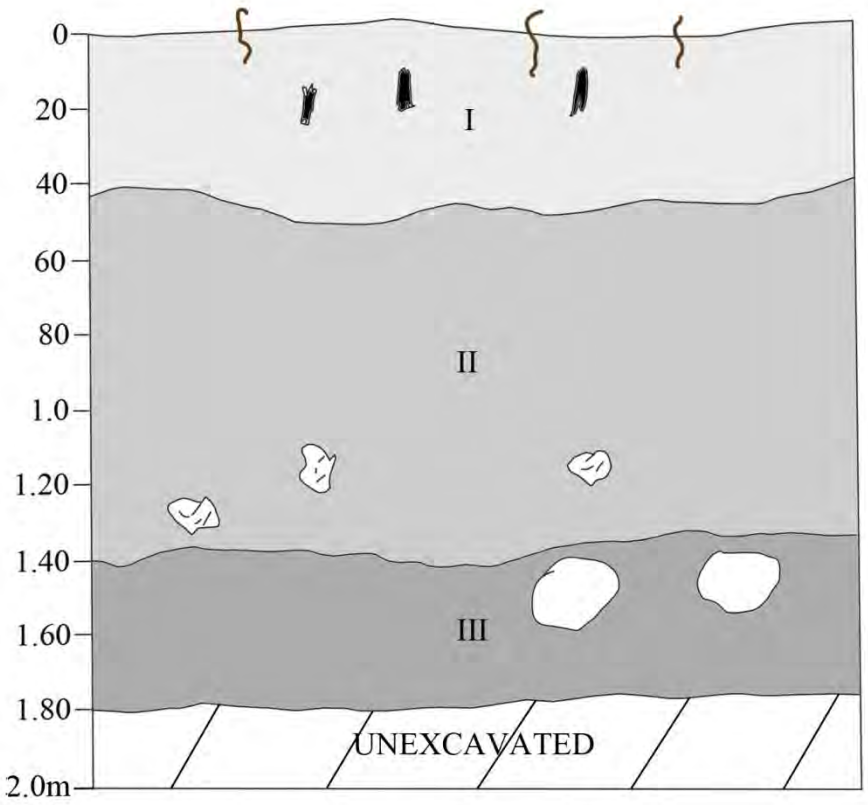


Figure 135. Photograph of West Wall of Trench 218 (top) Stratigraphic Profile of Trench 218 (TR 218) West Wall

Trench 222

Trench 222 (TR 22) was situated within the northern portion of Parcel 6, within fallow sugarcane field (see Figures 121, 125 and Table XVIII). The trench contained a two layer stratigraphic sequence with excavations terminating within decomposing bedrock (Figures 136 and 137). TR 222 measured A 4.9 m long by 1.45 m wide by 1.79m deep, oriented at 360° and was non-cultural and is further described below.

> **Layer I** consisted of a loamy silt very dark grayish brown (7.5 YR4/3) till zone from sugarcane cultivation activities Layer I contained numerous roots and irrigation black plastic drip-lines with few rocks. The soil was slightly sticky, slightly plastic, blocky texture. Boundary was clear and wavy overlying layer II.
> **Layer II** dark reddish brown (5YR 3/3, 3/4) stony silt loam and clay loam deposit that varied 60-150 cm thick with a few trenches containing decomposing bedrock, with a low density of roots and a medium frequency of rocks.

Figure 136. Photograph of West Wall of Trench 222 within Parcel 6

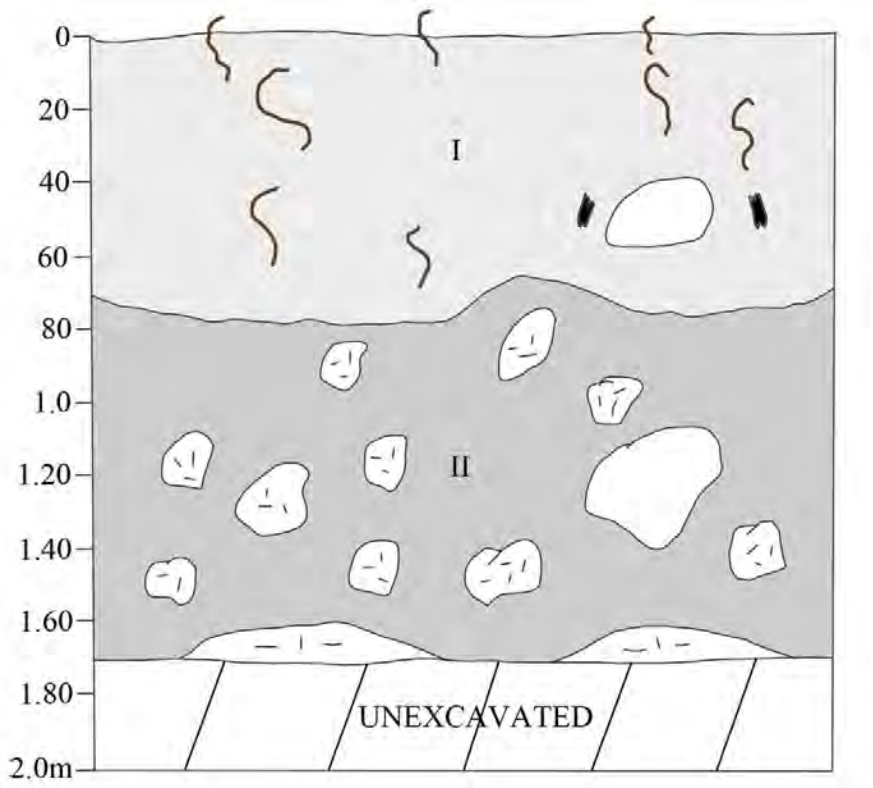


Figure 137. Stratigraphic Profile of West Wall of Trench 222

DISCUSSION PARCEL 6 BACKHOE TRENCHING

A total of 26 trenches were excavated within Parcel 6, and no intact cultural layer or deposit was noted. The majority of the LCA's are located in the central and north portion of the project area around the cane flume easement; however testing was performed throughout the parcel. Trenches 200-203 were excavated in the southern portion of Parcel 6 along the northern boundary of Parcel 3 Waena within an area of active sugar-cane cultivation. These trenches exhibited the same stratigraphy that was identified in Parcel 3 Waena. Trenches 205-213 were excavated in the central portion, and TR's 214-225 were situated in the northern portion where Grants, LCA's and flumes are concentrated. Trenches 205, 206, and 210-218 were similar. Trenches 207-209 and 219-225 exhibited a similar stratigraphy with a few showing slight variations in color hues and decomposing bedrock in Layers II and Layer III.

Similar to the other zones within the project area; initial archaeological monitoring of areas containing LCA's and Grants is warranted. A Monitoring Plan detailing the proposed areas to be monitored will be prepared and submitted to SHPD prior to development.

PARCEL 7 MAUI TROPICAL PLANTATION

Parcel 7 (TMK 3-6-005:007) is an improved parcel and the current site of the Maui Tropical Plantation located within the central portion of the overall project area (see Figures 1, 2 and 6). It contains a total of 59 acres that is bounded to the west by Site 5197 (Waihe`e Ditch) and Parcel 6, residential development of Waikapū Town towards the north, Honoapi`ilani Highway bounds the east and active sugarcane cultivation within Parcel 3 Waena towards the south. As the subject parcel has been partially developed, it contains not only active agricultural production (botanical gardens, private and commercial plantings, landscaping), open fields, a reservoir and several ancillary buildings (Figures 138-140). Test trenches were excavated within the open areas among the agricultural activities and around the periphery of the buildings.

During the current undertaking, a total of twenty-five (25) trenches designated TR's 300-324 were excavated within Parcel 7 to provide a representative sample of the subsurface conditions, and to test areas along flumes and within LCA's and Grants (Figure 141 and Tables VII, VIII, XIX and XX). Most of the trenches contained three to four stratigraphic layers with Layer I designated as the former till/agricultural zone and or grass lawn. Trenches 300 (TR 300 -303) were placed within the southern portion of the parcel, TR 305-309 were placed within the west central section of the project area along the former cane flume and numerous LCA's, TR's 311-316 were placed in the northern portion of the subject parcel where most of the maintenance buildings and storage facilities are located, and TR's 317-324 were situated in the east central portion along the same cane flume easement as TR's 305-309 in the vicinity of several LCA's and Grants.

Figure 138. Overview Photograph of Parcel 7 in area of TR 300-303, View to West

Figure 139. Overview Photograph of Parcel 7 in area of TR-320, View to East

Figure 140. Overview Photograph of Parcel 7 in area of TR 318, View to West

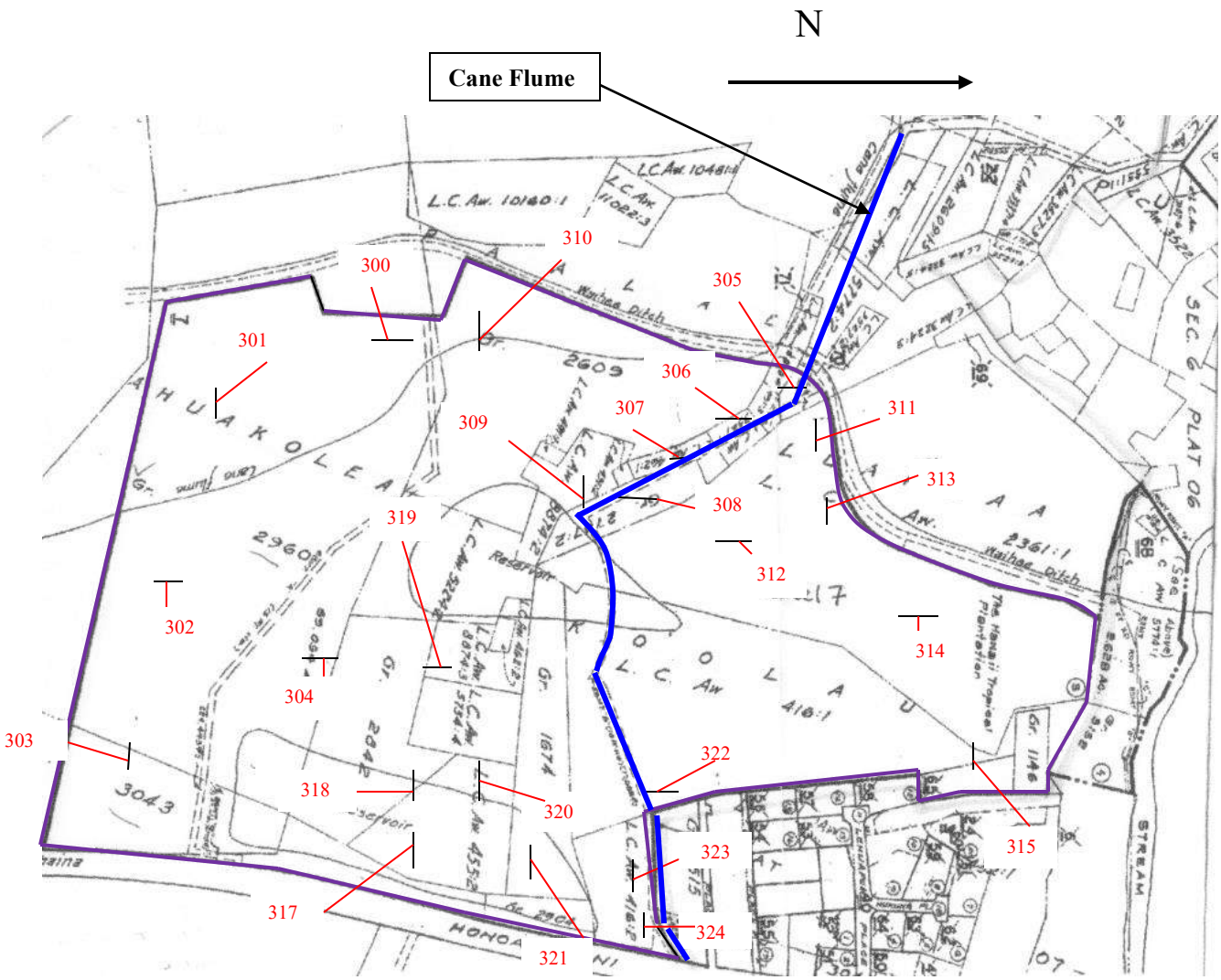


Figure 141. Tax Map Key of Parcel 7 Showing Location of Trenches 300-324, LCA's and Grants

OVERALL GENERAL STRATIGRAPHY

Trenches 300-303 were placed in the open field within Grants 2960 and 3043 surrounding the Maui Tropical Plantation on the south; TR's 300 and 304 were located near the southern cane flume easement and GR2960 and TR's 305-309 and 322-324 were situated along the northern cane flume easement and locality of numerous LCA's and a few Grants. Trenches 311-316 and 322-324 were located in the northwestern and eastern portions of the parcel. The trenches exhibited similar soil profiles within the respective zones of which they were excavated. All trenches were non-cultural and the stratigraphic sequences are presented below.

Layer I generally consisted of an upper loamy silt layer, that varied from a dark brown, brown or a very dark gray brown (7.5 YR 3/2, 3/3 or 10YR 4/3), and varied from 40 to 60 cm thick. This was the plow zone from previous cultivation activities. Layer I was typically mixed with torn black plastic drip-lines, PVC plastic irrigation hoses, and concrete aggregate pieces that had been used during the previous commercial sugarcane cultivation. There was a low frequency of rocks in this layer, but a high frequency of roots from

surface vegetation.
Layer II generally consisted of a silt loam layer, that varied from a dark reddish brown, brown (2.5yr 3/4, 7.5yr 4/4) or a silt clay loam, that varied from a dark reddish brown, dark brown (2.5yr 2.5/4, 7.5 YR 3/4), and varied from 30 to 150 cm thick. There was usually a distinct transition between this layer and the plow zone above, as this layer never had any materials from commercial sugarcane cultivation mixed within it and generally appeared less disturbed and contained medium frequency of rocks. In a few trenches excavated previous disturbances were identified and contained Layer I inclusions and materials from commercial sugarcane cultivation mixed within it.
Layer III generally consisted of a silt loam and/or clay loam layer that varied from a dark reddish brown (2.5yr 3/3, 5 YR 3/4), strong brown (7.5yr 4/6) and/or dark yellow brown (10yr 4/4). Layer III varied from streambed and/or storm wash deposits and in a few identified trenches contained decomposing bedrock, Layer III varied from 30 to 160 cm thick overlying Layer IV or terminated in decomposing bedrock or saprolytic bedrock with a medium to high frequency of rocks with the absence of roots. The streambed and/or storm wash deposits consisted of water-affected cobbles, pebbles and gravel.
Layer IV generally consisted of a silt loam and/or clay loam layer that in a few excavated trenches varied from exhibited a water deposited layer and/or lens, that varied from dark reddish brown, strong brown (2.5yr 2.5/4 to 7.5yr 4/6). Layer IV varied from streambed and/or storm wash deposits and in a few identified trenches contained decomposing bedrock or saprolytic bedrock with a medium to high frequency of rocks, with the absence of roots.

Six (6) trenches 305, 312, 314, 320, 323, and 324 exhibited an alluvium deposition recorded as a layer and/or lens which may be attributed to a meandering stream or episodic flood events. This alluvium was in the form of water affected cobbles, pebbles, and gravel, imbedded between silt layers. Three of these trenches are located in the eastern portion of the parcel and three are located on the western portion. These six trenches were intentionally excavated in LCA's or Grants and are as follows: TR 305 in LCA 9324 5824, TR 312 in LCA 2361:1, TR 314 in LCA 2361:1, TR 320 in LCA 455:2, TR 323 and 324 in LCA 416:2 (see Figure 141 and Tables VII and VIII). The land use for these areas was primarily un known with the exception of House lot and sugarcane for LCA 455:2 and House lot for LCA 416:2.

Nine (9) trenches (TR's 300-304, 315, 317-319) exhibited a darker soil that contained a clay loam or silty clay. Five of these trenches are located in the southern portion of the parcel, three are in the eastern section and the remaining solitary trench was in the extreme southeastern area. Trenches that were intentionally excavated in known LCAs or Grants are as follows: TR's 300-302 are within Grant 2960, TR 303 in Grant 3043, TR 304 within Grant 2842 and TR 315 partially within LCA 416:1. Trenches 317 and 318 in LCA 455:2, TR 319 in LCA 5734:4 and TR 320 within LCA 455:2. Former land use for these Grants is unknown; however the LCA's were a house lot (455:2) and house lot and *`auwai* (416:1). Eleven (11) trenches TR 306-311, 313, 315, 316, 321, and 322) exhibited a distinct stratigraphy that tended to have reddish and yellowish hues. Trenches that were intentionally excavated in known LCAs or Grants are as follows: TR 306 in LCA 491:3 was utilized for *lo`i* and LCA 3527:1 for *kula and lo`i*; TR 307 in LCA 462:1 for house lot, *kula* and *lo`i* and Grant 2747:2 (reservoir and sugarcane); TR 308 in Grant 2747:2, TR 309 in LCA 8874:2 (house lot and *lo'i*) and Grant 2747:2, TR 310 in Grant 2609, TR

311 in LCA 2361:1, TR 312 in LCA 2361:1, TR 313 in LCA 2361:1, TR 315 in LCA 2361:1 and LCA 416:1 house lot and *`auwai* , TR 316 in LCA 2361:1, TR 321 in Grant 2904 (no land use info), TR 322 within LCA 416:1.

As previously discussed and exhibited in blue on Figure 141, several of the above LCA follow the linear, and curvilinear cane flume easement. Testing was concentrated along this easement to ascertain presence/absence of historic residential use; as well as evidence of traditional use. Prior to this waterway being utilized historically for sugarcane and residential use, it is surmised that this path may follow an ancient watercourse or *auwai*. Unfortunately, no evidence of traditional or historic habitation was noted during the test trench excavations.

Two (2) trenches exhibited a two layer sequence, sixteen (16) trenches exhibited a three layer sequence, and seven (7) trenches exhibited a four layer sequence.

Table XIX. Summary of Backhoe Trenches Parcel 7

TRENCH	LOCATION	DIMENSIONS	ORIENTATION	STRATIGRAPHY	COMMENTS
300	Open Field, within Grant 2960	4.8m x 1.45m x 1.8m	360° x 180°	Layer I-III	Non-Cultural
301	Open Field, within Grant 2960	4.8m x 1.44m x 1.82m	270° x 90°	Layer I-III	Non-Cultural
302	Open Field, within Grant 2960	4.9m x 1.44m x 1.8m	360° x 180°	Layer I-III	Non-Cultural
303	Open Field, within Grant 2960 and 3043	4.8m x 1.43m x 1.82m	270° x 90°	Layer I-III	Non-Cultural
304	South of Parking Lot within Grant 2842	4.9m x 1.45m x 1.81m	360° x 180°	Layer I-III	Non-Cultural
305	Within LCA 5824 and/or 9824	4.8m x 1.44m x 1.7m	360° x 180°	Layer I-III	Non-Cultural
306	Within LCA 491:3 (lo`i) and 3527:1 Kula and Lo`i	4.8m x 1.45m x 1.81m	360° x 180°	Layer I-III	Non-Cultural, charcoal flecks in Layer III
307	Within LCA 462:1 and Grant 2747:2 House lot, kula lo`i	4.8m x 1.44m x 1.78m	360° x 180°	Layer I-III	Non-Cultural
308	North of (MTP) Buildings within Grant 2747:2	4.9m x 1.46m x 1.82m	360° x 180°	Layer I-III	Non-Cultural
309	North of Buildings within LCA 8874:2 and Grant 2747:2	4.8m x 1.45m x 1.75m	270° x 90°	Layer I-III	Non-Cultural
310	East of Site 5197-Waihe'e Ditch, within Grant 2609	4.9m x 1.45m x 1.75m	270° x 90°	Layer I-III	Non-Cultural
311	East of Site 5197-Waihe'e Ditch, within LCA 2361:1	4.8m x 1.46m x 1.61m	360° x 180°	Layer I-II	Non-Cultural
312	East of Waihe'e Ditch, within LCA 2361:1	4.9m x 1.45m x 1.6m	360° x 180°	Layer I-IV	Non-Cultural
313	South of Waihe'e Ditch, within LCA 2361:1	4.9m x 1.46m x 2.2m	270° x 90°	Layer I-VI	Non-Cultural
314	Maintance/Auxiliary Buildings Area Within LCA 2361:1	4.9m x 1.45m x 1.8m	360° x 180°	Layer I-III	Non-Cultural
315	Maintance/Auxiliary Buildings Area in LCA's 2361:1 and 416:1 House lot and `auwai	4.8m x 1.43m x 1.78m	270° x 90°	Layer I-III	Non-Cultural

Table XX cont'd . Summary of Backhoe Trenches Parcel 7

TRENCH	LOCATION	DIMENSIONS	ORIENTATION	STRATIGRAPHY	COMMENTS
316	Within the (MTP) Parking lot within LCA 2361:1	4.9m x 1.44m x 1.78m	360° x 180°	Layer I-III	Non-Cultural
317	West of State Highway 30 and within LCA 455:2 House lot and Ko	4.8m x 1.31m x 1.85m	270° x 90°	Layer I-IV	Non-Cultural
318	West of State Highway 30 and within LCA 455:2 and Grant 2842	4.8m x 1.32m x 1.85m	270° x 90°	Layer I-III	Non-Cultural
319	West of Highway 30 within LCA's 8874:3 5734:4 House lot	4.9m x 1.33m x 1.75m	360° x 180°	Layer I-III	Non-Cultural
320	West of State Highway 30 and within LCA's and 455:2 House lot and Sugarcane	4.9m x 1.45m x 1.81m	270° x 90°	Layer I-III	Non-Cultural
321	West of State Highway 30 and within Grant 2904	4.9m x 1.44m x 1.79m	270° x 90°	Layer I-IV	Non-Cultural
322	West of State Highway 30 and within LCA 455:2 House lot and Sugarcane	4.9m x 1.45m x 1.55m	360° x 180°	Layer I-IV	Non-Cultural
323	West of State Highway 30 and within LCA 416:2 house lot	4.9m x 1.45m x 1.78m	270° x 90°	Layer I-IV	Non-Cultural
324	West of State Highway 30 and within LCA 416:2 house lot	4.8m x 1.43m x 1.55m	270° x 90°	Layer I-IV	Historic Materials, Glass and Metal

Trench 302

Trench 302 (TR 302) was situated within the open fields of the southern portion of Parcel 7within former Grant 2960 (see Figures 141 and 142). No land use information was available for this Grant; however TR 302 contained a three layer stratigraphic sequence with excavations terminating at 1.82 mbs (Figures 143-144). No cultural materials were observed within TR 302 which measured 4.9 m long by 1.44 m wide by 1.8 m deep and was oriented north south. The stratigraphic sequence is further described below.

Layer I (0-51cmbs): is a dark brown (7.5yr 3/3), silt loam, agricultural plow zone, slightly-plastic, slightly-sticky, blocky, fine to medium grain, with a high frequency of coconut roots and a high frequency of rocks. No cultural materials were observed in this layer. Boundary was clear and wavy overlying Layer II .
Layer II (40-143cmbs): is a dark brown (7.5yr 3/4), clay loam, slightly-plastic, slightly-sticky, blocky, weak, fine to medium grain, with a low frequency of rocks and a high frequency of coconut roots . No cultural materials were observed in this layer. Boundary was clear and a plane overlying Layer III.
Layer III (140-182cmbs): is a brown (10yr 4/3), clay loam, slightly-plastic, slightly-sticky, blocky, slightly hard, fine to medium grain, with a low frequency of roots and a high frequency of rocks and decomposing bedrock. No cultural materials were observed in this layer.

Figure 142. Overview Photograph of Trench 302 Pre-Excavation within Parcel 7, View to East

Figure 143. Photograph of East Wall of TR 302 within Parcel 7

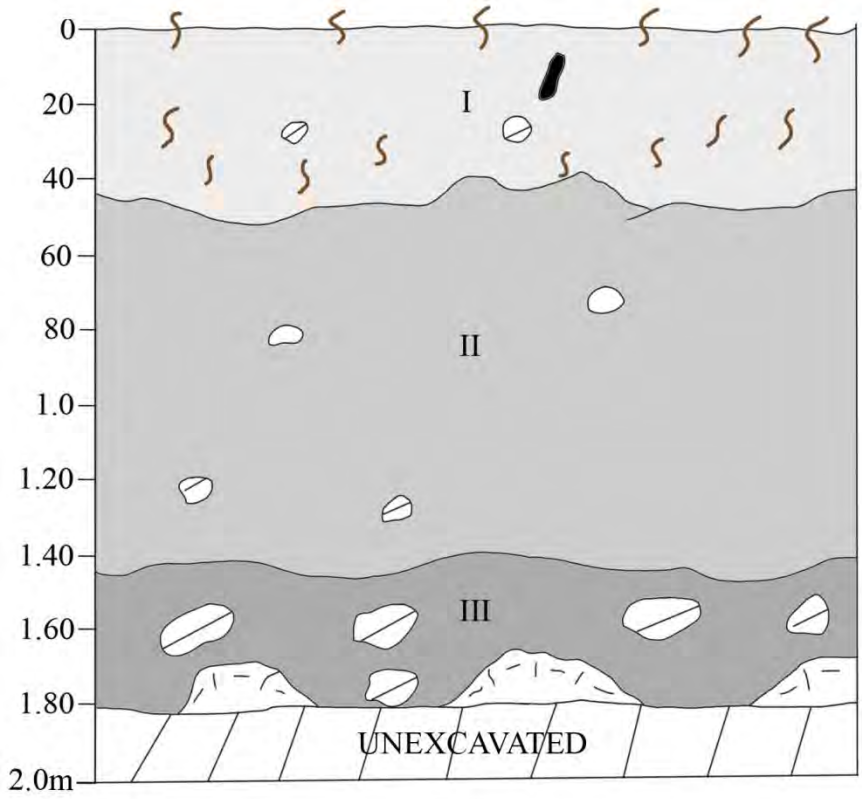


Figure 144. Stratigraphic Profile of TR 302 East Wall

Trench 306

Trench 306 (TR 306) was situated within the north eastern portion of the project area along the cane flume easement within LCA's 491:3 and 3527:1 (see Figures 141 and 146 and Table XIX). LCA 491:3 was for *lo`i* and 3527:1 was claimed for *kula* and taro *pauku.* This section contained a four layer stratigraphic sequence within an area that contained silt and clay dark soil loams (Figures 147 and 148). A 4.8 m long by 1.45 m wide by 1.45 m deep, oriented at 360°. The testing within TR 306 was negative for cultural materials.

Figure 145. Overview Photograph of TR 306 Pre-Excavation, View to South

Layer I (0-30cmbs): is a dark reddish brown (2.5yr 3/3), silt loam, within a previous agricultural plow zone, with deteriorated drip-lines, slightly-plastic, slightly-sticky, weak, fine grain, blocky, friable with a medium frequency of roots. Boundary was clear and a plane overlying Layer II. No cultural materials were observed in this layer.
Layer II (25-110cmbs): is a dark reddish brown (2.5yr 3/4), with dark grey brown silt clay loam, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky, slightly hard, a low frequency of roots and rocks. Boundary was clear and wavy overlying Layer III.
Layer III (99-123cmbs): is a dark reddish brown (2.5yr 2.5/3), clay loam, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky, slightly hard, with a low frequency of roots and rocks. Boundary was clear and wavy overlying Layer III. Charcoal flecks were noted scattered in layer.
Layer IV (120-155cmbs): is a dark reddish brown (2.5yr 2.5/4), clay loam, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky, slightly hard, with a low frequency of roots with a high frequency of rocks and yellowish brown decomposing bedrock along the northern edge. No cultural materials were observed in this layer.

Figure 146. Photograph of East Wall of TR 306

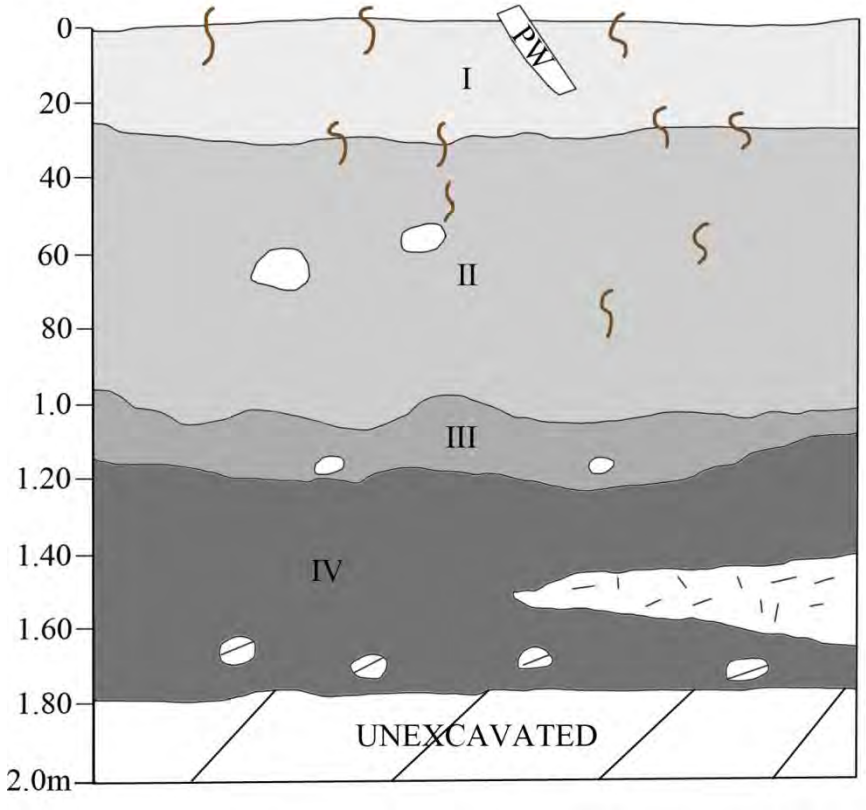


Figure 147. Stratigraphic Profile of TR 306 East Wall

Trench 309

Trench 309 (TR 309) was situated within the north eastern portion of the project area along the cane flume easement in the vicinity of 305-308 within LCA's 8874:2 and Grant 2747:2 (see Figures 141 and 146 and Table XIX). LCA 88742:2 was for a house lot and taro *pauku (*section) and Grant 2747:2 was claimed for sugarcane and reservoir. TR 309 contained a tripartite layer stratigraphic sequence that was negative for cultural remains (Figures 148 and 149). A 4.8 m long by 1.45 m wide by 1.75 m deep, oriented at 360°. The testing within TR 309 was negative for cultural materials.

Layer I (0-21cmbs): very dark gray brown (10YR4/3) silt loam within a previous agricultural plow zone, slightly-plastic, slightly-sticky, weak, fine grain, blocky, friable with a medium to high frequency of roots and low frequency of rock. Boundary was clear and smooth overlying Layer II. No cultural materials were observed in this layer.
Layer II (21-77cmbs): is a dark gray brown (7.5 YR 3/2) with dark reddish brown (2.5yr 3/4) silt clay loam, slightly-plastic, slightly-sticky, weak, fine to medium grain, slightly compact, a low frequency of roots and rocks. Boundary was clear and wavy overlying Layer III. Non-cultural.
Layer III (77-175cmbs): is a dark reddish brown (2.5yr 2.5/3), clay loam, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky, slightly hard, with a low frequency of rocks and decomposing bedrock.

Figure 148. Photograph of South Wall of Trench 309

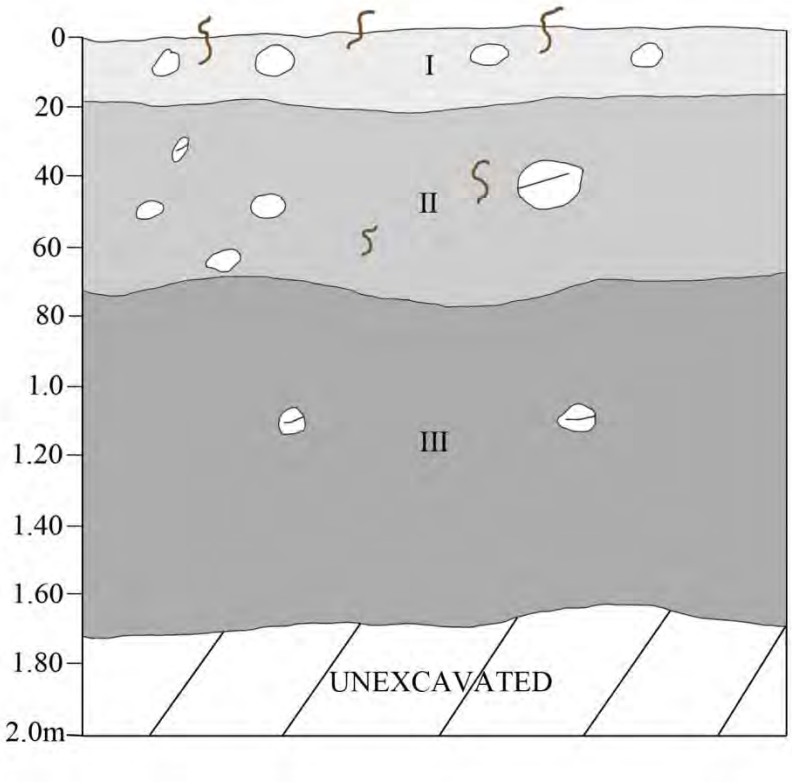


Figure 149. Stratigraphic Profile of South Wall of Trench 309

Trench 310

Trench 310 (TR 309) was situated near the western boundary and Waihe`e Ditch within the southwestern quadrant and Grant 2609 (see Figure 141 and Table XIX). There was no land use information about this Grant however no cultural materials were noted in any of the strata. TR 310 contained a three-layer soil profile with Layers I and II exhibiting a gradual transition between the lower boundaries (Figures 150 and 151). It measured 4.9 m long by 1.45 m wide by 1.75 m deep, oriented east/west.

Layer I (0-18cmbs) consisted of a loamy silt layer, very dark gray brown (10YR 4/3) probable former till zone, now portion of grass lawn. A high frequency of roots from surface vegetation and a few rocks. Soil is non-plastic, non-sticky, blocky, boundary is gradual and wavy. Layer I is non-cultural.
Layer II (18-41 cmbs) is a silt loam, reddish brown to yellowish brown (2.5yr ¾ to 10YR4/3). It contained low frequency of rocks and roots, non-sticky, non-plastic, slightly compact. Boundary is gradual and smooth.
Layer III (41-BOE) consisted of a silty clay brown to yellowish brown (10YR3/4 and 4/3) with saprolytic rock and decomposing bedrock.

Figure 150. Photograph of South Wall of Trench 310

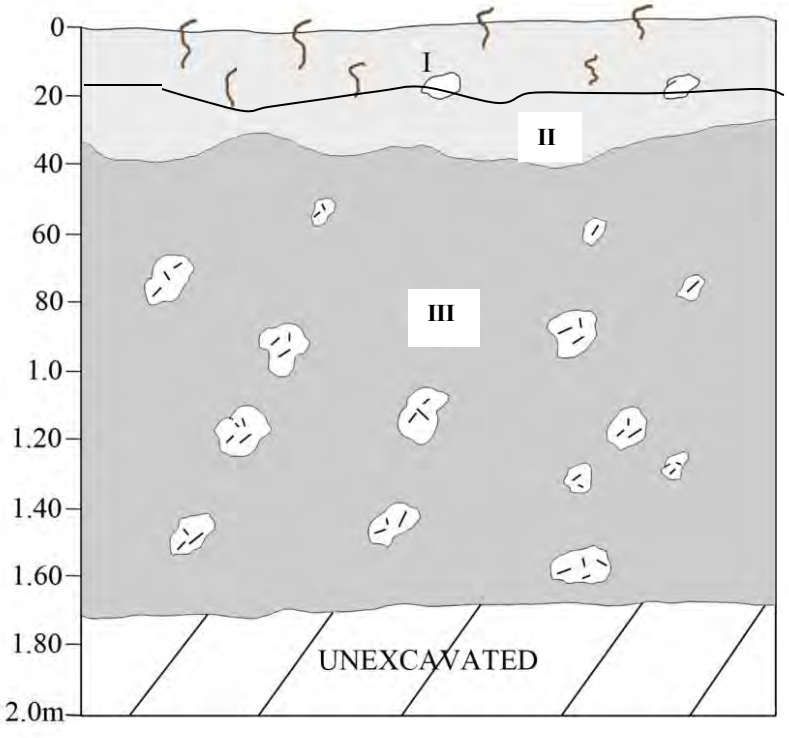


Figure 151. Stratigraphic Profile of South Wall of Trench 310

Trench 318

Trench 318 (TR 318) was situated along the southern side of the entrance road within LCA 455:2 and Grant 2842 (see Figures 141, 152 and Table XX). LCA 455:2 was claimed as a house lot and for sugarcane; although no land use information was available for Grant 2842 a "pie shaped" reservoir was noted on the tax map key in the area of TR 318 and 317 (see Figure 141).TR 318 measured 4.8 m long by 1.32 wide by 1.85 m deep and was oriented east/west. It contained a four layer stratigraphic sequence (Figures 153 and 154) which included lenses of alluvium gravel designated Layer III. No cultural materials were observed within the soil profile.

Layer I is a disturbed loamy silt layer, dark gray brown (10YR 4/3), which contained a grass lawn. The layer has a high frequency of roots and rocks which are sub rounded cobbles, non-plastic, slightly sticky. Boundary is clear and smooth overlying Layer II.
Layer II disturbed and consisted of a silty clay loam dark reddish brown (2.5yr 3/4) that contained a medium frequency of rocks and high frequency of roots. Very slightly, plastic, slightly sticky, granular and crumbly, non-cultural. Layer II had a clear wavy boundary. Near the base an intrusive lens or pocket of grayish brown gravel. Very abrupt, smooth boundary within Layer II.
Lens/Layer III disturbed gravelly silt (10YR4/3) numerous roots, low frequency of sub rounded cobbles, high frequency of pebbles, appears to be an alluvial deposit possibly from a streambed or the former reservoir. The deposit was thickest in the central portion tapering at both ends.
Layer IV is a silty clay, dark reddish brown (2.5yr 3/4), slightly plastic, slightly sticky, few sub rounded cobbles and gravel, very low frequency of roots. Non-cultural. Layer IV is similar to Layer II in color and soil texture but not content (rock and roots) and may represent an undisturbed portion of Layer II.

Figure 152. Overview Photograph of Trench 318 Base of Excavation

Figure 153. Photograph of South Wall of Trench 318

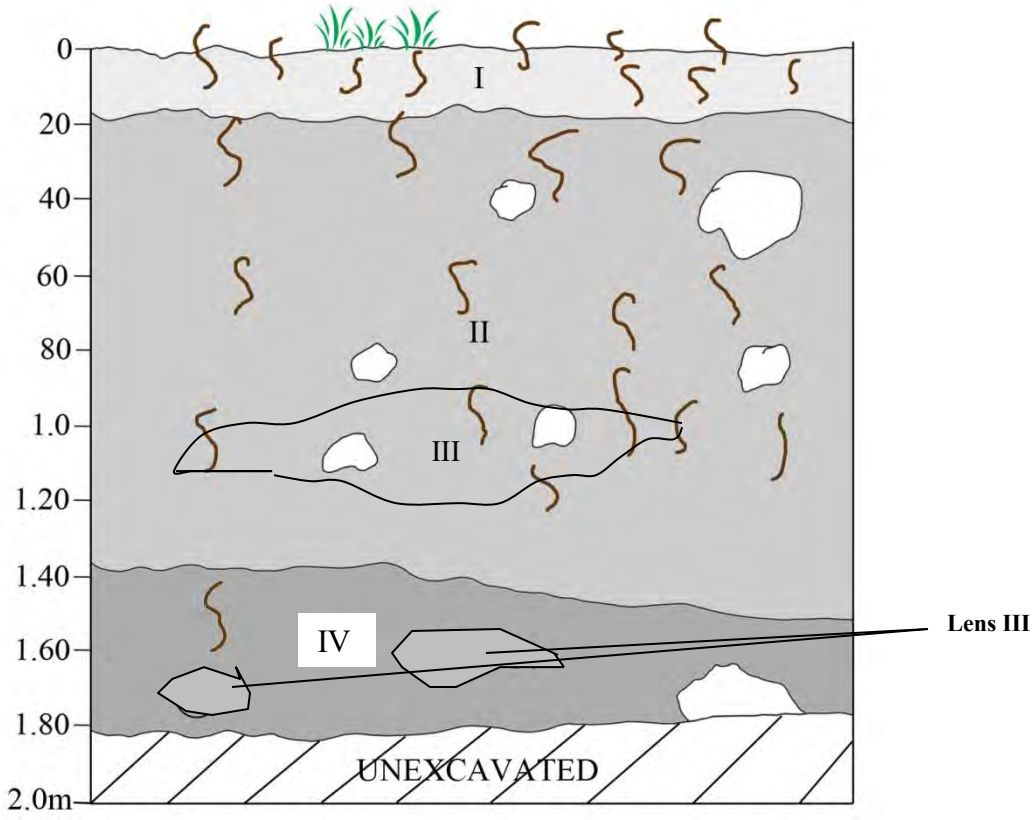


Figure 154. Stratigraphic Profile of South Wall of Trench 318

Trench 319

Trench 319 (TR 319) was situated along the southern side of the entrance road to capture a portion of LCA 8874:3 which stated *lo`i* for land use and LCA 5734:4 that had no information (see Figures 141, 156 and Table XX). Unfortunately, the entire area was previously disturbed as evidenced by the numerous roots and presence of a cable near the base of the trench (see Figure 156). No cultural materials or gleyed soils indicative of *lo`i kalo* were recorded. TR 319 measured 4.9 m long by 1.33 wide by 1.75 m deep and was oriented north/south. It contained three layers, of which Layers I-II and upper portion of III were disturbed.

Figure 155. Photograph of TR 319 West Wall

Trench 324-Site 7884 Fe. 3

Trench 324 (TR 324) was placed along in the northeastern corner of Parcel 7 within LCA 416:2 which was claimed as a house lot (see Figure 141, 156 and Table XX). It contained a four layer stratigraphic sequence within an area where alluvial deposits (stream and or flood episodes) were documented within TR 320, 322 and 323 (Figure 157). At the interface of Layers I and II, a small historic trash deposit designated Site 7884 Feature 3 consisting of glass, ceramics and a burning event was identified from 20-40 cmbs (Figures 158-159). Layers III and IV were comprised of rounded small cobbles and boulders, interspersed with smaller pebbles and gravel surmised to be from an intermittent streambed or episodic flood events. TR 324 measured 4.8 m long by 1.43 m wide by 1.55 m deep and was oriented east west.

The cultural materials were sparse and considered domestic, utilitarian items possibly associated with the LCA but more likely the adjoining residential area with neighbors throwing trash over the property line.

Layer I (0-20cmbs): is a dark brown (7.5yr 3/3), silt loam, within a previous agricultural plow zone, with deteriorated drip-lines, slightly-plastic, slightly-sticky, weak, fine to medium grain, slightly hard, blocky, friable with a medium frequency of roots. Boundary was clear and wavy overlying Layer II. No cultural materials were observed in this layer.
Layer II (22-120cmbs): is a brown (7.5yr 4/4), is a disturbed layer a silt loam, slightly-plastic, slightly-sticky, weak, fine to medium grain, blocky, slightly hard, a low frequency of rocks. Cultural materials were observed in this layer at 20-40cmbs in the form of a burned deposit of bottle glass and ceramics identified along the north eastern profile. At ca. 102-118cmbs and 120 to 130cmbs water affected pebbles and gravel were identified along the northwestern wall. Boundary was clear and broken overlying Layer III on the west and overlying Layer IV on the east
Layer III (82-117cmbs): is a dark yellowish brown (10yr 4/4), riverbed stony silt, structureless, non-plastic, non-sticky, loose, single grain to fine to medium grain, with a high frequency of rocks, cobbles. Boundary was clear and wavy overlying bedrock. No cultural materials were observed in this layer.
Layer IV (120-155cmbs): is a dark yellowish brown (7.54/6), riverbed stony silt, weakly coherent, non-plastic, non-sticky, loose, single grain to fine to medium grain, with a high frequency of rocks, cobbles, structureless. No cultural materials were observed in this layer

 .

Figure 156. Overview Photograph of TR 324 Pre-excavation, View to East

Figure 157. Photographs of North Wall of TR 324 (top); and Close-up of Gravel Deposit along North Wall

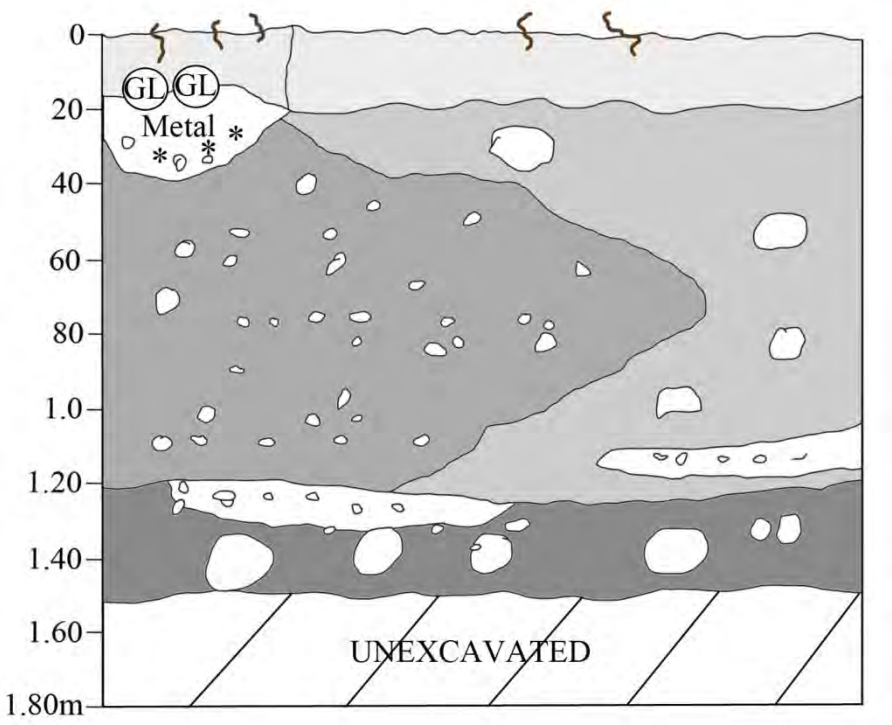


Figure 158. Stratigraphic Profile of Trench 324 North Wall

Figure 159. Historic Material from Site 7884 Feature 3 (TR 324) North Wall

Site 5197 Waihe`e Ditch

Site 5197 Waihe'e Ditch (Waihe'e Canal) was built by the Maui Agricultural Company (MA) in cooperation with the Wailuku Sugar Company for the irrigation of sugarcane. The construction started in June 1905 and was completed in May 1907. The water source for the Waihe'e Ditch originates in the upper Waihe'e Valley from the Waihe'e stream, the water intake from the stream follows a course from the north towards the south thru Waihe'e, Waiehu, Iao Valley, and Waikapu (Na Wai `Eha – the four great waters) with water intake along its route, thru tunnels, flumes, open ditches, reservoirs and penstocks terminating into the West Maui reservoir (Figures 160 and 161). The Spreckles Ditch also originates in the upper portion of the Waihe'e Valley and follows a similar southerly direction at a lower elevation and empties into the Waiale Reservoirs.

Within the boundaries of the larger project area the Waihe'e Ditch (Site 5197) flows from the north towards the south along the central portion encompassing an area approximately 7000 ft long. Specifically, beginning in the northern property boundary the Waihe'e Ditch (Site 5197) defines the western boundary of Parcel 7 and the eastern boundary of Parcel 6. Along the southern half of the parcel, Site 5197 bisects Parcel 3 Waena east/west.

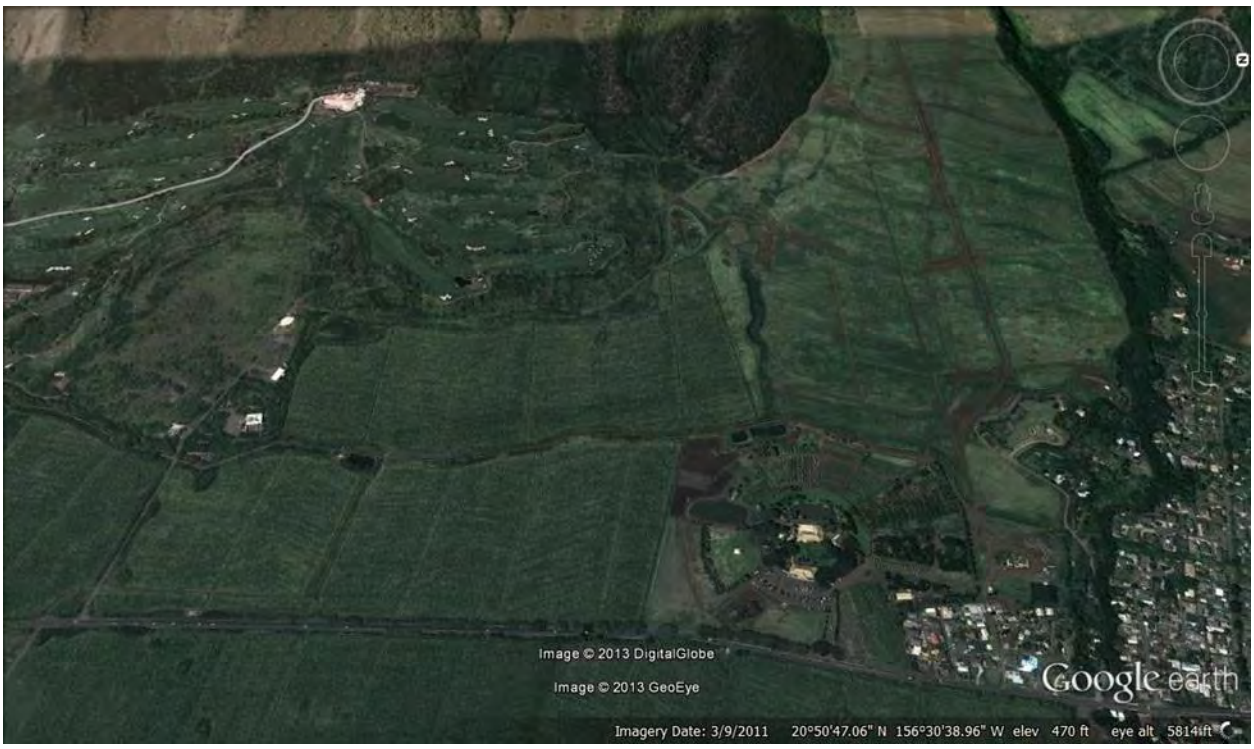


Figure 160. Overview Photograph of Site 50-50-04-5197 Waihe'e Ditch Extending North to South thru the Waikapū Tropical Plantation Land Holdings (Google earth 2013)

At the extreme northern property boundary the Waihe'e Ditch (Site 5197) emerges from an earthen underground tunnel (Figure 162) from an adjoining parcel that is located adjacent to the Waikapū Stream. It is at this juncture that Waihe'e Ditch (Site 5197) emerges into an open earth ditch on the south for a length of 6.0 m and continues thru a basalt keystone arched and faced tunnel for a length of 8.5 m and emerges on the south from an arched basalt keystone and faced tunnel (Figures 163-164). This tunnel appears to have supported a possible bridge in the past as it is covered with a dirt access road. The tunnel measures 3.1 m wide and 2.2-2.4 m in high above the active water course. The keystone faced arch is constructed of keystone cut basalt blocks that measure 45 cm in length and 40 cm in width. The interior of the tunnel is concrete lined. The southern section of the Waihe'e Ditch following the southern end of the tunnel for a distance of 29.5 m is presumably original construction consisting of a concrete lined ditch with the upper slopes stacked, faced, basalt water-worn and sub-angular cobbles, four courses high, measuring 1.3 m above the cement lined base that measures 1.1 m above the water level (Figures 165-166). The width at this juncture measures 2.1 m to 3.1 m. The ditch transitions from stacked, faced sides into being completely cement lined, (a modern modification) measuring 2.1 m wide, and 1.1 m in height above the water level with sections along the southern water course containing remnants of previous construction of rock faced sides.

Bridges are located along the central and southern sections of the ditch within the project area crossing over to Parcel 3 Mauka. Figures 167 and 168 depict the construction of concrete and re-bar reinforced, metal beamed and wooden bridges, the last being the more recently constructed.

Site 5197 is in good condition and is maintained by HC&S. The ditch remains consistent in terms of construction all along the water course towards the southern terminus of the project area beginning after the first 44 m from the northern section. The first 44 meters beginning from the northern property boundary is the only area of the ditch that exhibits a difference in construction, that being, an earlier original construction with stacked rock and faced sides and a tunnel with keystone arches. The continuing ditch along the southern portion of the project area clearly exhibits modern modifications and modern penstocks (PVC pipes, sluice gates and pipe valves) to existing irrigation routes and reservoirs. Tee bars are located atop the ditch as reinforcements and are primarily located along the southern sections as depicted on Figures 169-170. Along the southern route of the ditch are remnants of older penstocks, drainage culverts and shut-off valves that are predominately located near the bridges. Figures 171-174 show these areas.

Figure 161. State Department of Agriculture Map Showing Site 5197 Waihe`e Ditch and Spreckels Ditch

Figure 162. Overview Photograph Site 5197 Waihe'e Ditch Emerging from an Underground Culvert from the Northern Property Boundary, View to North

Figure 163. Overview Photograph of Waihe'e Ditch from an Underground Keystone Tunnel/Bridge, View to South

Figure 164. Overview Photograph of Keystone Arched Tunnel/Bridge, View to South

Figure 165. Overview Photograph of Site 5197 Waihe`e Ditch Showing two Types of Construction along the Ditch (photo from atop the keystone arched tunnel/bridge), View to South

Figure 166. Overview Photograph of Site 5197 Waihe'e Ditch Showing Older Construction with Stacked Rock Atop the Concrete Lined Ditch (View of Western Side Wall

Figure 167. Overview Photograph of Second Bridge from the North, Metal Beam and Cement Construction (background), Older Drainage Culvert (foreground), View to Northeast

Figure 168. Photographic Overview Second Bridge, Metal Beam and Concrete Construction, View to West

Figure 169. Photographic Overview from Second Bridge with Tee-Bar Reinforcements Across Ditch, View to Southwest

Figure 170. Overview Photograph of Third Bridge from North, Cement Construction with PVC Drainage, View to North

Figure 171. Overview Photograph of Third Bridge with Older Penstock with Metal Shut-off Valve (left), View to South

Figure 172. Overview Photograph of Fourth Bridge from North, West of Maui Tropical Plantation and Reservoir with Modern Wooden Construction, View to North

Figure 173. Overview Photograph of Site 5197 Waihe'e Ditch with Modern Concrete Lining, View to Northeast

DISCUSSION OF PARCEL 7

Parcel 7 currently contains commercial structures, subsurface utilities, a large reservoir, botanical gardens and ancillary buildings for lessee's and the Maui Tropical Plantation. As exhibited on Figure 141, the subject parcel formerly contained numerous LCA's and Grants due in part to the presence of cane flumes (in blue) and reservoirs, as well as the proximity to Old Waikapū Town. Portions of the cane flume easements and concrete lined ditches also noted in Parcels 3 Mauka and Waena may have been prior non-commercial waterways and or *`auwai* during the pre-Contact period. Today, a shallow, narrow concrete lined swale (Figures 174 and 175) approximately 48 to 60 cm wide by 10 cm deep is present along portions of the curvilinear and linear cane flume easement noted in blue on Figure 141. Site 5197 Waihe`e Ditch is prevalent and utilized for current agricultural activities along its north-south route.

Although several LCA's and Grants were present within the subject property, the backhoe test excavations were primarily negative with the exception of a small historic trash dump, Site 7884 Feature 3, near the surface of TR's 323 and 324 in the northeast corner of the parcel. The negative results are likely due to several factors, consisting of the compounded disturbances across the parcel from prior sugarcane cultivation, the development of the Maui Tropical Plantation and the inherent bias from backhoe sampling.

Sites 5197 (Waihe`e Ditch) and 7884 have been adequately documented at the inventory level and require no further work beyond construction monitoring during removal (if applicable) or grading activities near the historic properties.

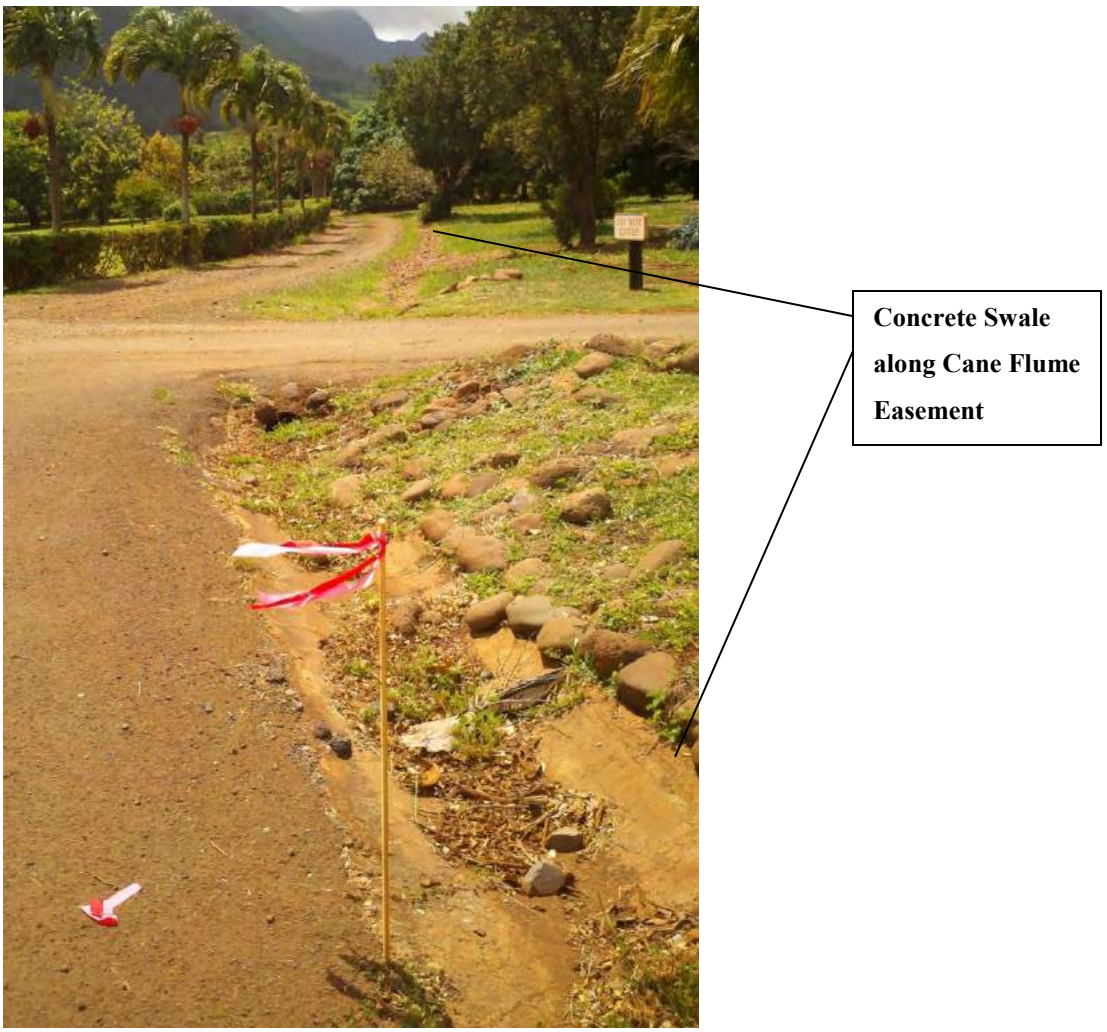


Figure 174. Overview Photograph of Extant Portion of Concrete Swale along Northern Cane Easement in Parcel 7

Figure 175. Overview Photograph of Concrete Swale along Cane Flume Easement

CULTURAL MATERIALS

During the archaeological investigations, a relatively small assemblage of historic artifacts was recovered (Figures 160-165). The majority of these artifacts consisted of utilitarian ware and was recovered from a secondary context either from the surface or within disturbed soil layers during backhoe test trenching. Trenches which contained fragments of historic artifacts consist of the following: from Parcel 6 TR 218; Parcel 7 TR's 323 and 324. The surface finds noted within Parcel 3 Mauka designated Site 7884 Feature 1, is a scatter of historic materials was noted around the open ditch, Site 7881 Feature 2, in between Waikapū Stream to the north and the access service road to the south. These materials may have washed down from further upslope, or may have been dumped with various other trash from the service road. Two ceramic sherds were also collected by the picnic table by Site 7881 Feature 3 (reservoir). Site 7884 Feature 1assemblage is from the late 1940's to the early 1950's. The historic artifacts from Parcel 6 assigned Site 7884 Feature 2 comprises a secondary deposit of historic domestic items from the early to mid 1900's. Parcel 7, TR 324 designated Site 7884 Feature 3 is probably the earliest deposit dating from the late1800's to early 1900's century based on diagnostic traits of the bottle glass. This trench was located in an LCA 416:2 that claimed a house lot in the award.

Ceramics

The ceramic assemblage consists of fragments that primarily represent three vessel forms: bowls, plates, cups including rice bowls and tea cups fragments. Three general material classes were present, including earthenware, porcelains, and stone-wares. From TR 324, an Italian scene was depicted around the perimeter of the plate and consisted of blue on white floral design, and a gondola. The rice bowl shards contained a greenish glaze with an Asian motif depicting Koi fish. Two ceramic sherds that were recovered from the surface area surrounding the upper reservoir by a picnic table and old tree growth belonged to a crock pot. This earthen ware contained a blue stenciled stamp that is typical of English crock pots. It contained a partial makers' mark that appears to have "sell" and maybe a portion of a ribbon design after the letter "s". The ceramics recovered from Site 7884 Feature 2 were plates and bowls. The plates are blue glazed and are from the "Fiesta Wear" type and the other plate was white glazed and had a discontinuous makers mark that appeared to say "Adam Stewa" and the rest was not discernible but likely Stewart.

Glass

Dating analysis was based on the key manufacturing techniques developed during the 19th century. Manufacturing techniques changed considerably during the 19th and early 20th century, and at the end of the 19th century, mechanization began. The manufacturing technique utilized for most of the bottle types recovered was mechanization. The bottle openings from TR 324 are applied lips and a blown in mold for

the dark olive green colored wine bottle had a push up bottom with a pontil scar, and the aqua colored bottle was machine made molds for the body. Bottle types include medicinal, wine or whiskey and unidentifiable. The colors were dark brown, dark olive green, olive green, aqua and clear.

Figure 176. Photograph of a Dark Olive Green Wine Bottle from Site 7884 Feature 3 at Parcel 7 TR324

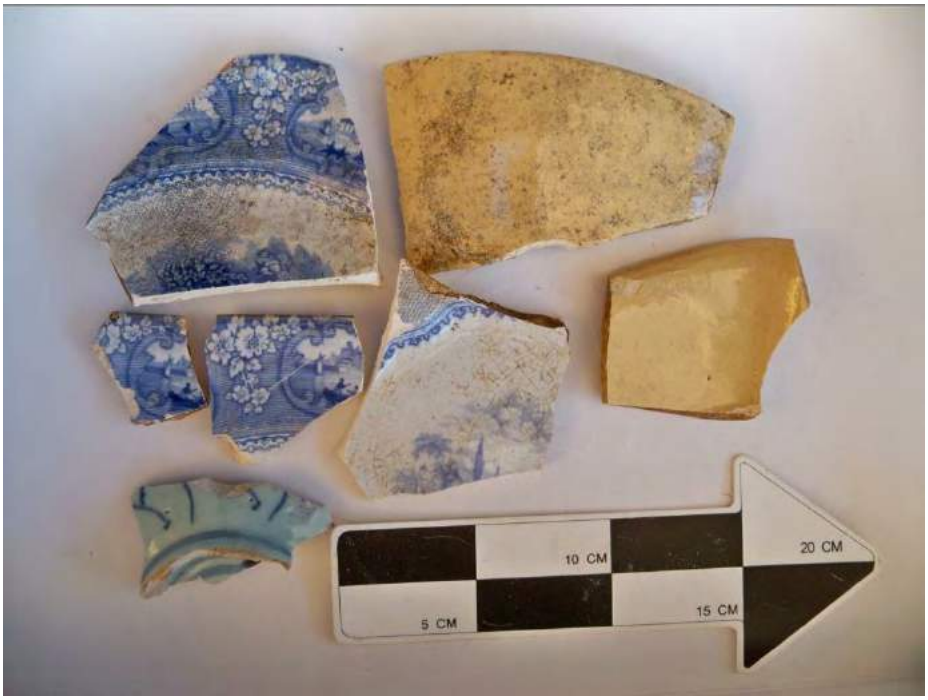


Figure 177. Photograph of Site 7884 Feature 3 from Parcel 7 TR324 Ceramic Assemblages

Figure 178. Photograph of Glass Assemblages from Site 7884 Feature 3 Parcel 7 TR324

Figure 179. Photograph of Ceramic Sherds on Surface by Site 7881 Feature 3 (Reservoir) Parcel 3 Mauka

Figure 180. Photograph of Site 7884 Ceramics within Parcel 3 Mauka

INITIAL SIGNIFICANCE ASSESSMENT

The sites identified during the survey are assessed for significance based on the below criteria outlined in the Rules Governing Procedures for Historic Preservation Review (DLNR 1998: Chapter 275). A site may be considered significant if it meets one or more of the following criteria:

> **Criterion A:** associated with events that have made an important contribution to the broad patterns of our history;
>
> **Criterion B:** associated with the lives of persons important in our past;
>
> **Criterion C:** embody the distinctive characteristics of a type, period, or method of construction; represents the work of a master; or possesses high artistic value;
>
> **Criterion D:** have yielded, or is likely to yield, information important for research on prehistory or history; and
>
> **Criterion E:** have an important traditional cultural value to the native Hawaiian people or to another group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events, or oral accounts; these associations being important to the groups history and cultural identity.

Based on the above criteria, Sites 50-50-04-7881-7884 are assessed a significance of Criterion D, as they have yielded, or have the potential to yield significant information pertaining to the history of the area. Site 7883 the WWII bunker may also be significant under Criterion C, as a distinct method of construction during a certain era.

DISCUSSION

Since the time of the Mahele and prior to; the *ahupua'a* of Waikapū has been utilized for agriculture, religious and habitation activities. LCA testimony, historical research and archaeological studies have documented pre-Contact and historic sites within the project area and neighboring parcels. During the current investigation, no evidence of traditional Hawaiian, with the possible exception of Site 7882 (remnant retaining wall or terrace) activities was recorded. These negative results are primarily due to the compounded disturbances from sugarcane cultivation, historic habitation and modern land use; and possibly the inherent bias of random sampling during the inventory survey testing.

The current survey consisted of a pedestrian survey and backhoe test trenches across the project area consisting of approximately 503-acres divided into five zones. A total of 150 backhoe trenches were executed during the undertaking in the following zones; Parcel 3 Mauka-15 trenches (TR400-414); Parcel 3 Waena-42 trenches (TR1-27 and 01-015); Parcel 3 Makai-42 trenches (TR100-141); Parcel 6-26 trenches (TR200-225) and Parcel 7-25 trenches (TR300-324). This survey documented four historic properties Sites 50-50-04-7881-7884 from the post-Contact era, and only one feature was documented subsurface (Site 7884 Feature 3).

As discussed in the foregoing section, Sites 7881-7884 are considered significant under Criterion D, and one historic property, Site 7883 may be considered significant under Criterion C. Site 7881 Features 1-18 is comprised of historic agricultural irrigation features consisting of a reservoir, concrete and earthen ditches, as well as sluice gates. These features are located along the northern boundary of Parcel 3 Mauka outside the proposed A.P.E. and will not be adversely affected. Site 7882 is a remnant L-shaped retaining wall or terrace also located in the Parcel 3 Mauka within the northeast corner. This feature may have been constructed during the traditional period, but this supposition is inconclusive. Site 7883 consists of a World War II bunker located within the east central portion of Parcel 3 Mauka. This site has been documented at the inventory level and may or may not be affected by proposed development. Site 7884 comprises surficial scatters of historic domestic refuse (Features 1 and 2) and Feature 3 is a small historic trash dump, likely associated with former habitation. A section of Site 5197 Waihe`e Ditch bisects the central portion of the project area in a north/south direction. This historic property was also recorded during the current undertaking and may be covered (though continue to be operational) during construction.

RECOMMENDATIONS

Based on the proposed development plan, Site 7884 Features 2-3 (historic trash scatter and refuse pit); a section of Site 5197 (Waihe`e Ditch) and possibly Site 7883 (WWII bunker) may be adversely affected during the development activities. These aforementioned historic properties have been properly recorded and may be removed and or altered during construction; however if it is recommended that if Site 7883, the WWII bunker cannot be preserved in place within the planned development, an interpretive plaque commemorating this site should be erected. Additionally, Sites 7881 (agricultural waterways, sluice gates, reservoirs) and 7882 (L-shaped retaining wall) may be removed and or altered during construction; although no ground-altering activities are planned at this time.

Archaeological monitoring of Parcel 3 Mauka and Waena is primarily recommended for those areas which contain former LCA's and Grants, as well as extant historic properties; however spot monitoring inspections of other localities not expressed above may also be instituted. Parcels 6 and 7 contain numerous LCA's and Grants; thus monitoring will initially be full time until the nature of the subsurface conditions in relationship to the proposed ground-altering activities is determined. Similarly for Parcel 3 Makai, monitoring will initially be full-time; yet it is envisioned that the primary focus will be along the eastern and western perimeters which are close to Waiale and Waiko Roads, known areas to contain traditional and historic burials.

Prior to the commencement of construction, an Archaeological Monitoring Plan (AMP) detailing the localities to undergo monitoring procedures will be prepared and submitted to SHPD for review and approval.

REFERENCES

Armstrong, R.W., J.A. Bier, and S. Chang

1983 *Atlas of Hawaii,* University of Hawaii Press, Honolulu.

Bassford, Q.S., and M. Dega

2007 *An Archaeological Assessment Report for 208 Acres in Waikapū Ahupua'a, Wailuku District, Island Maui, Hawaii, [TMK: (2) 3-6-04:03 por. And :por.].* Prepared for Steven Kikuchi. Scientific Consultant Services Inc. Honolulu.

Board of Commisssioners

1929 Indices of Awards Made by the Board of Commissioners to Quiet Land Titles in the Hawaiian Islands. Commission of Public lands, Territory of Hawaii. Honolulu.

Brisbin, J., and A.E. Haun

1991 *Archaeological Data Recovery Excavation Waikapū Mauka Partners Golf Resort Project Area, Land of Waikapū , Wailuku District, Island of Maui.* Prepared for Waikapū Mauka Partners. Paul H. Rosendahl, Ph.D., Inc. Hilo.

Buffum, A., and M. Dega

2001 *Archaeological Inventory Survey of 7.5 Acres in Waikapū Ahupua'a, Wailuku District, Island of Maui, Hawai'i (TMK: 3-5-04:92).* Scientific Consultant Services, Inc., Honolulu.

Creed, Victoria

1993 *Settlement Pattern for Waikapū , Wailuku District, Maui, Hawaii, Vol. I*. Cultural Surveys Hawaii.

1993 *Vol. II: LCAs for the Ahupua'a Wailuku, Maui, Hawaii*. Cultural Surveys Hawaii.

Dega, M.F.

2003 *Archaeological Inventory Survey in the Intermediate Dry Zone of Wailuku, Wailuku Ahupua'a, Wailuku (Kula) District, Maui Island Hawai'i (TMK:3-5-001:portion of 100).* Scientific Consultant Services, Inc. SCS Report No. 385-2, Honolulu.

2004 *An Intermediate Zone Archaeology Inventory Survey Located in Wailuku, Wailuku Ahupua'a, Wailuku (Kula) District, Maui Island, Hawai'i (TMK: 3-5-001: portion of 001).* SCS Report N. 396-2. Prepared for Stanford Carr. On file at SHPD, Kapolei, Hawaii.

Denham, T., J. Kennedy, and L. Reintsema

1992 *Inventory Survey with Subsurface Testing Report for a Property at TMK:3-503:01, Wailuku Ahupua'a, Wailuku District, Island of Maui.* Archaeological Consultants of Hawaii, Inc., Haleiwa. On file as report M-395 at SHPD, Kapolei, Hawaii.

Donham, T.K.

1991 *Field Inspection of a Water Pipeline Easement Across Waikapū Stream, Waikapū , Maui TMK 3-5-04:14 and 3-6-04:2.* On file as report M-347 at SHPD, Kapolei, Hawaii.

1995 *Field Inspection of the Richardson Family Cemetery (50-50-04-4001), Kukuialamaka, Waikapū , Wailuku District, Island of Maui (TMK:3-5-04:22).* SHPD. Kapolei, Hawaii.

1996 *A Summary of Archaeological Finds in Wailuku Showing Settlement Patterns.* Paper Presented at the 9th Annual conference for the Society of Hawaiian Archaeology in Wailea, Maui.

Gibson, Erica

2011 *Ceramic Maker's Marks.* Left Coast Press, Inc. Walnut Creek Ca. 94596

Google Earth

2013 Data USGS, Geoeye, Image 2013 Digital Globe, Data S/O, NOAA, U.S. Navy, NGA GEBCO.

Foote, D., E.L. Hill, S. Nakamura, and F. Stephens

1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai*. U.S.D.A. Soil Conservation Service, U.S. Government Printing Office, Washington, D.C.

Handy, Craighill E.S.

1940 *The Hawaiian Planter* – Vol. I. Bishop Museum Bull. 161. Honolulu: Bishop Museum Press.

Handy, E.S. Craighill, and Elizabeth Green Handy

1972 *Native Hawaiian Planter in Old Hawaii; their life, lore and environment.* Bishop Museum Bull. 233. Honolulu: Bishop Museum Press.

Munsell Color

1974 *Munsell Soil Color Charts*. MacBeth Division, Kollmorgan Corporation, Baltimore.

Neal, M.C.

1965 In Gardens of Hawaii. Bishop Museum Special Publication 50. Honolulu: Bishop Museum Press.

Pantaleo, Jeffrey

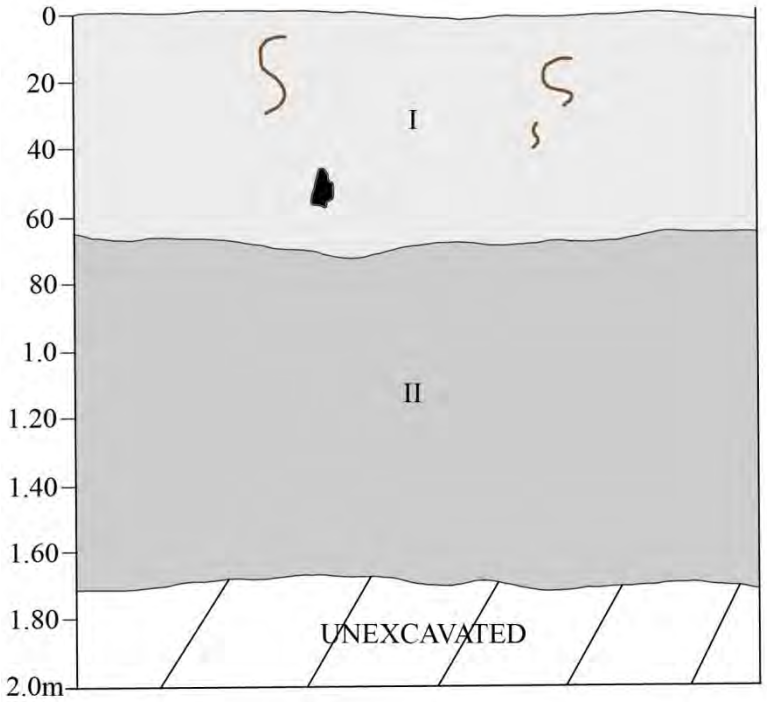
2005 *Archaeological Inventory Survey Report of an Approximate 3-Acre Parcel, Waikapū Ahupua'a, Wailuku District, Island of Maui TMK 3-6-07:2.* For Mark Miller. Archaeological Services Hawaii, Wailuku.

Wilcox, Carol

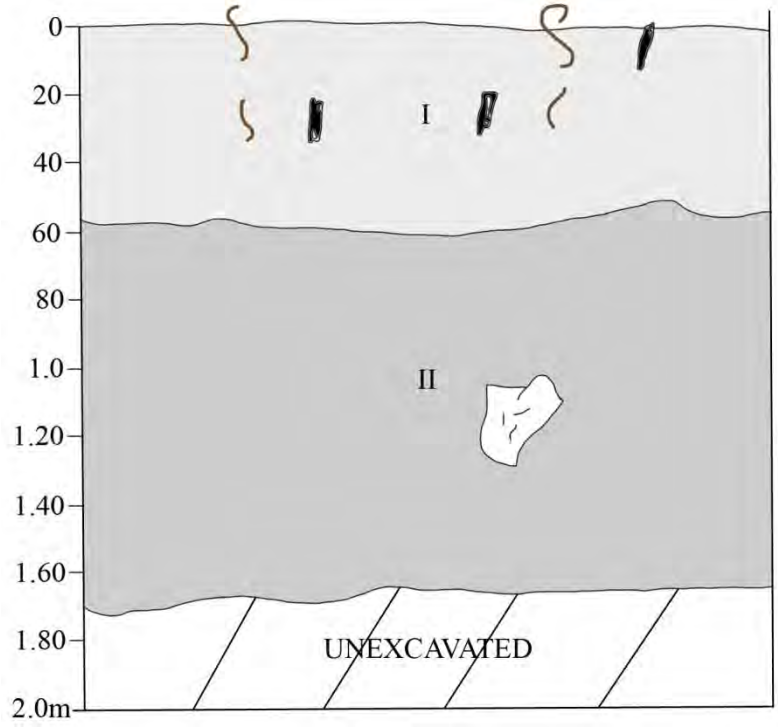
1996 *Sugar Water Hawaii's Plantation Ditches.* University of Hawaii Press, Honolulu.

APPENDIX A

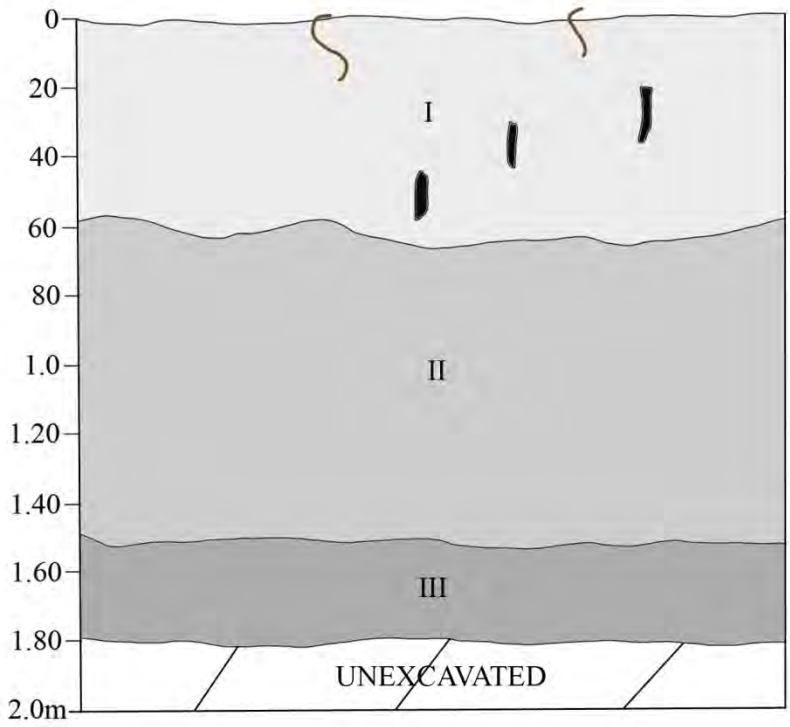
PARCEL 3 MAUKA



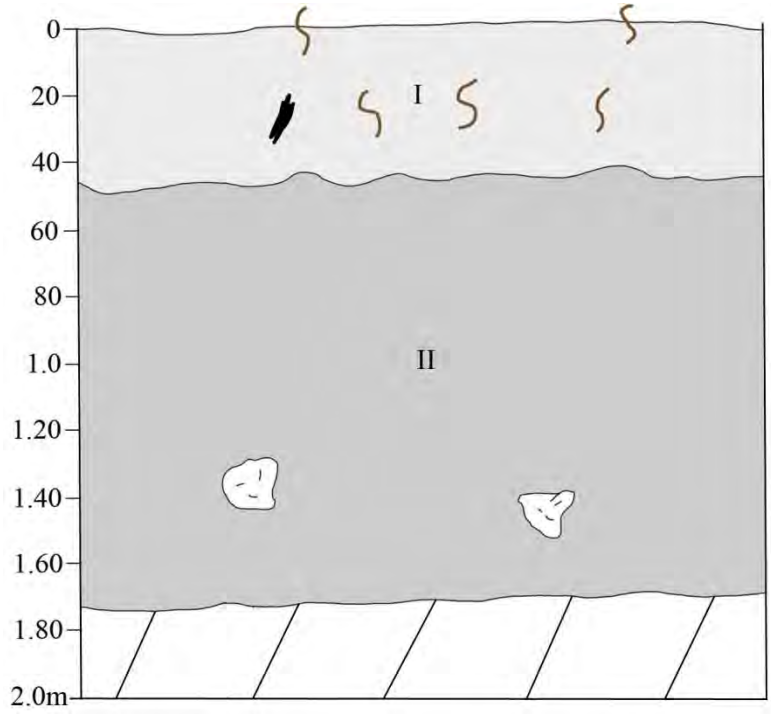
Trench 402



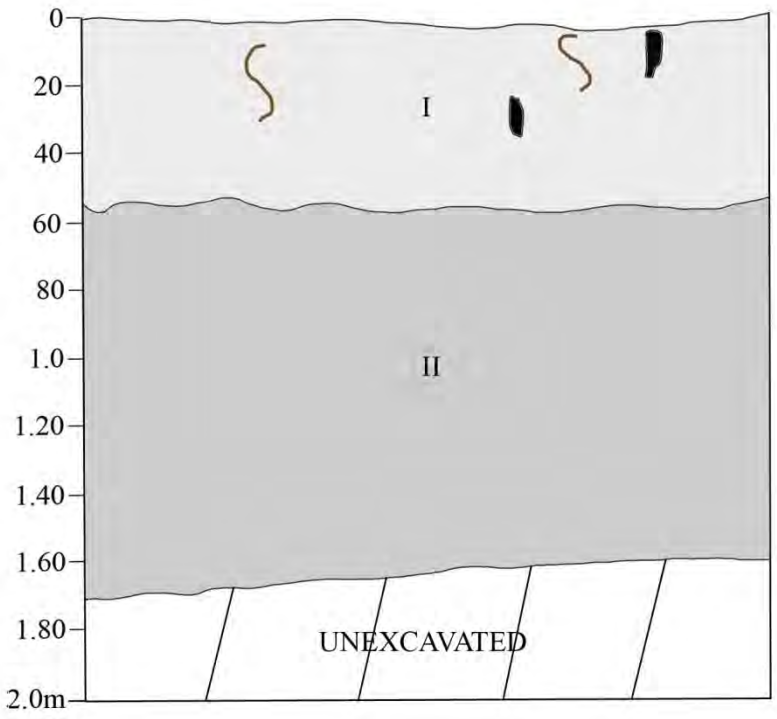
Trench 403



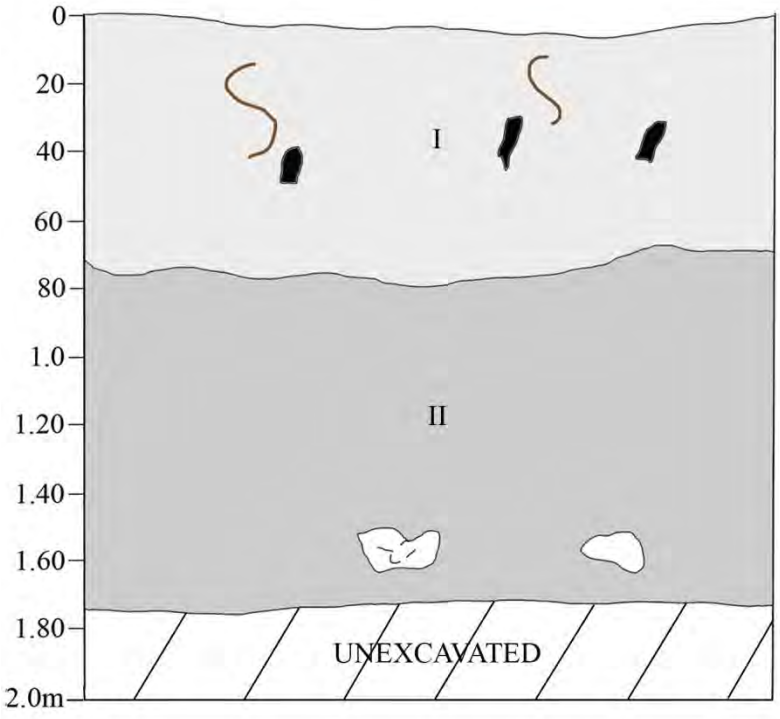
Trench 404



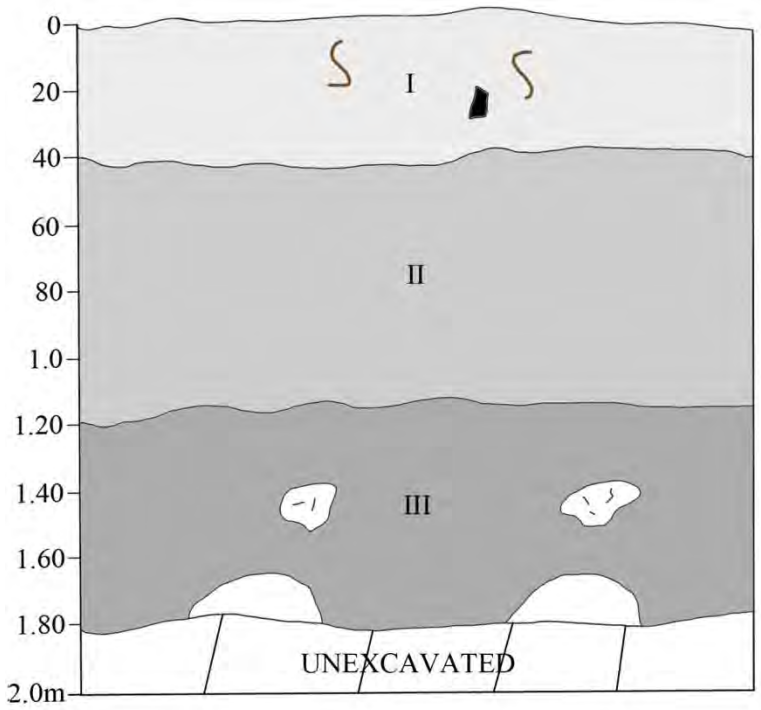
Trench 405



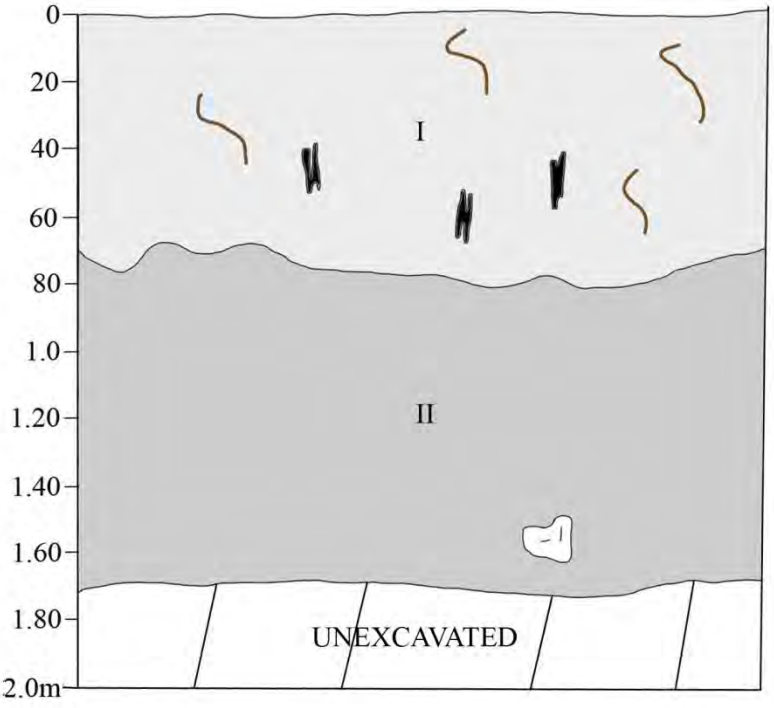
Trench 407



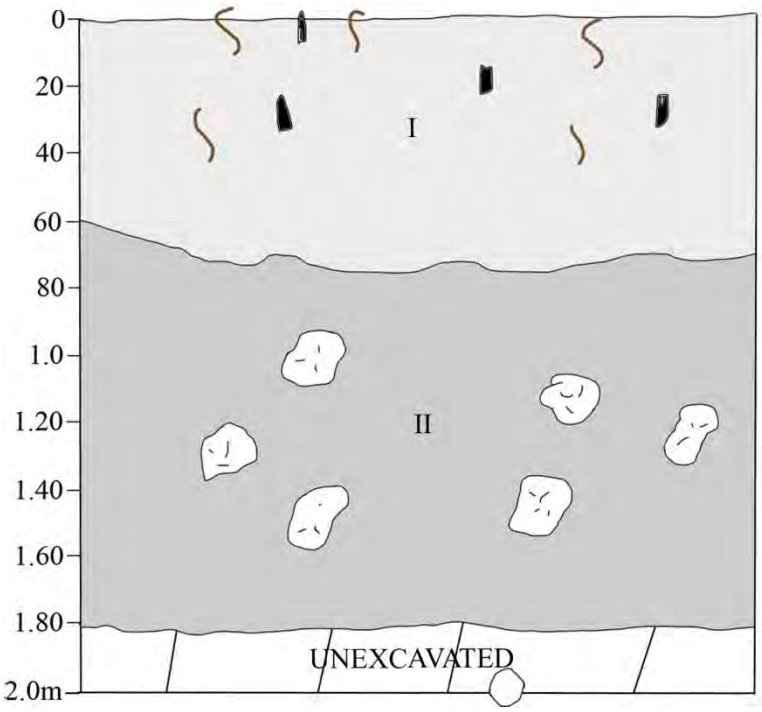
Trench 408



Trench 409

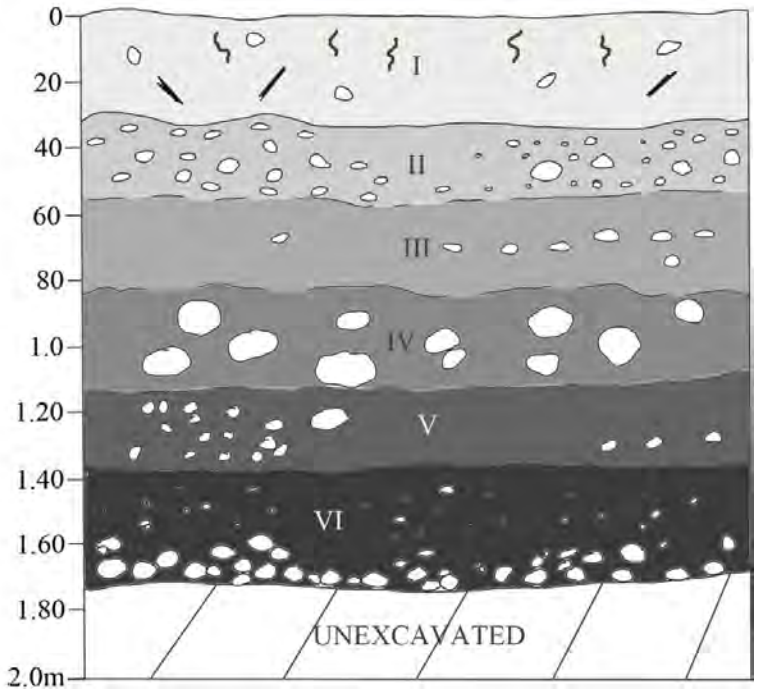


Trench 411

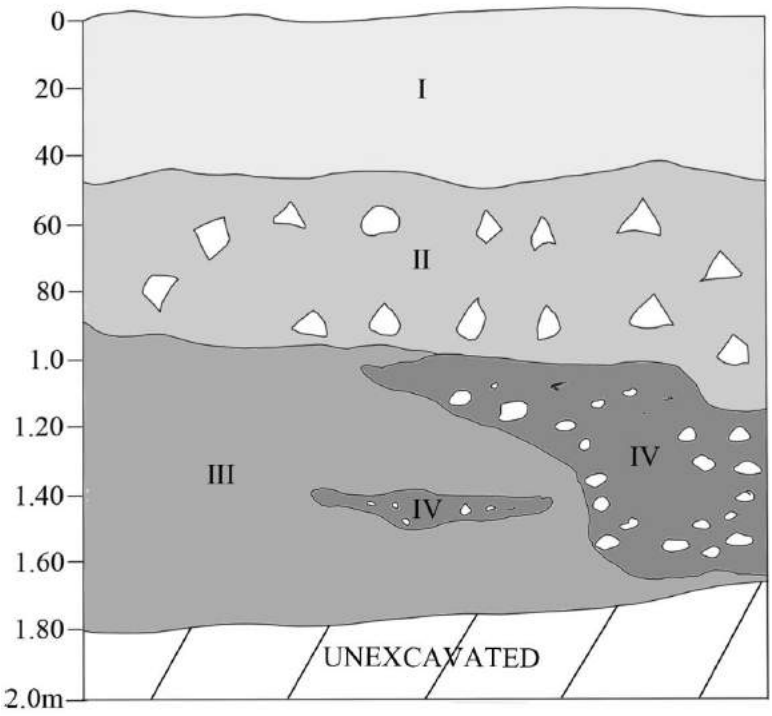


Trench 413

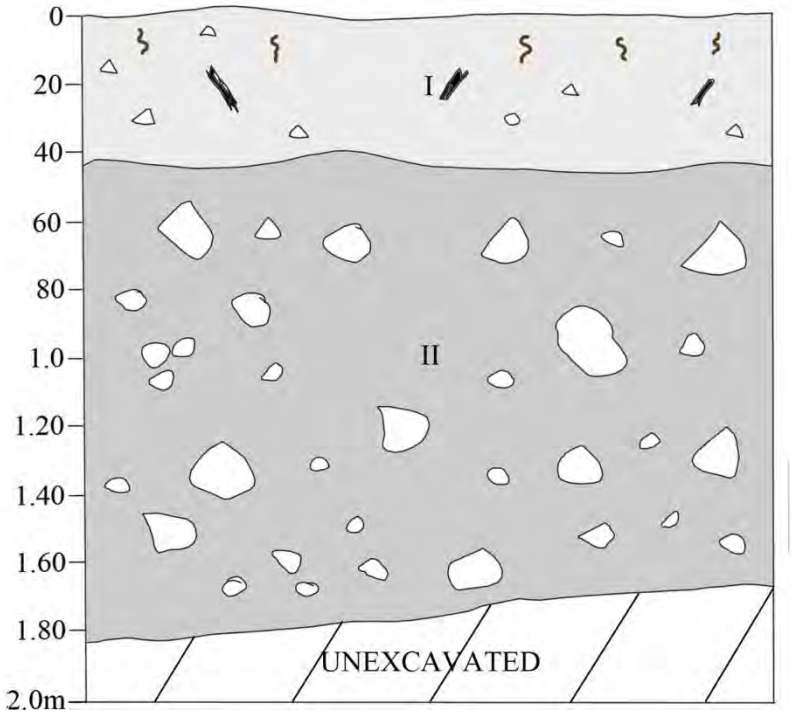
PARCEL 3 WAENA



Trench 01

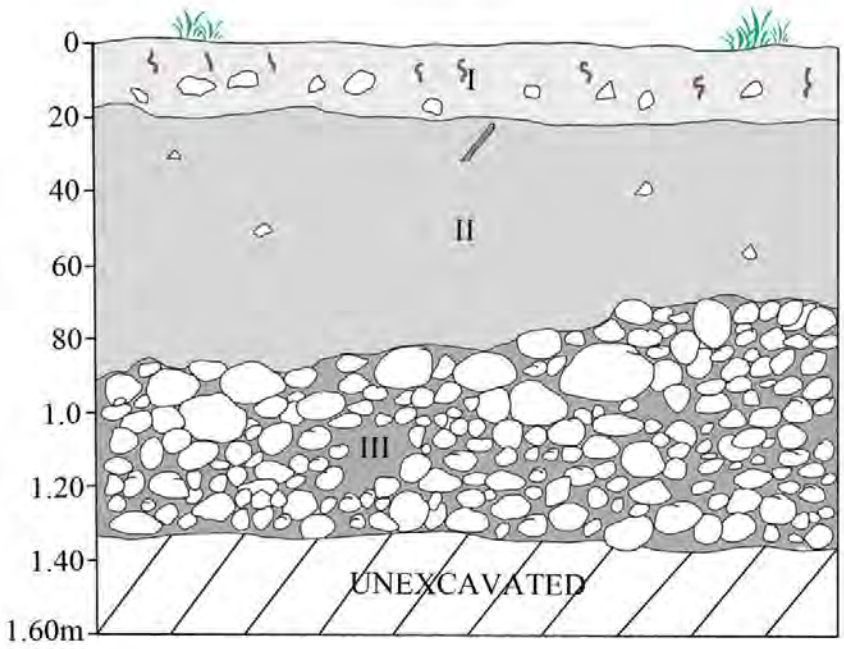


Trench 03

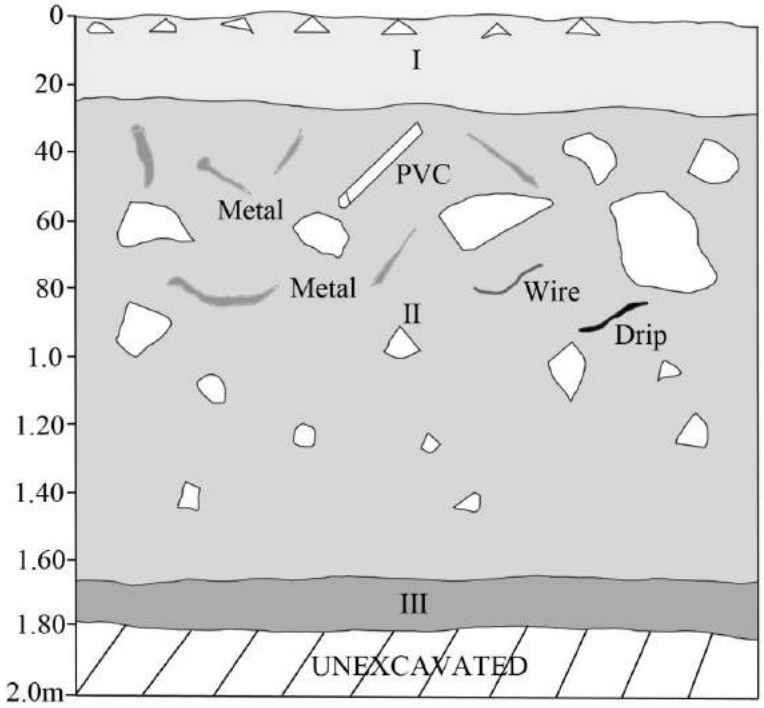


Trench 015

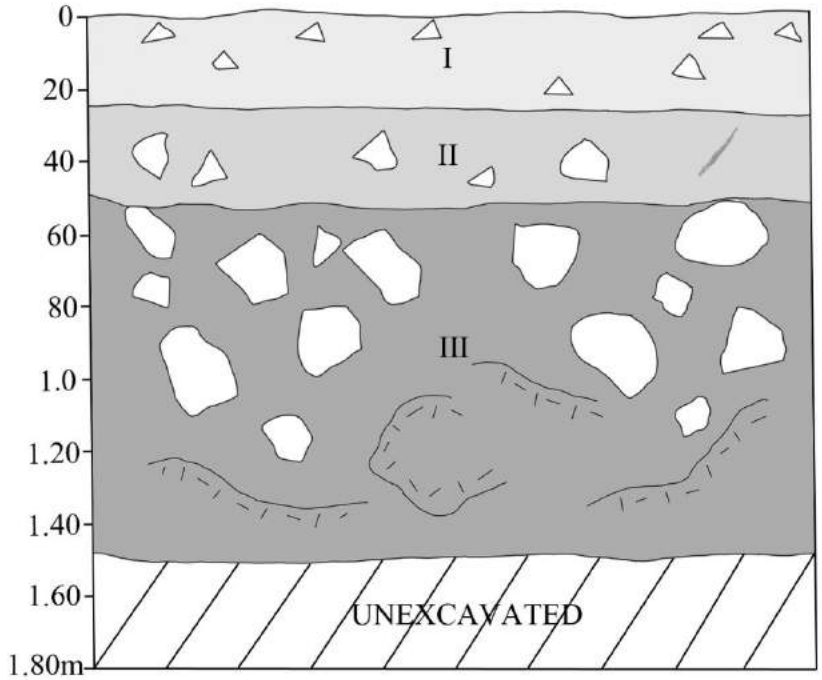
PARCEL 3 MAKAI



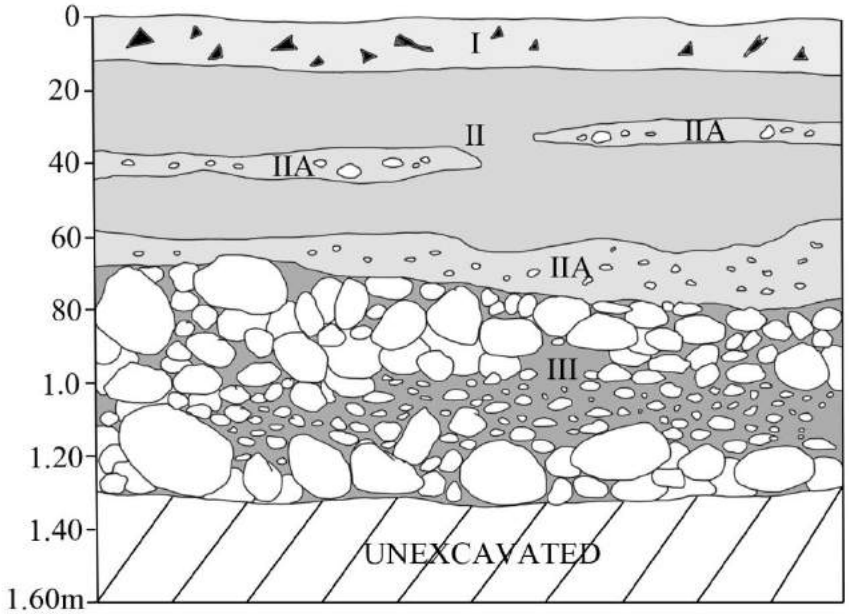
Trench 101



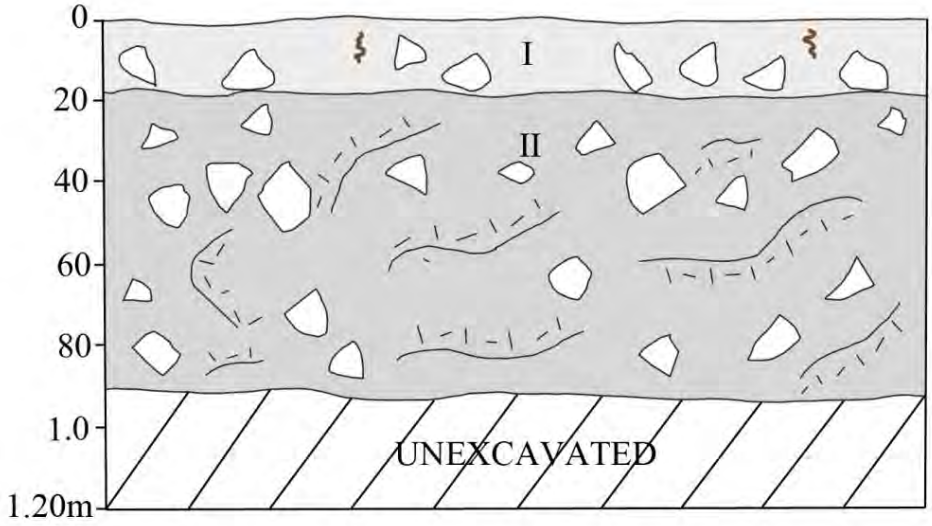
Trench 103



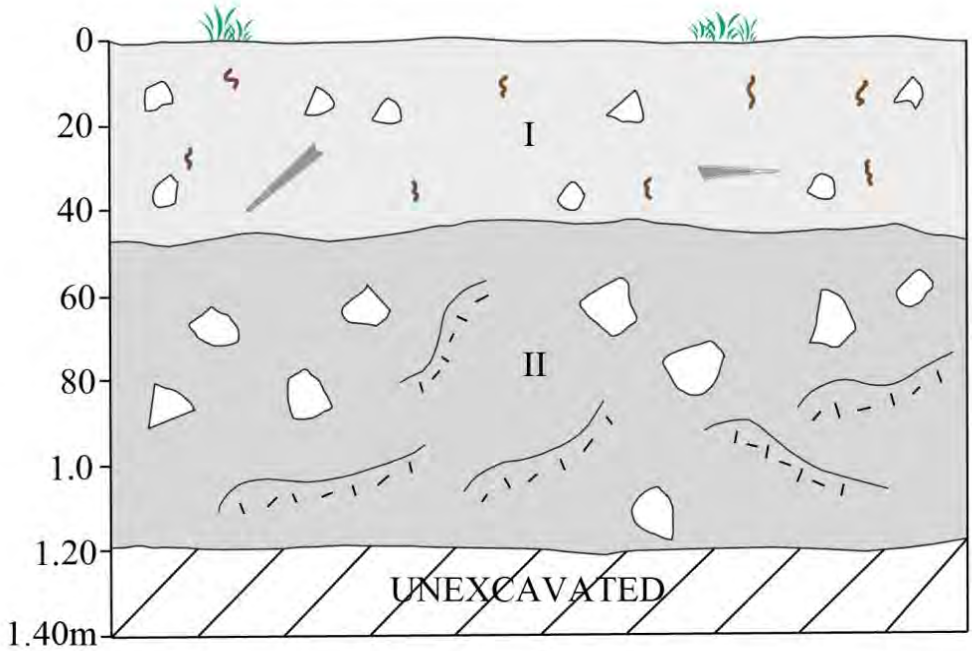
Trench 104



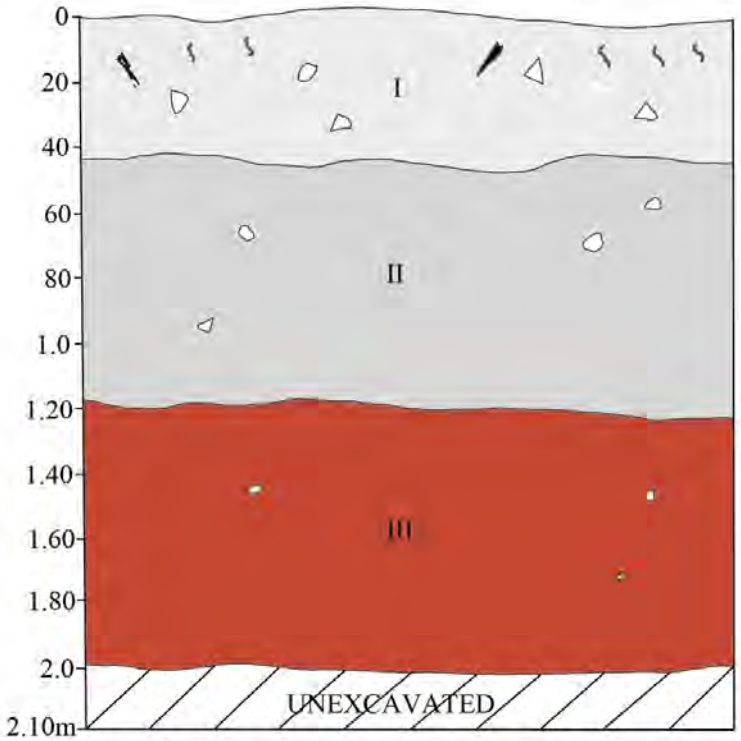
Trench 105



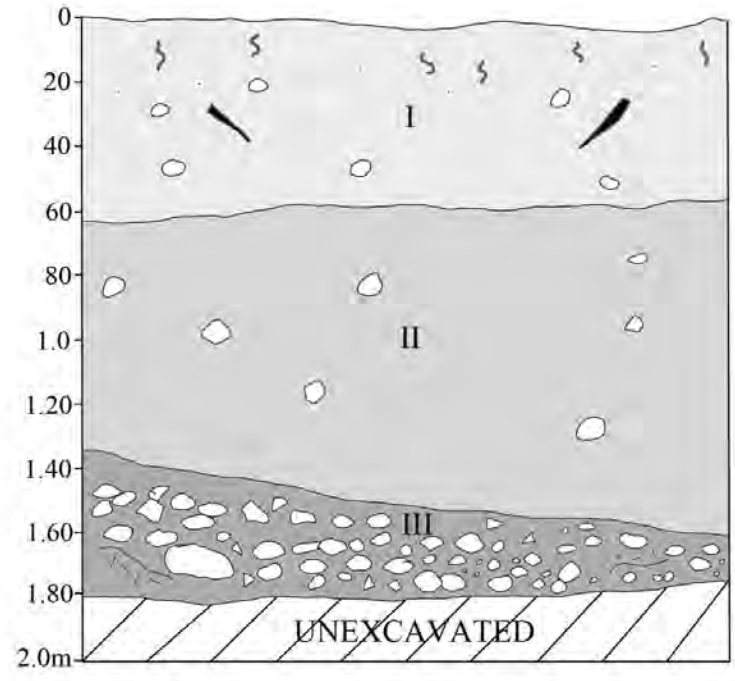
Trench 106



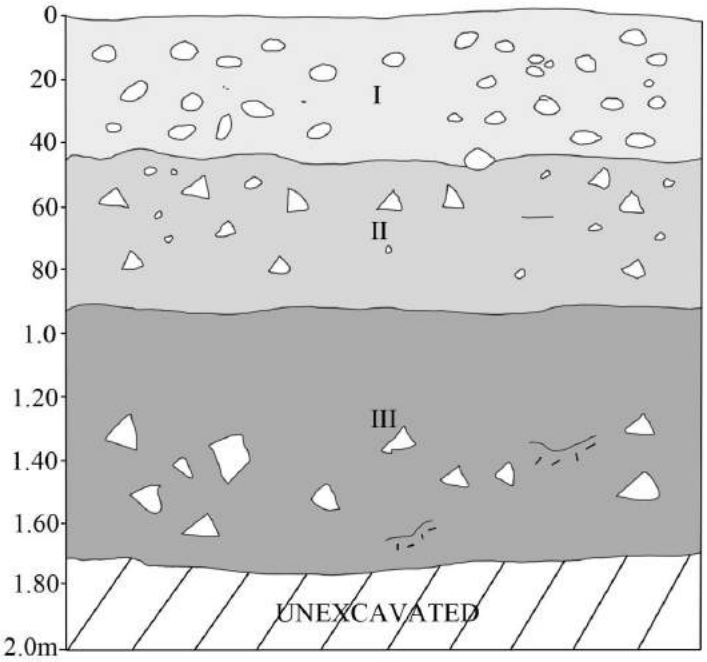
Trench 107



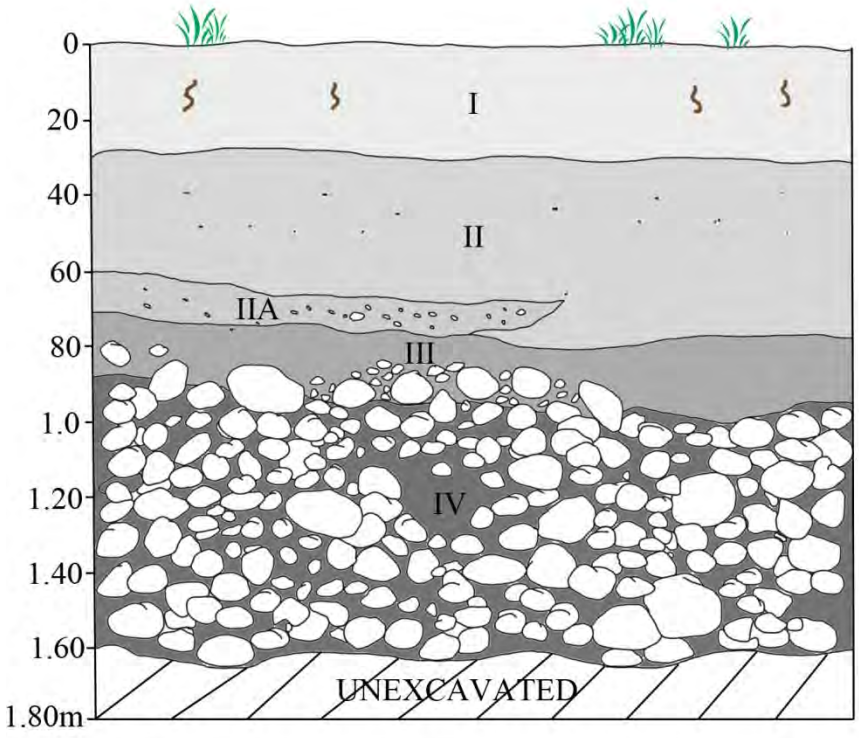
Trench 109



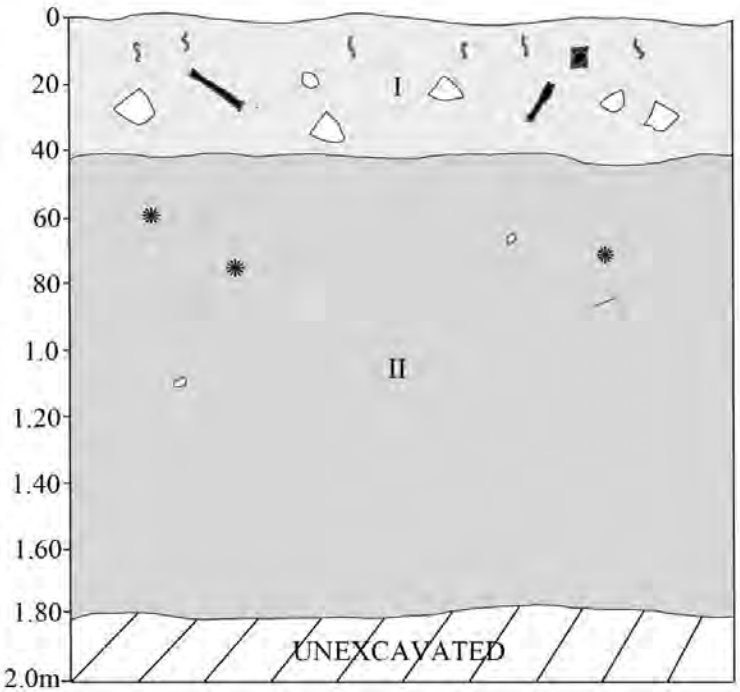
Trench108



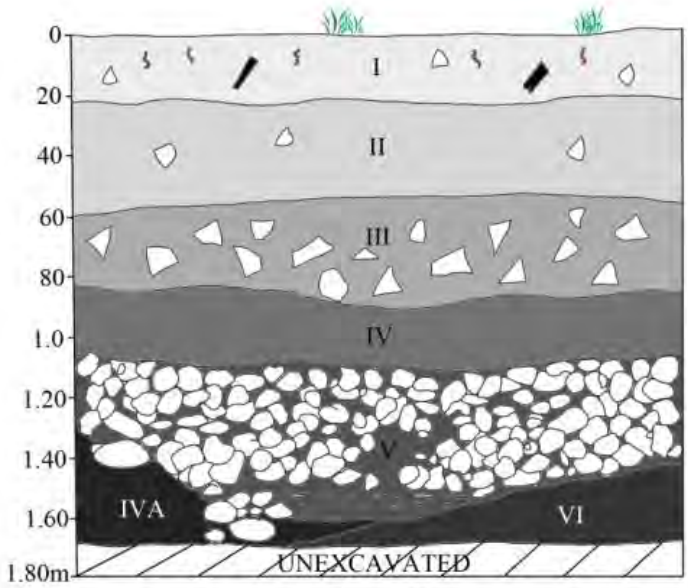
Trench 112



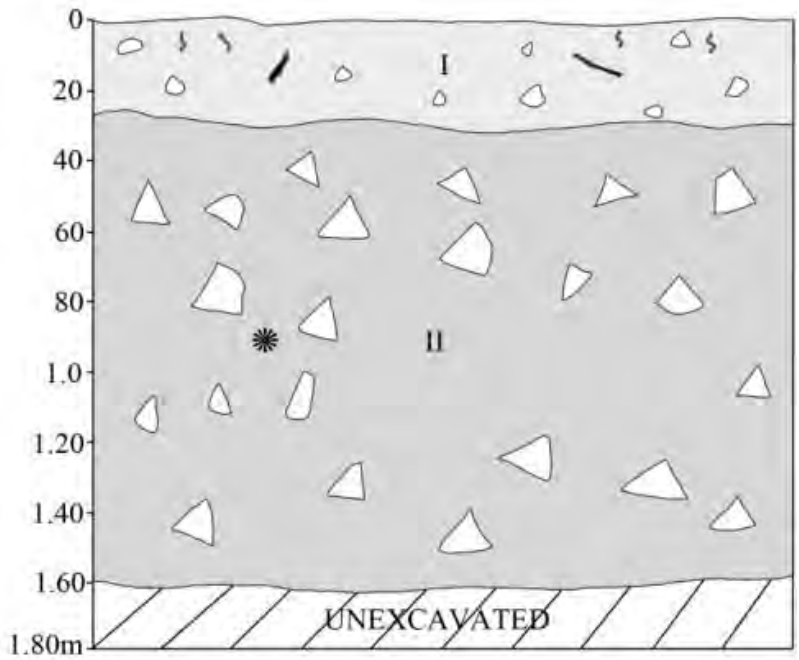
Trench 111



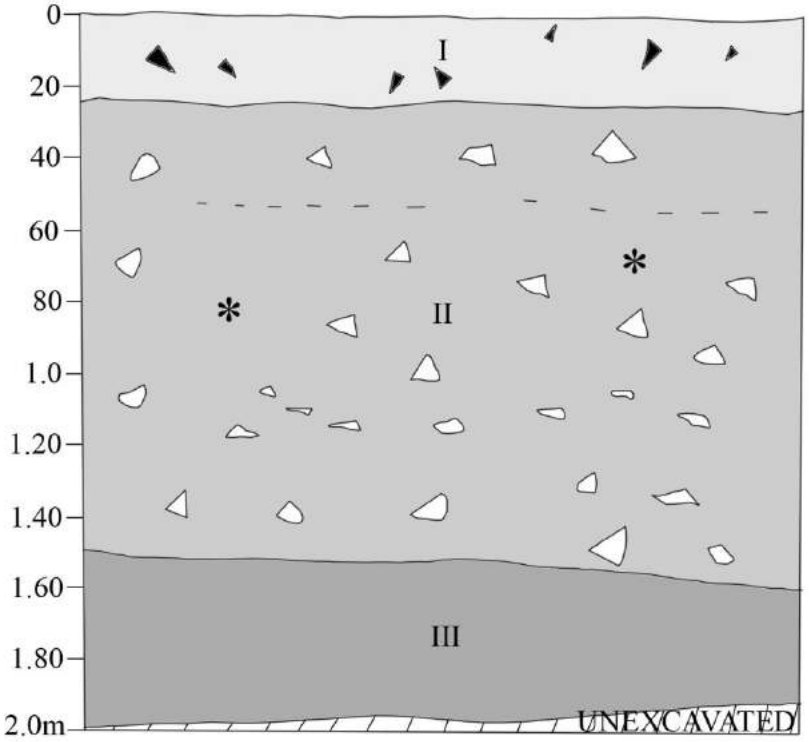
Trench 113



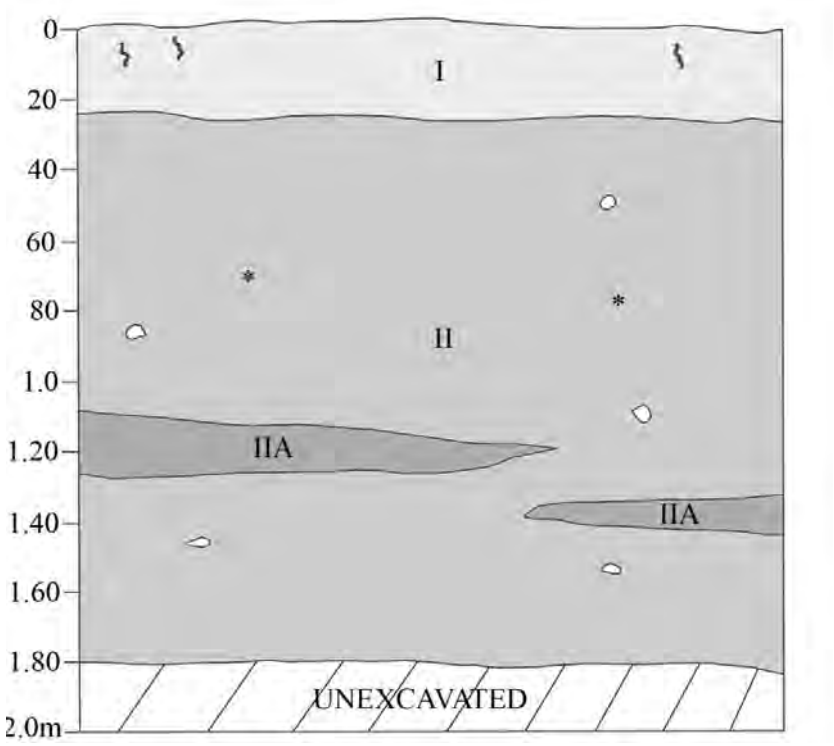
Trench 114



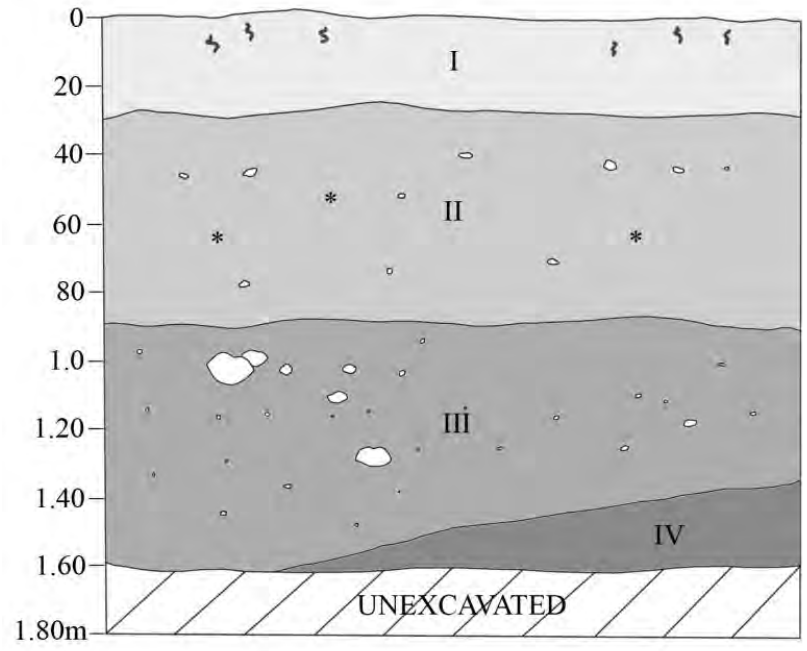
Trench 115



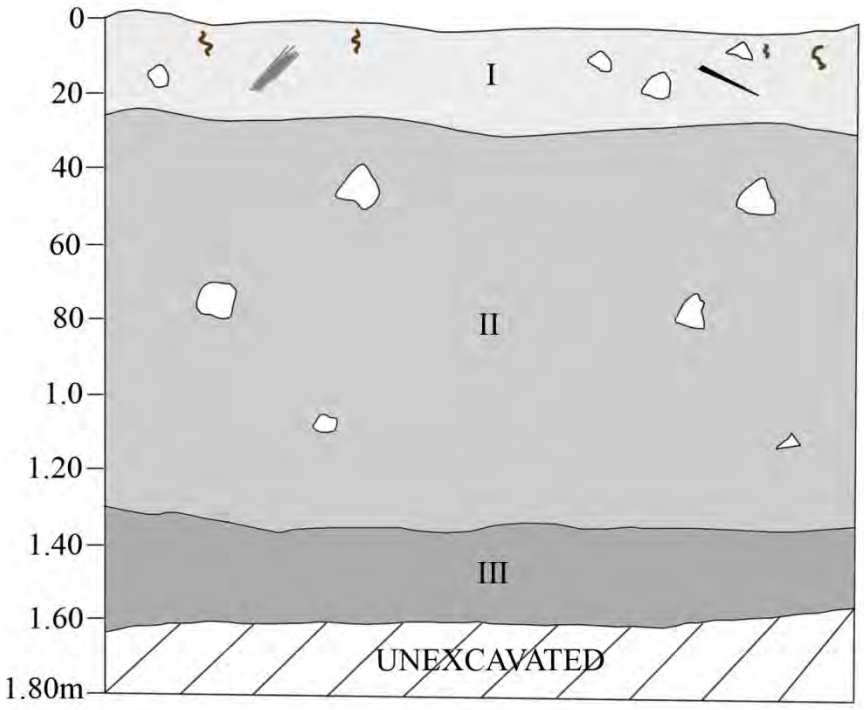
Trench 116



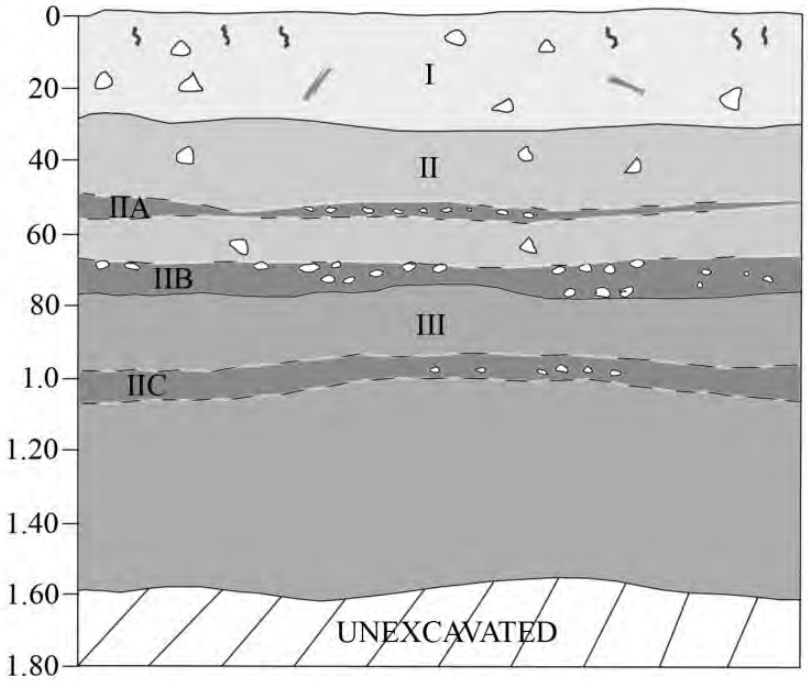
Trench 117



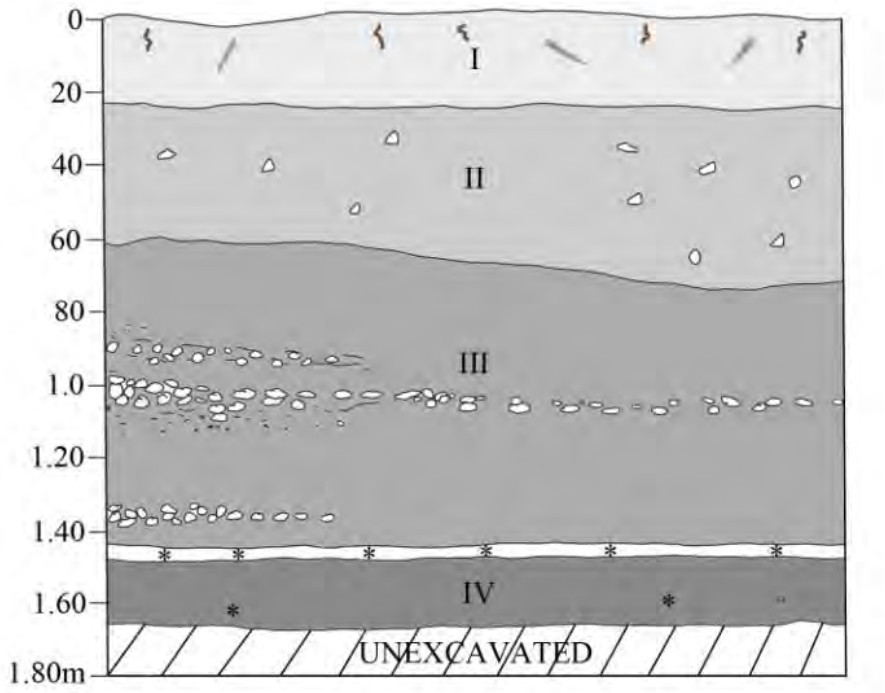
Trench 118



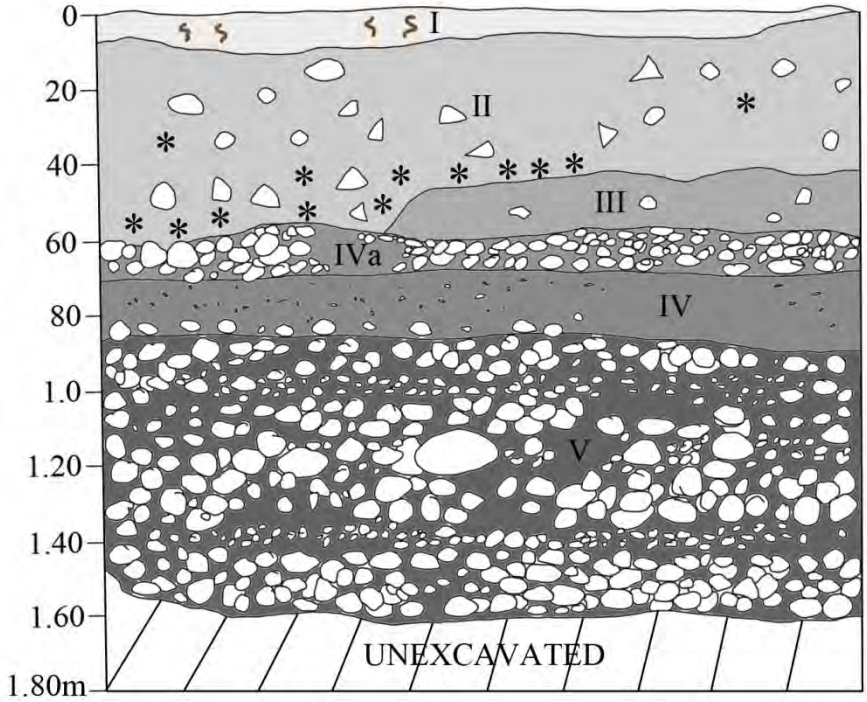
Trench 119



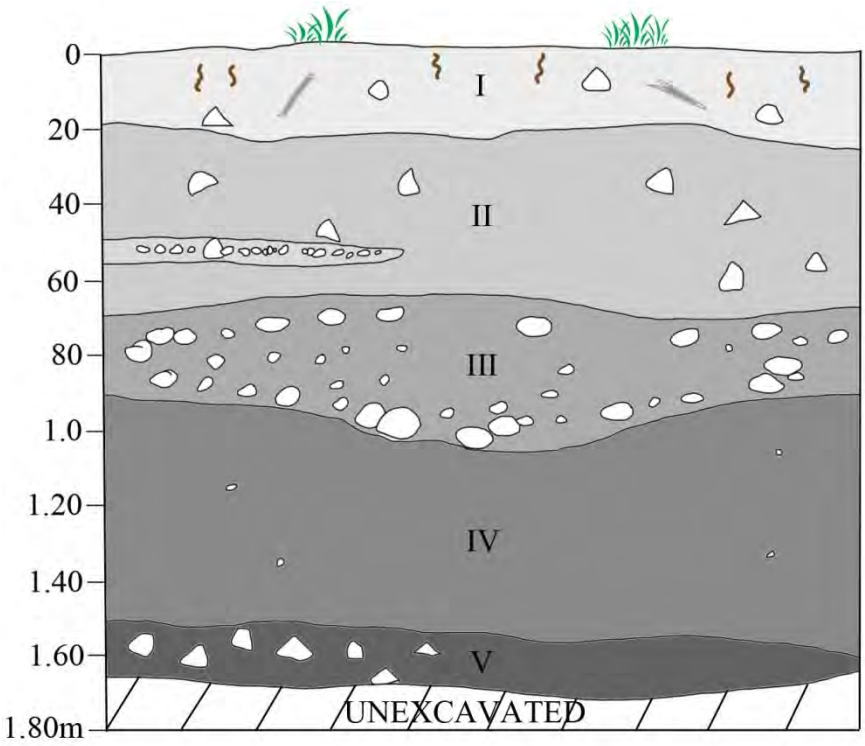
Trench 120



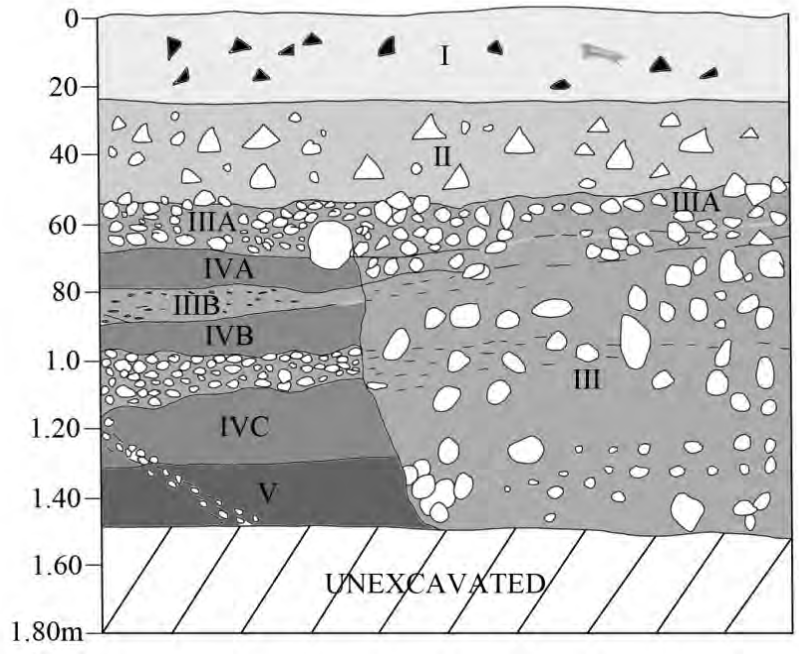
Trench 121



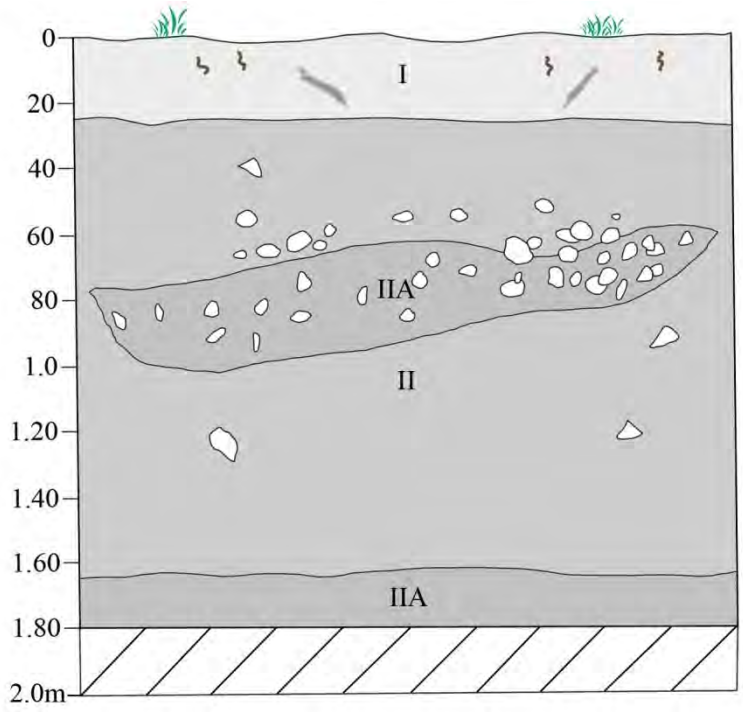
Trench 122



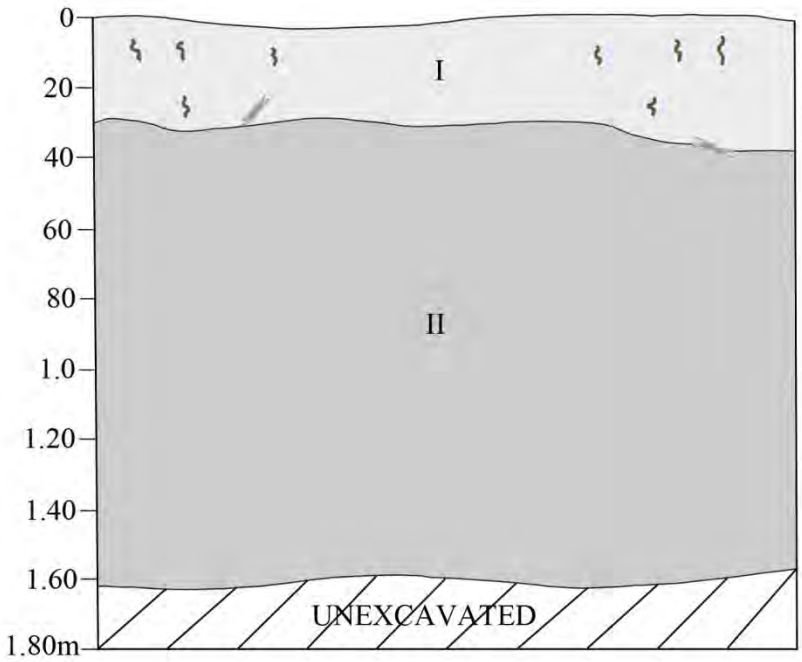
Trench 123



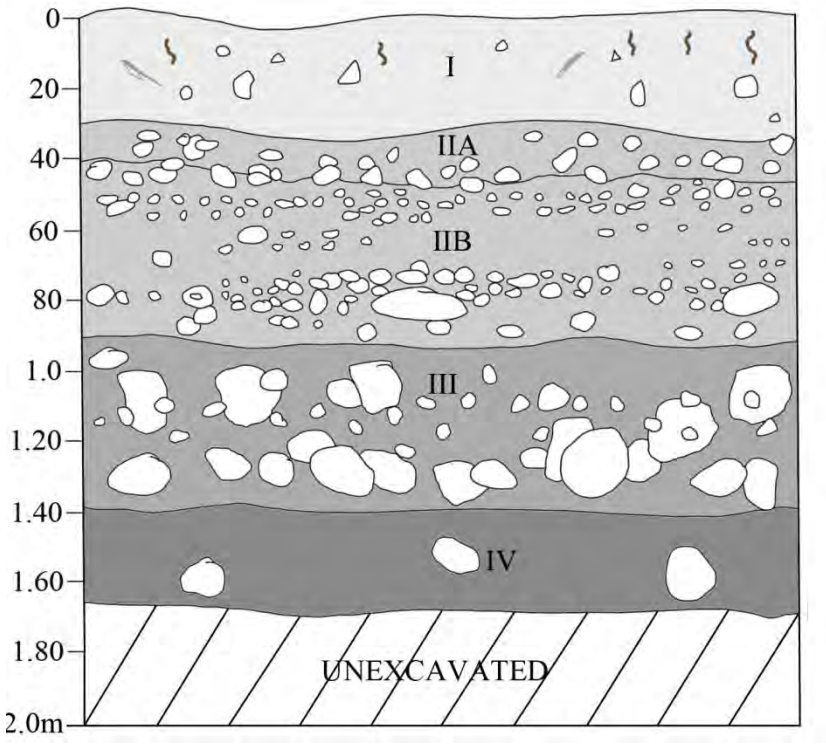
Trench 124



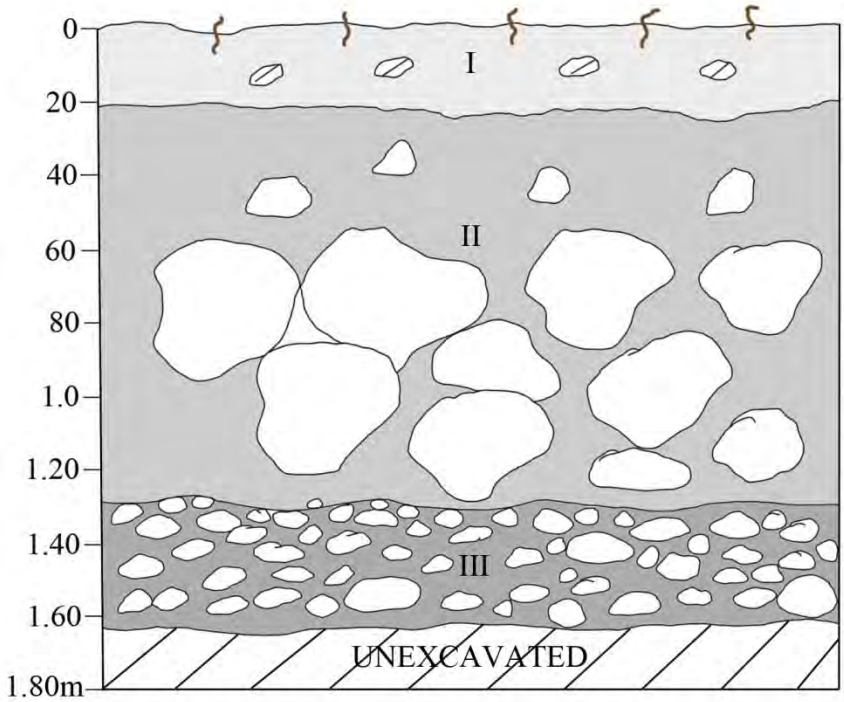
Trench 126



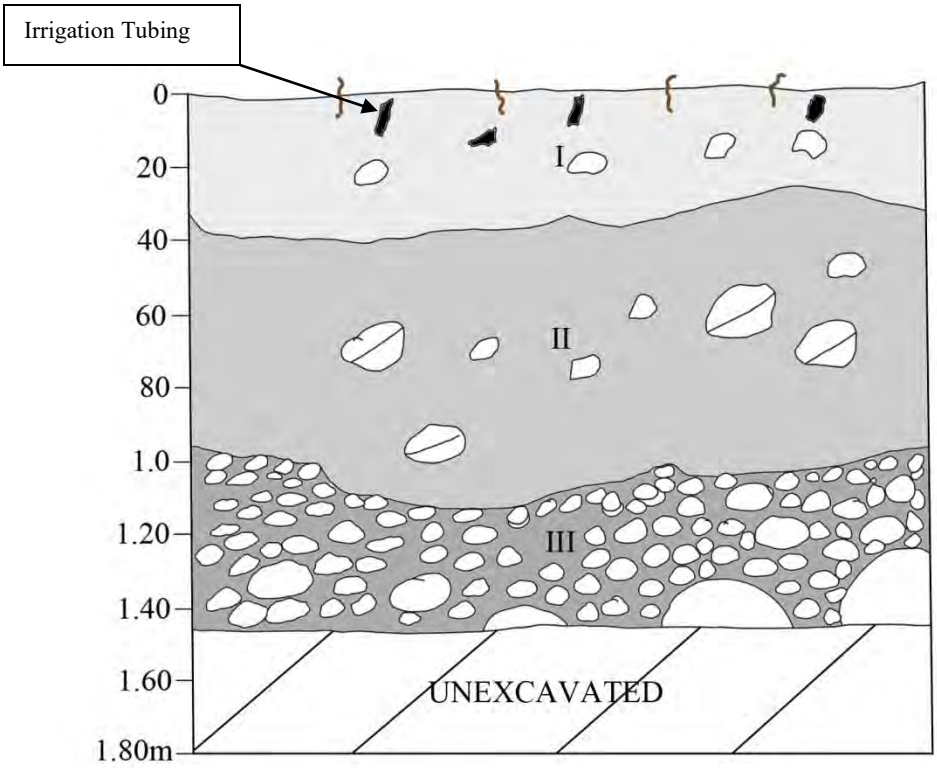
Trench 127



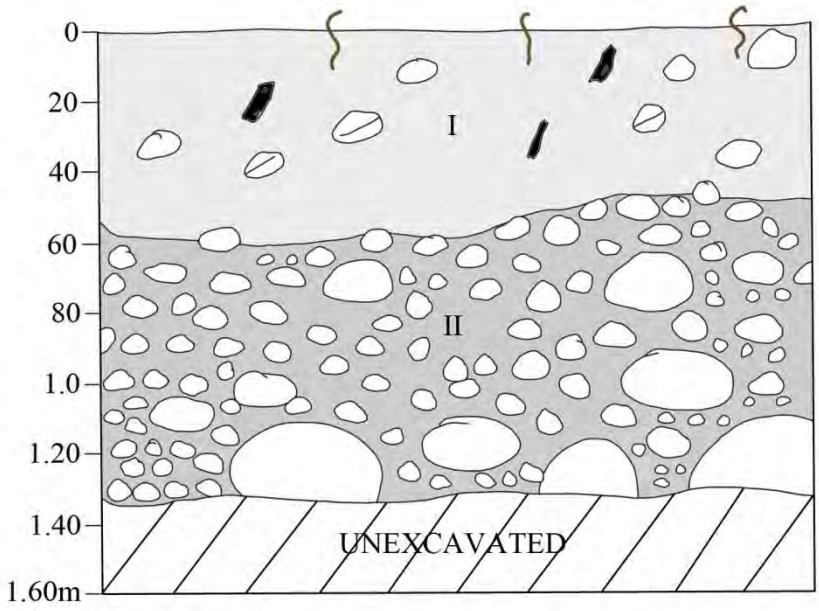
Trench 128



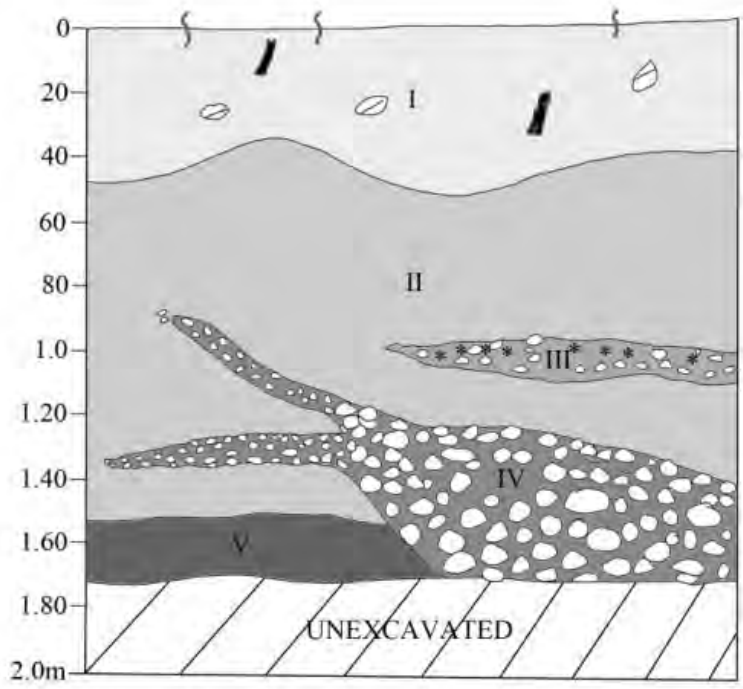
Trench 129



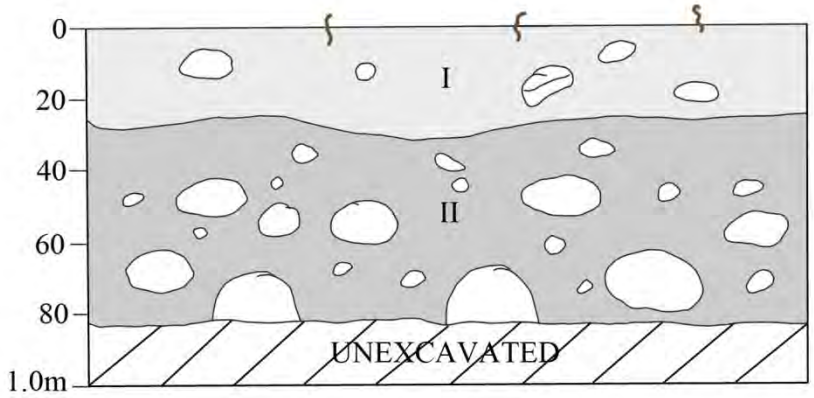
Trench 130



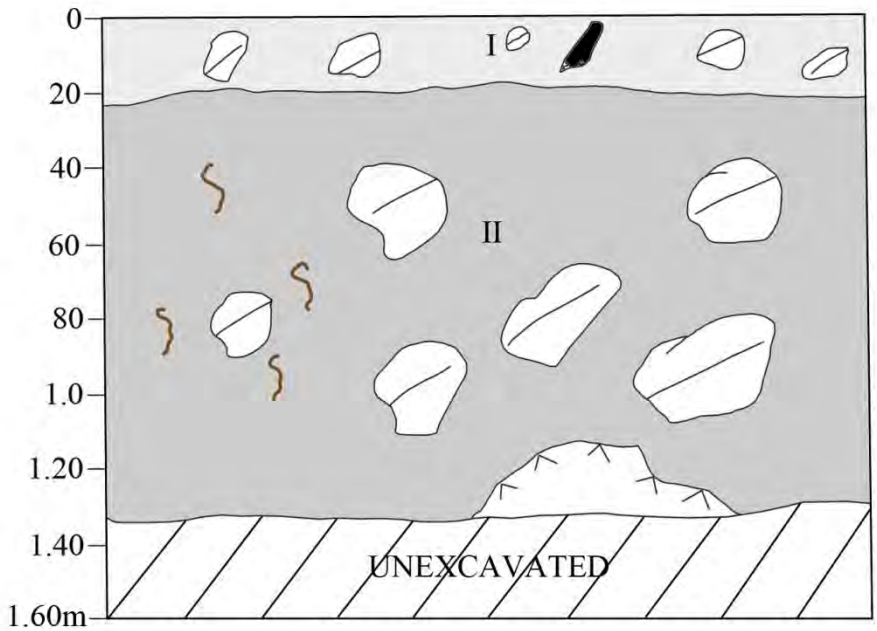
Trench 131



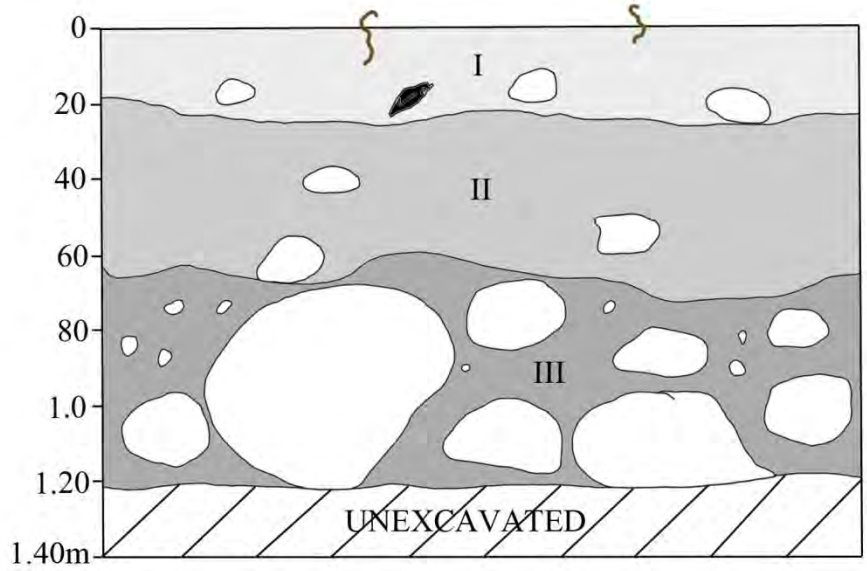
Trench 132



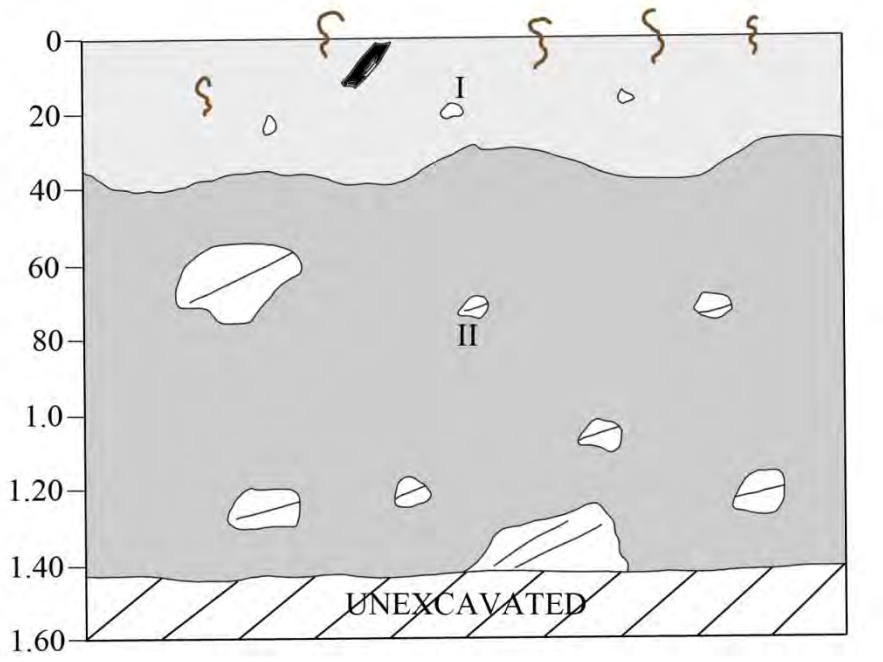
Trench 133



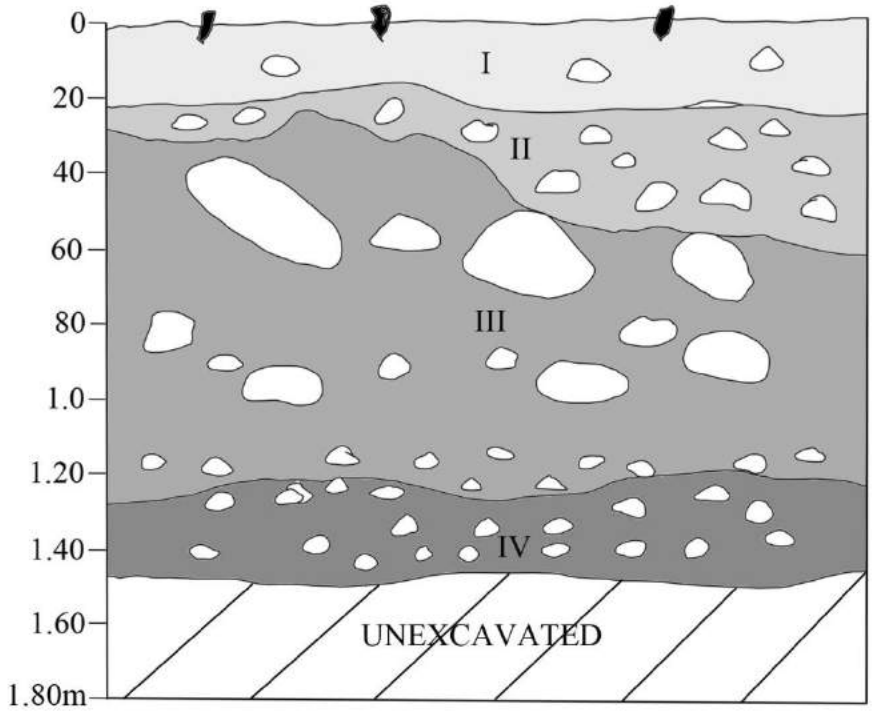
Trench 134



Trench 135

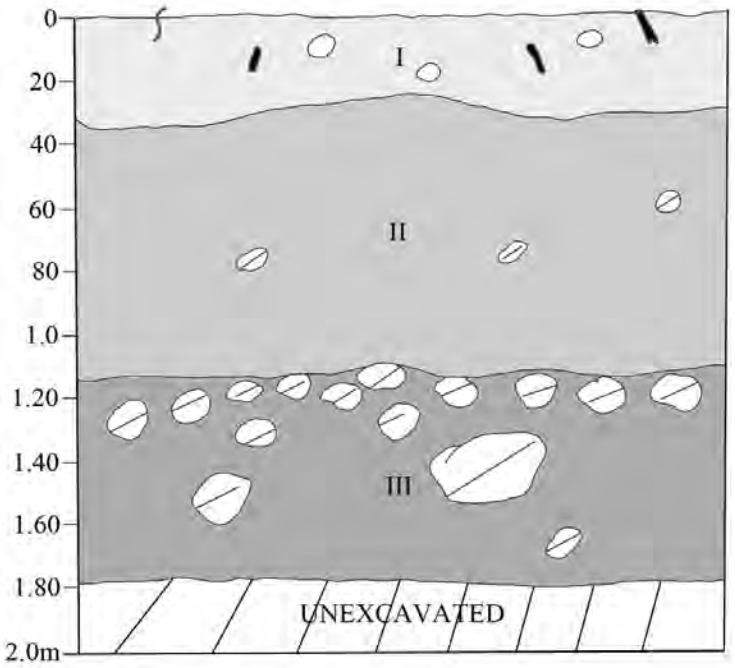


Trench 136

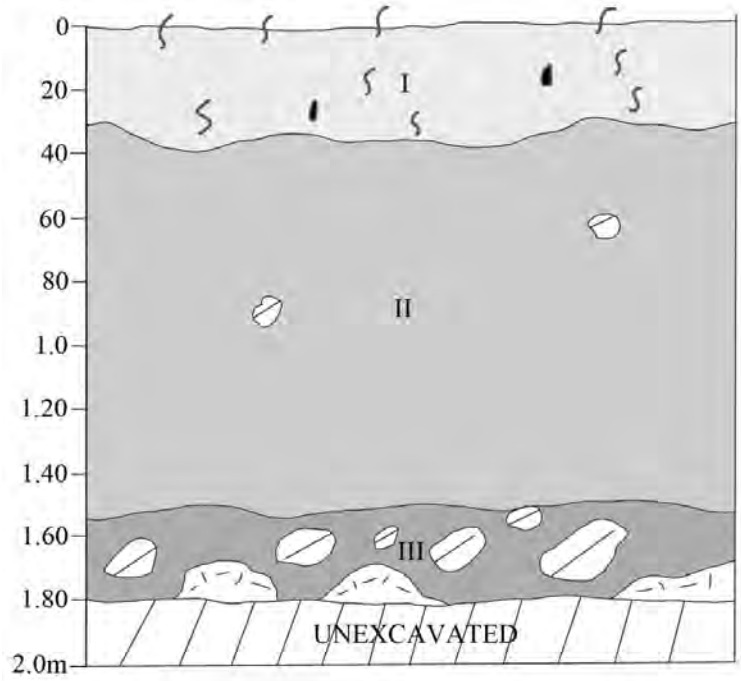


Trench 137

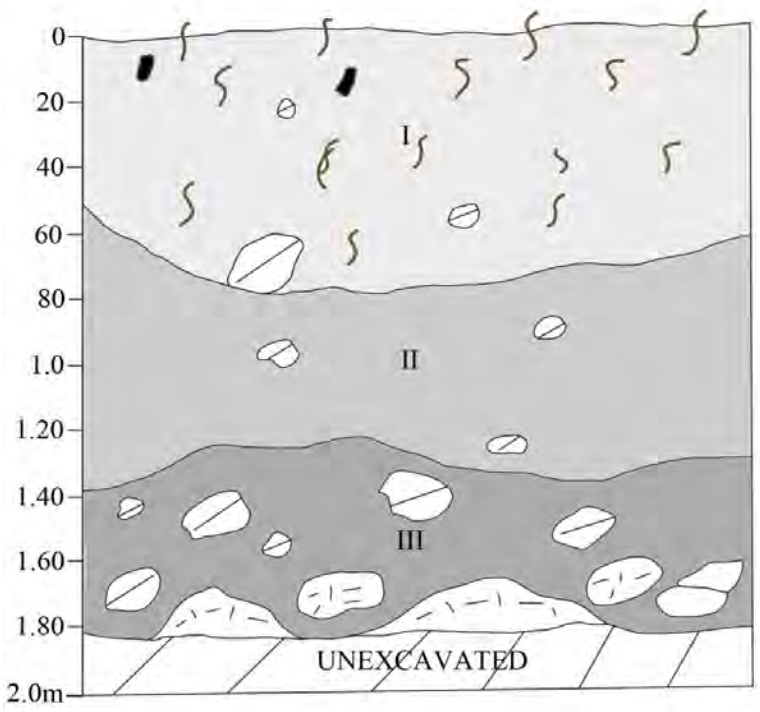
PARCEL 7 TRENCHES



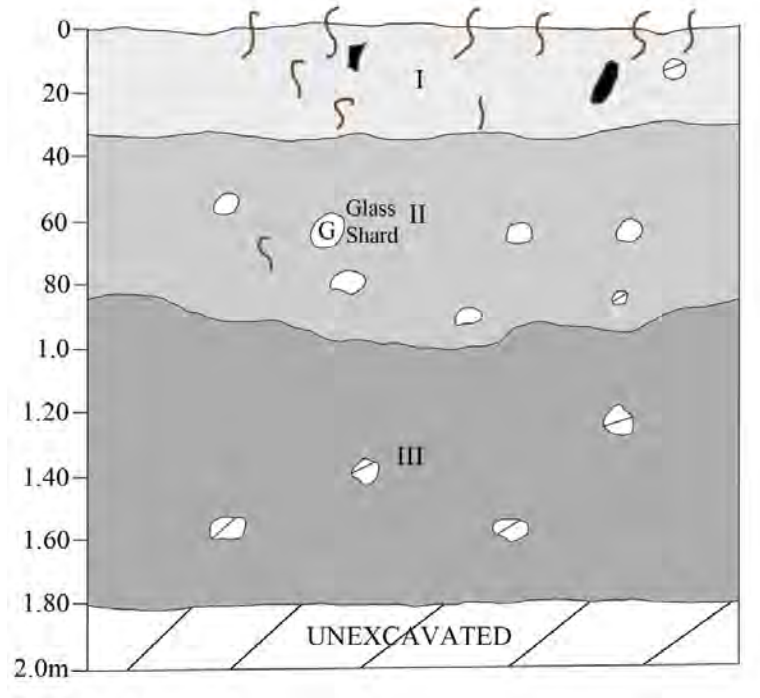
Trench 300



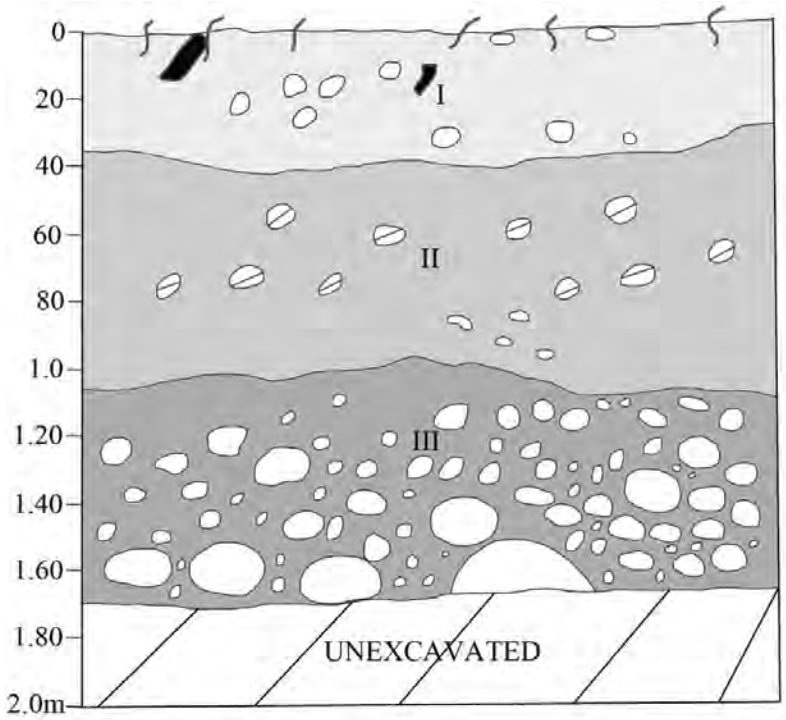
Trench 301



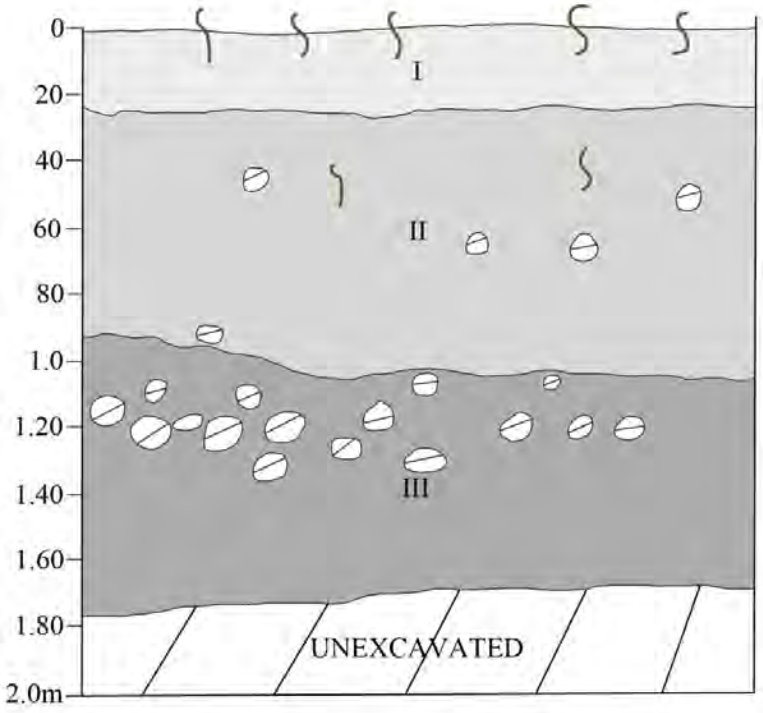
Trench 303



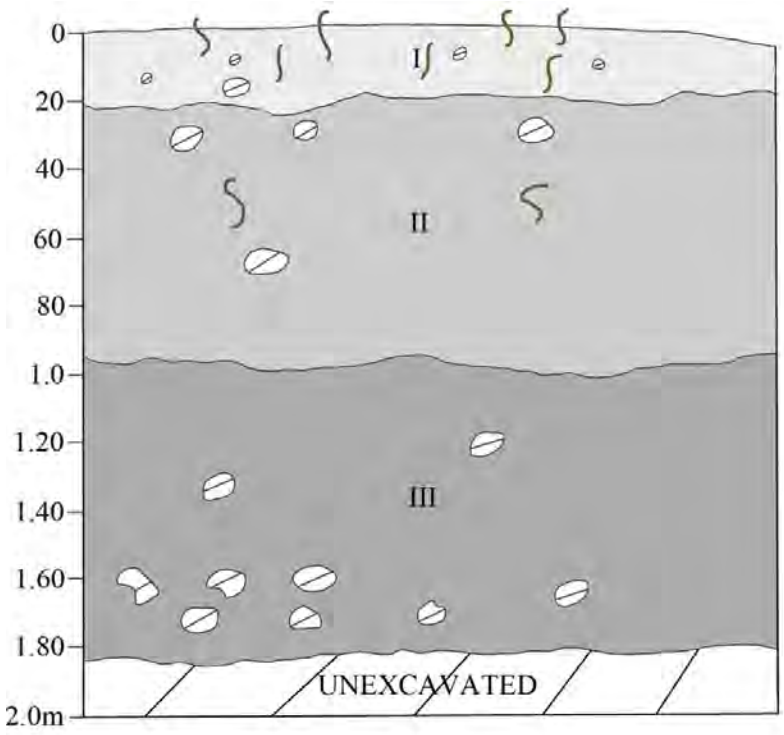
Trench 304



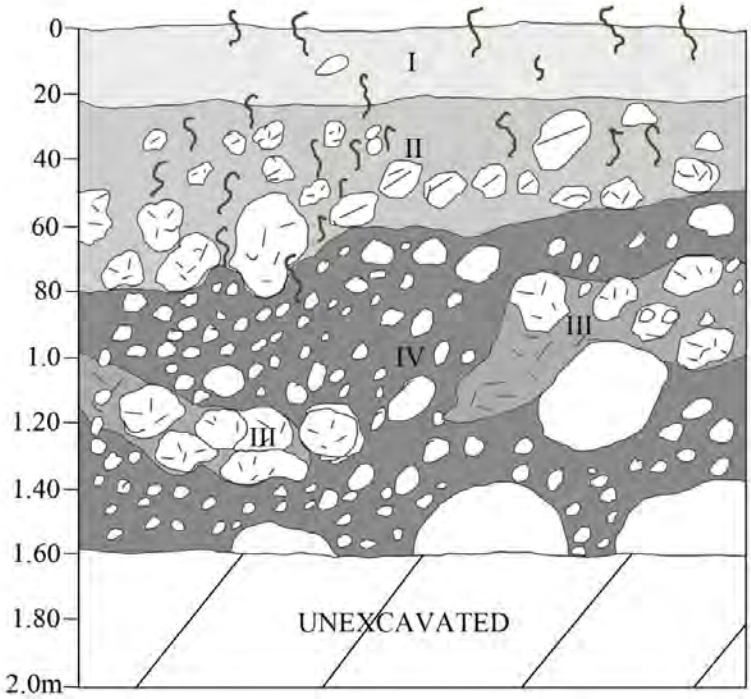
Trench 305



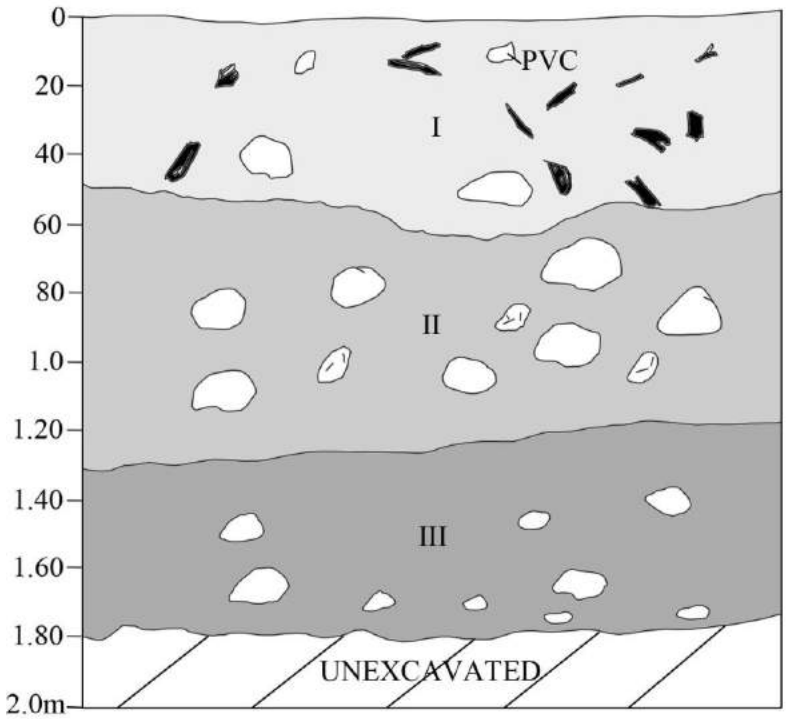
Trench 307



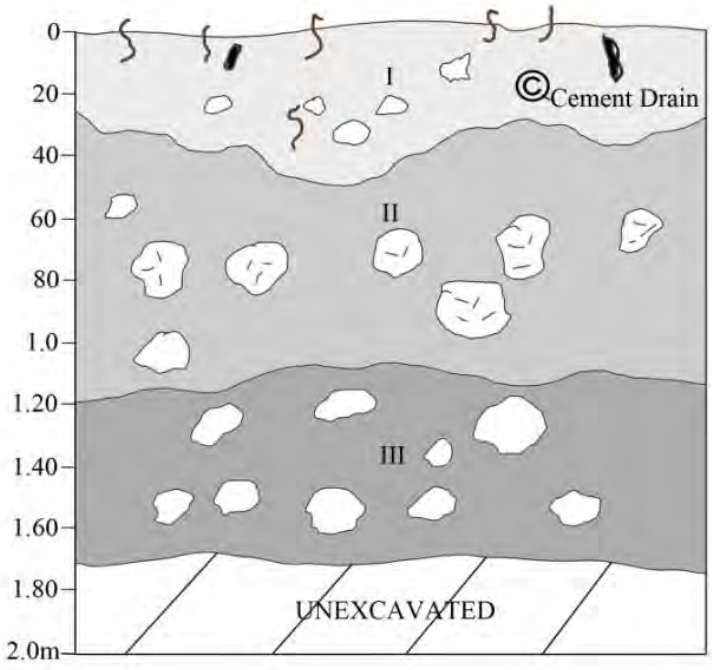
Trench 308



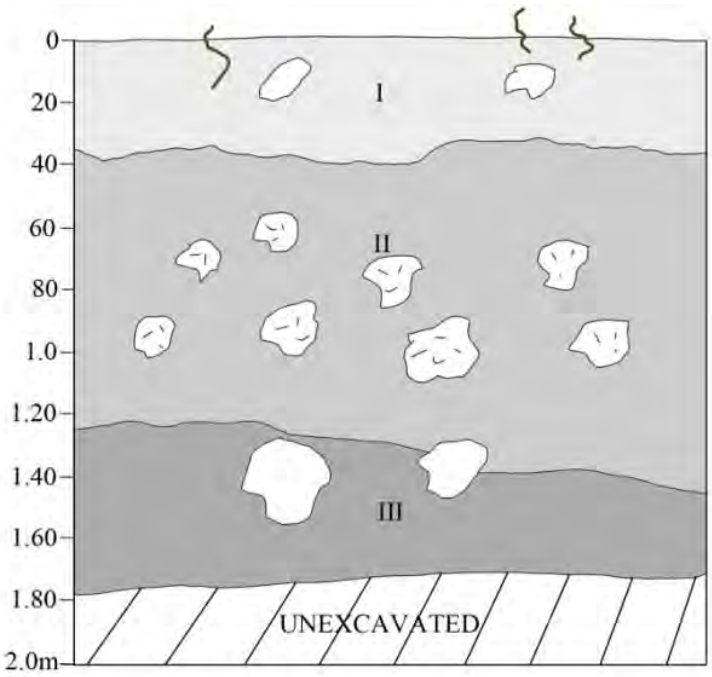
Trench 312



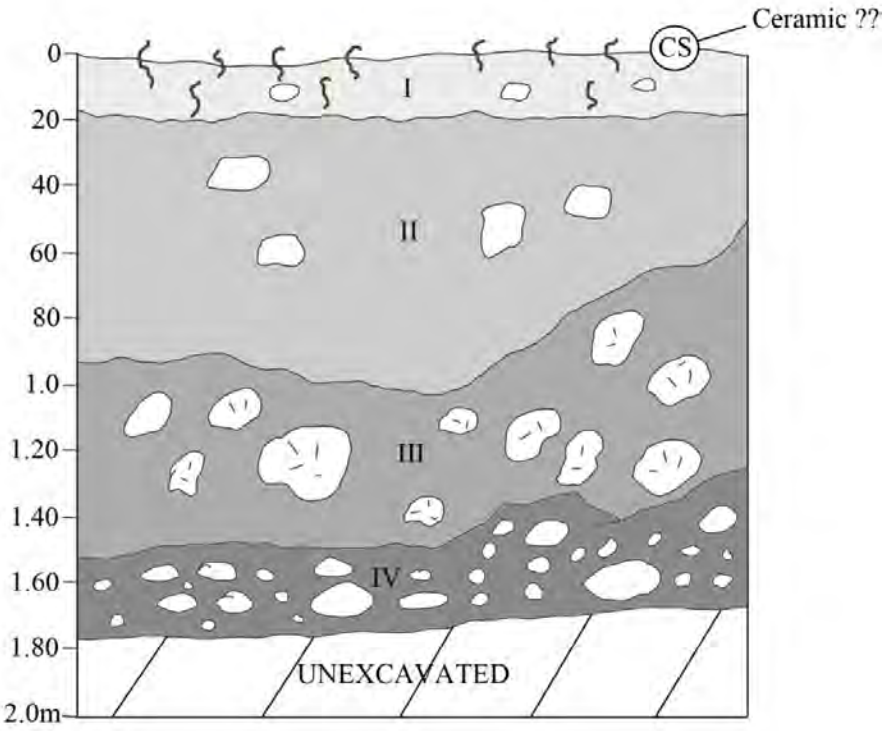
Trench 314



Trench 315



Trench 316



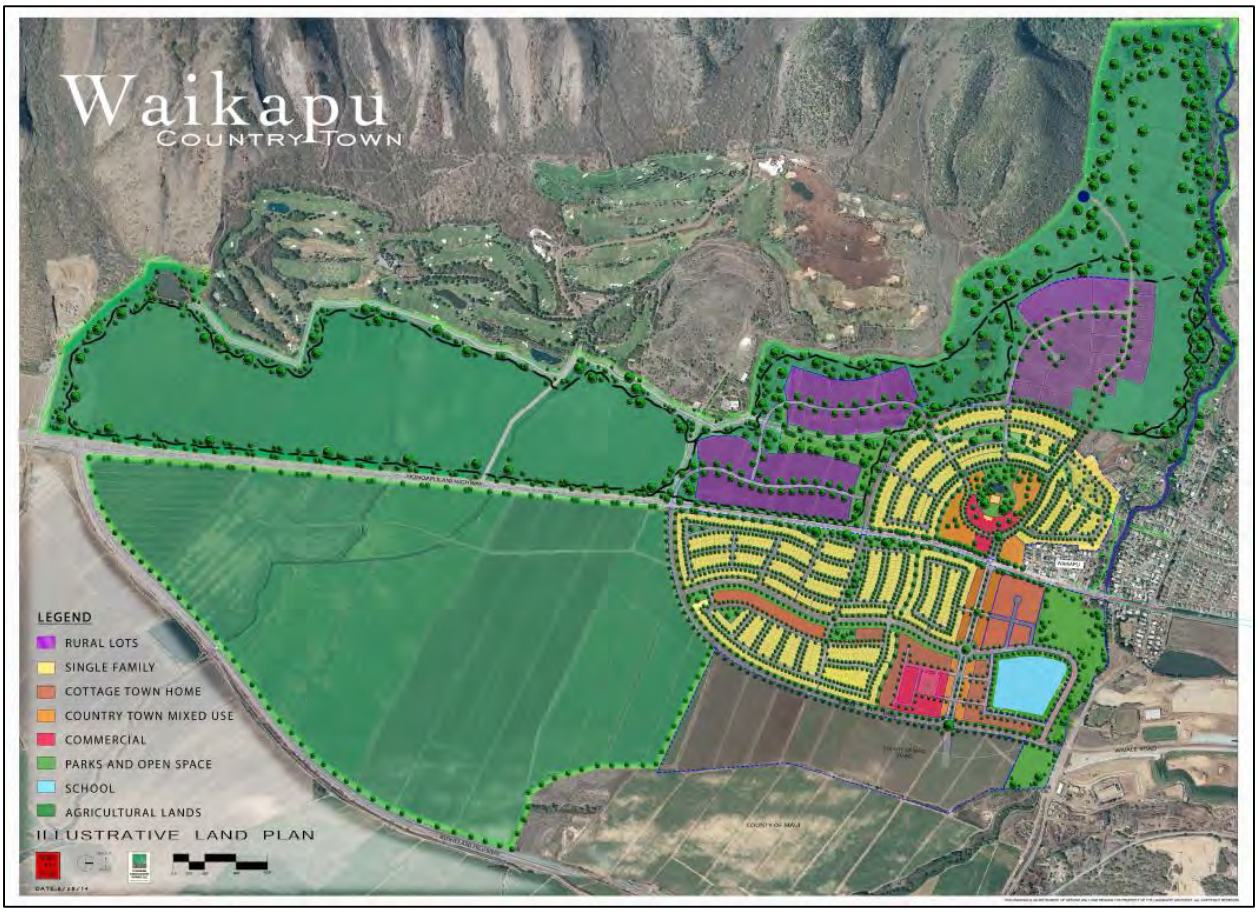
Trench 323

APPENDIX F

Cultural Impact Assessment

Cultural Impact Assessment
For The
Waikapū Country Town Development
Waikapū, Maui, Hawai‘i

(TMK: (2) 3-6-05:007 por., (2) 3-6-05-007, (2) 3-6-04:006, (2) 3-6-04:003 por.)



Prepared by:

Hōkūao Pellegrino
Cultural Consultant

Contracted by Hana Pono, LLC
P.O. Box 2039
Wailuku, Hawai‘i 96793
Hanapono@gmail.com

ABSTRACT

On behalf of Planning Consultants Hawai‘i, LLC of Wailuku, Hōkūao Pellegrino sub-contracted by Hana Pono, LLC has prepared the following Cultural Impact Assessment for the proposed Waikapū Country Town Development. Hana Pono, LLC began the initial efforts of this report in May of 2013. Archival research and interviews were conducted throughout the duration of the report and was completed in January of 2014.

Included in this document is information on the methods of the archival review and the interviews which form the core of the Cultural Impact Assessment. The individuals interviewed maintain knowledge of and ties to the Waikapū area. Brief biographical information is provided on each individual.

Information compiled for this document suggest that Waikapū has a long and rich cultural history and representation of traditional cultural practices, and that must be considered during the proposed Waikapū Country Town Development. These include practices around cultural site preservation, natural and cultural resource management, Hawaiian agricultural resources, water resources, the land divisions and place names within and surrounding the project area, and the spiritual essence of the resources found within the Waikapū ahupua‘a. Interviewees agree that cultural site, natural resources, and traditional and customary practices must be maintained throughout the proposed development projects. They also agree that the community should have an integral role in the ultimate planning of how these resources shall continue to be managed, preserved and perpetuated during and after the completion of the proposed project, as to avoid over-exploitation of larger cultural and natural resources found within the ahupua‘a of Waikapū and its surrounding environmental and cultural landscape.

TABLE OF CONTENTS

1.0 INTRODUCTION……...4
1.1 Guiding Legislation for Cultural Assessment……..5
1.2 Scope…….....6
2.0 APPROACH AND METHODOLOGY……..7
3.0 CULTURAL-HISTORICAL OVERVIEW……...8
3.1 Cultural Perspective of Island Formation and Habitation……8
3.2 Modern Perspectives of Colonization and Habitation…….....8
3.3 Evolution of Hawaiian Land Tenure……9
3.4 Impacts on Hawaiian Land Tenure Due to Great Māhele……...11
3.5 Following the Great Māhele……..12
4.0 SETTLEMENT PATTERN OF WAILUKU (NĀ WAI ʻEHĀ)…….....13
5.0 INTRODUCTION TO WAIKAPŪ……..……..16
5.1 Meaning of Name…….16
5.2 Cultural and Historical Boundaries…….……..18
6.0 CULTURAL AND NATURAL LANDSCAPE……19
6.1 Kai (Coastal Region)…….……19
6.2 Kula (Plains Region / Isthmus)…..……25
6.3 Uka (Upland Region)…….……31
6.3.1 Watershed……...31
6.3.2 Water Resources……32
6.3.3 Pre-contact Hawaiian Agriculture……..35
6.3.4 Other Cultural Sites of Significance……...39
7.0 WAIKAPŪ SUGAR PLANTATION HISTORY……41
7.1 Sugar Plantation Agricultural History……...44
8.0 WAIKAPŪ TOWN AND COMMUNITY……51
9.0 TRADITIONAL HAWAIIAN USES AND PRACTICES IN PROJECT AREA……52
10.0 CURRENT USES AND TRADITIONAL PRACTICES IN PROJECT AREA……53
11.0 ORAL INTERVIEWS……54
11.1 Faith Epp and Dawn Mahi……55
11.2 Wally Rogers……58
11.3 Muriel Prager……69
11.4 Dalani Tanahy……...…74
11.5 Flo Nakama……...77
11.6 Ace Miller……..84
11.7 Wallette Pellegrino……89
11.8 Keahi Bustamente..……95
12.0 CONCLUSION: SYNTHESIS OF ARCHIVAL, LITERARY, ORAL ACCOUNTS……102
13.0 POTENTIAL CULTURAL IMPACTS AND RECOMMENDATIONS……...103
14.0 INDICES OF MAHELE AWARDS…….....107
15.0 REFERENCES……...111

1.0 INTRODUCTION

Hana Pono, LLC, under contract to Planning Consultants Hawai‘i, LLC conducted the Cultural Impact Assessment (CIA) for the proposed Waikapū Country Town Development in Waikapū. The project area consists of approximately 1,290.625 acres of land. The area of concentration is located within the ‘ili (subdivision) of Aikanaha (‘Aikanahā), Kaumuilio (Kaumu‘īlio), Luapueo, Koolau (Ko‘olau), Kaloapelu, Ahuakolea (‘Āhuakōlea), Kaopala (Ka‘ōpala), Kaalaea (Ka‘alaea), Kamauhalii (Kama‘uhāli‘i), Pikoku (Pikokū), Olohe (‘Ōlohe), Loaloa, and Waihalulu, in the ahupua‘a (land division) of Waikapū, moku (district) of Wailuku (Nā Wai ‘Ehā), mokupuni (island) of Maui. These aforementioned historical parcels of lands and place names are situated within the current town of Waikapū and south of the Waikapū Stream. The proposed development consists of the following Tax Map Keys which include (2) 3-6-05:007 por., (2) 3-6-05-007, (2) 3-6-04:006, (2) 3-6-04:003 por.

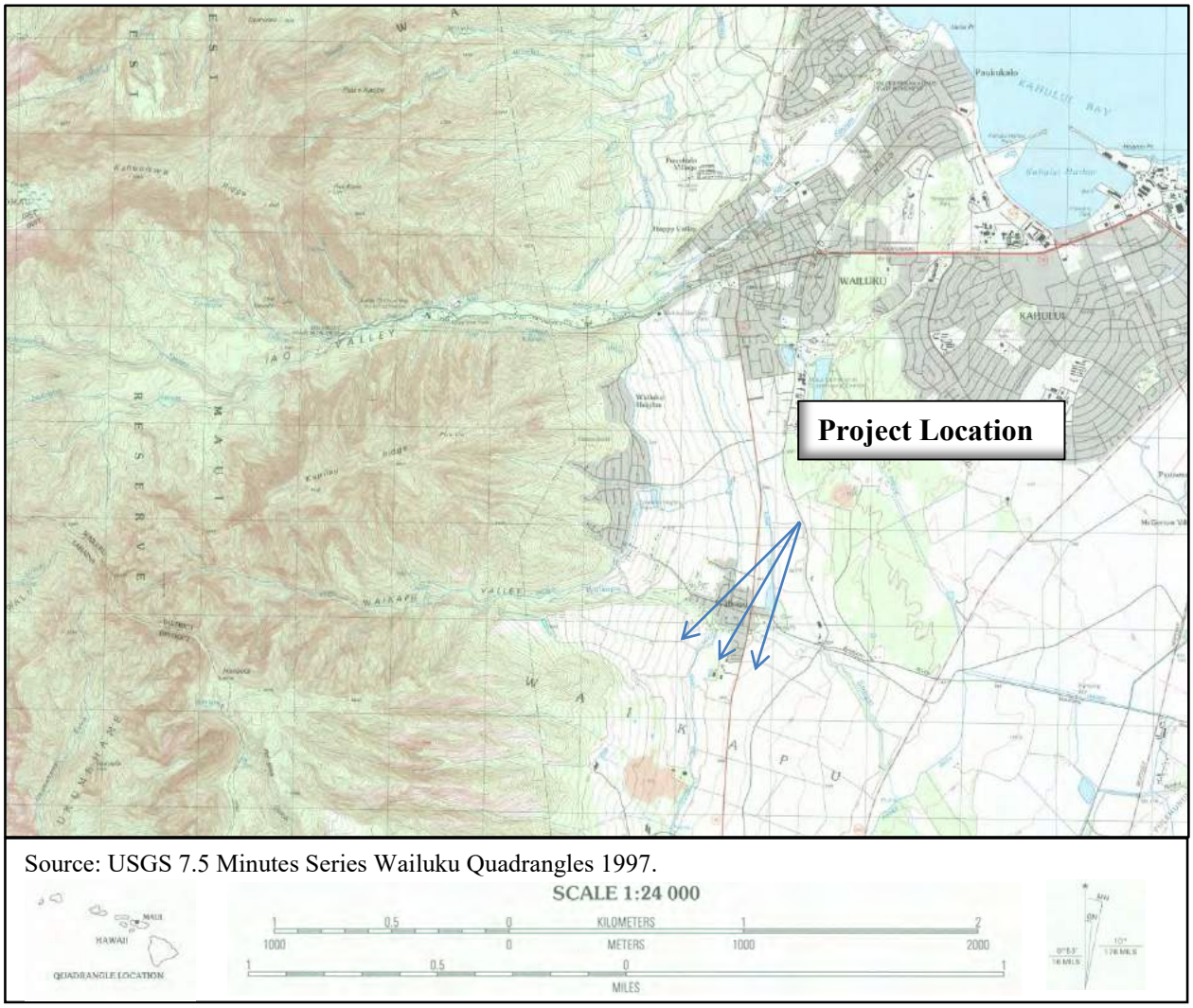


Figure 1. Project location map.

1.1 GUIDING LEGISLATION FOR CULTURAL ASSESSMENTS

This report is intended to accompany an Environmental Impact Survey compliant with Chapter 343 HRS, as well as fulfilling the requirements of the County of Maui Planning Department and the Department of Land and Natural Resources (DLNR) with respect to permit approvals for land-altering and development activities. Articles IX and XII of the Hawai‘i State Constitution, other state laws, and the courts of the state require the promotion and preservation of cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups. Specifically, the document will address potential effects on the Hawaiian culture, cultural landscapes, and traditional and customary rights of Native Hawaiians.

Guidelines for Assessing Cultural Impacts established by the Hawai‘i State Office of Environmental Quality Control (OEQC 1997) emphasize the importance of examining the various types of cultural practices and beliefs associated with a particular location. These may include “subsistence, commercial, residential, agricultural, access-related, recreational, and religions and spiritual customs” (ibid. 1997). OEQC does not differentiate between manmade traditional cultural properties and natural properties which may have traditional cultural significance. Therefore, the entirety of the project area, whether modified or natural, is the subject of this inquiry. These Guidelines also amend the definition of “significant effect” to include adverse effects on cultural practices.

OEQC further suggests the methodology to be followed in the preparation of a Cultural Impact Assessment. These are enumerated as drawn from the “Guidelines for Assessing Cultural Impacts” (OEQC)

1. A discussion of the methods applies and results of consultation with individuals and organizations identified by the preparer are being familiar with cultural practices and features associated with the project area, including any constraints or limitations which might have affected the quality of the information obtained.
2. A description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken.
3. Ethnographic and oral history interview procedures, including the circumstances under which the interviews were conducted, and any constraints or limitations which might have affected the quantity of the information obtained.
4. Biographical information concerning the individuals and organizations consulted, their particular expertise, and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or interviewed, their particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area.
5. A discussion concerning historical and cultural source materials consulted, the institutions and repositories searched, and the level of effort undertaken. This discussion should include, if appropriate, the particular perspective of the authors, any opposing views, and any other relevant constraints, limitations or biases.
6. A discussion concerning the cultural resources, practices and beliefs identified, and, for resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site.

7. A discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area, affected directly or indirectly by the proposed project.
8. An explanation of confidential information that has been withheld from public disclosure in the assessment.
9. A discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs.
10. An analysis of the potential effect of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place.
11. A bibliography of references, and attached records of interviews which were allowed to be disclosed.

1.2 SCOPE

The intent of this assessment is to define information related to the practices and beliefs of native Hawaiians within the project region. It shall also identify traditional, historical, or other noteworthy practices, resources, sites, and beliefs attached to the project area in order to analyze the impact of the proposed development on these practices and cultural features. Information was also collected by interviewing and consulting with lineal descendants, kūpuna, and long standing residents who have in-depth knowledge of this area. "The geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment. An ahupuaʻa is usually the appropriate geographical unit to begin an assessment of cultural impacts of a proposed action, particularly if it includes all of the types of cultural practices associated with the project area. In some cases, cultural practices are likely to extend beyond the ahupuaʻa and geographical extend of the study area should take into account those cultural practices." (OEQC, Guidelines for Assessing Cultural Impacts, Nov. 9th, 1997)

2.0 APPROACH AND METHODOLOGY

While the study of focus is limited to portions of the ahupuaʻa of Waikapū that lie within the current Waikapū Town vicinity, in an effort to provide a comprehensive and holistic understanding of the current study area, this report will examine the entire ahupuaʻa of Waikapū and its relationship to neighboring ahupuaʻa within the larger context of Wailuku (Nā Wai ʻEhā) moku. As there have been some previously reported cultural studies in the ahupuaʻa of Waikapū, this current study shall bring forth new documentary materials that have not been previously, or widely reported, as every source of archival-historical information for Waikapū could be located was investigated. Archival-historical literature from both Hawaiian and English language sources was reviewed and translated, and includes an extensive examination of the Hawaiian land tenure through Hawaiian Land Commission Award (LCAw.) records from the Māhele ʻĀina (Land Division) of 1848; Boundary Commission Testimonies and Survey records of the Kingdom and Territory periods; and topographical accounts. This study also includes multiple Native Hawaiian accounts from Hawaiian language newspapers (compiled and translated by Hōkūao Pellegrino) as well as historical records authored by eighteenth and nineteenth century visitors and tenants of the ahupuaʻa of Waikapū.

Extensive archival-historical sources researched for the purpose of this assessment were gathered from collections of the Hawaiʻi State Archives, Land Management Division, Survey Division, Bureau of Conveyances, State Historic Preservation Divion, Bishop Museum Archives, Maui Historical Society, University of Hawaiʻi-Mānoa Hamilton Library, private family history collections and on-line databases such as Papakilo and Kīpuka. Records represent findings from research conducted by the author for the specific purpose of this study, as well as materials collected by him over the last 10 years. This assessement includes many references not previously cited, and in some cases not previously translated from their original texts, until the present time. Among the vast amount of historical resources used for this document, an index and compilation of 450 pages of Māhele ʻĀina (Land Division Records from 1848-1860) associated with lands contained in the project area was completed.

Ethnographic interviews and field visits were conducted with knowledgable individuals. Those interviewees that had participated in the study were either born and raised in Waikapū, is a current land owner in Waikapū, and/or has extensive knowledge of the ahupuaʻa and cultural resources of this area. Additionally, these oral interviews reflect the recollections of many native Hawaiian families with generational links to the ahupuaʻa of Waikapū. Individuals completely understood that conducting the interviews was for the purpose of completing a Cultural Impact Assessment for the Waikapū Country Town Development.

3.0 CULTURAL-HISTORICAL OVERVIEW OF HAWAIIAN CULTURAL BELIEFS AND PRACTICES ASSOCIATED WITH LAND AND RESOURCES

The purpose of this section is to explain how Hawai‘i’s land and resources were utilized by Hawaiians. This includes the origin of the islands, settlement and population expansion, traditional Hawaiian beliefs and practices that pertain to managing land and resources.

3.1 CULTURAL PERSPECTIVE OF ISLAND FORMATION AND HABITATION

Hawaiians viewed cultural and natural resources one and the same. The formation of the pae ‘āina (Hawaiian Islands) and the life that came forth on the land is based on genealogical accounts. All forms of Hawai‘i’s natural environment was considered as life. This includes but is not limited to such things as the lani (heavens), mauna (mountains), awāwa (valleys), kahawai (streams), kula (open plains), ‘a‘a (lava fields), manu (birds), holoholona (animals), i‘a (fish), and kahakai (ocean). All forms of life both animate and inanimate were and continue to be believed by Hawaiians as embodiments of their akua (gods and deities). One of many ko‘ihonua (genealogical accounts) in Hawai‘i speaks to that of Wākea (expansive sky, sky father) and Papahānaumoku (Papa, who gave birth to the islands, mother earth), also known as Haumeanuihānauwāwa (Great Haumea who is born over and over again). These two gods and creative forces of nature, gave birth to the Hawaiian Islands. As the account continues, the birth of the island of Maui is described as occurring. Following the birth of all of the islands, Wākea and Papa who are the parents of the islands, are also noted as the mother and father of Hāloanakalaukapalili (long stalk, quivering and trembling kalo leaf). Hāloanakalaukapalili was a keiki alualu (stillborn child). Thus, he was buried outside of his parent’s house and from his earthen grave grew a kalo (taro). Papahānaumoku became pregnant again and gave birth to their next male child who was also called Hāloa (long stalk or breath of life). Hāloa who was a healthy human is credited as being the progenitor of the Hawaiian people. It was through these genealogical ties, that Hawaiians had a strong relationship with their land resources.

3.2 MODERN PERSPECTIVE OF COLONIZATION AND HABITATION

Cultural anthropologists, archaeologists and historians alike describe the Hawaiian Islands as being inhabited based on settlement patterns throughout Polynesia by means of wa‘a kaulua (double hull canoes) navigating throughout the Pacific Ocean. Archaeologists conclude that Polynesians arrived in Hawai‘i via the Marquesas and Society Islands by ca. 400 A.D.. Reoccurring long distance voyages were generally thought to be taking place by the 13th century (cf. Cordy 2000).

Initial settlement in Hawai‘i took place along the ko‘olau (windward) shores. These areas encompassed vast water resources from perennial streams due to abundant rainfall. Streams gave way to highly productive agricultural lands in which crops such as kalo (taro) could grow. The ko‘olau region also offered sheltered bays from which deep sea fisheries could be easily accessed and near shore fisheries that were enriched by the nutrients from streams allowing for the development of inland and coastal fishponds. Hawaiians established kauhale (groups of homes) and thriving communities that engaged in subsistence farming and fishing.

As the koʻolau region became more populated and crowded by A.D. 800 to 1000, Hawaiians started to expand to more remote kona (leeward) areas. Although these lands did not encompass vast water resources such as those found in the koʻolau, leeward areas provided sheltered bays, expansive fisheries, and agriculture. Some of the most fertile soil in the islands are in the forested uplands which provided sufficient rainfall for growing crops such as ʻuala (sweet potato), kalo (taro), ʻulu (breadfruit), and uhi (yams). The upland forests also proved to be important for the gathering of natural resources such as wood for tools, house construction, and weapons, plants for lāʻau lapaʻau (herbal medicine), as well as the bird feathers used in the creation of ʻahuʻula (cloaks and capes) for the aliʻi (chief and chiefess). The land divisions and districts of Honuaʻula, Kahikinui and Kaupō are examples of inhabitited areas located on the leeward slopes of Haleakalā.

3.3 EVOLUTION OF HAWAIIAN LAND TENURE

Following the settlement and expansion period which occurred between the 12th and 16th centuries, Hawaiians began to develop a sophisticated and complex system of land, water, and resource management practices. Sustainability was the basis for which this comprehensive land system was developed. Hawaiians upon their arrival in the islands realized the resources that surrounded them were finite, therefore establishing a system which included very detailed laws around the use and management of the land and resources was imperative. Therefore, lands were divided beginning with the large land mass such as a moku (district) all the way down to a moʻo ʻāina (small strip of land). Each division had a name and defined boundaries. Knowledgeable individuals and groups of people within these divisions were trained to retain the knowledge of these divisions, and such knowledge was carefully passed on from generation to generation.

Land was held in trust for the akua (gods), by the aliʻi and mōʻī (chiefly class) and by kahuna (priests) who interceded with the akua (Creed). In turn, they provided for those ranking below them. Aliʻi and mōʻī in the 18th and 19th century established island governors known as Kuhina Nui who then then chose regional aliʻi and konohiki (land managers) to oversee the management of resources in each ahupuaʻa. Konohiki would establish rules and regulations specific to that region while providing land to makaʻāinana (commoners) for use of farming, fishing, gathering, and housing. At the time of a passing, the land was generally reverted to the ruling chief of that ahupuaʻa and was redistributed as needed. The ahupuaʻa system was a detailed system whereby land was managed from mauka to makai (mountain to the sea).

It was common for Hawaiians to make divisions of lands following mountain ridges, the bottom of ravines, the center of a stream or river, a shoreline, and so on. Oftentimes, a boundary line was defined by a line of growth of a certain type of tree or grass, and maybe sometimes only by a stone. This complex system was revered and understood in great detail by Hawaiians. When Westerners arrived in Hawaiʻi, the traditional land system made it challenging when they were creating areas to live and developing communities.

After Hawaiʻi was united by Kamehameha I, there were no changes in the traditional land system. As the supreme ruler of the Kingdom, he owned all of the land and was privileged to choose the tracts of land that he wanted for himself and to delegate the rest to the care of his loyal chiefs. Lesser chiefs such as Konohiki were given the opportunity to own and manage ahupuaʻa. The last in line were the makaʻāinana (working class), most of whom were farmers and fishermen who

lived on plots of land at the pleasure of their chiefs. They paid taxes with a portion of the products grown on their land and caught from the sea.

Lands in Hawai‘i were divided by the following terms and descriptions provided below.

Pae ‘Āina: This land division means group, cluster of land. It refers to all of the Hawaiian Islands together; Hawai‘i Pae ‘Āina. Until Kamehameha I unified the archipelago under one rule, the people thought and spoke of them as individual island chiefdoms since they were divided politically. Pae ‘Āina continues to be referred to as an archipelago of the Hawaiian Islands today.

Mokupuni: This land division means island and referred to an entire island as a political land division which was ruled by a high chief (ali‘i nui). The ruler of a mokupuni might have also been called an ali‘i ‘ai aupuni or ali‘i mokupuni. Their reign may have included more than one island or just part of one island. For example, at the time of Captain Cook’s visit (1778-1779), the island of Maui (except for Hāna), Moloka‘i, Lāna‘i and Kaho‘olawe were under the rule of Kahekili. Today, mokupuni is commonly known as an island.

Moku: A moku is a large district within a mokupuni and was traditionally ruled by the ali‘i ‘ai moku. This chief was appointed by an ali‘i nui. Today, moku continue to mean district and many still follow the same boundaries as they were in the time of the Kamehameha’s and the Hawaiian Kingdom. There are 12 moku on the island of Maui (Wailuku, Kā‘anapali, Lāhainā, Hāmākuapoko, Hāmākualoa, Ko‘olau, Hāna, Kīpahulu, Kaupō, Kahikinui, Honua‘ula, and Kula). Although Maui is not the largest island in Hawai‘i, it consisted of the most moku out of any island. Moku varied in size, usually in the thousands of acres.

Ahupua‘a: Nearly every ahupua‘a was a tract of land extending from the summit of the mountain to the sea and on to the outer edge of the reef. If there was no reef in that particular ahupua‘a, the boundary would extend into the sea a distance that would be around a mile and a half by our present-day measurement. Ahupua‘a literally means a pig’s head carved of kukui wood that was placed on an altar of stones to mark a certain boundary line. Ahupua‘a ranged in size from 50 acres to over 100,000 acres. The ahupua‘a of Waikapū in the moku of Wailuku was roughly 16,000 acres. These land divisions have various plant zones from the rainforest down to the coast, providing most of the needs of the communities within it. Other resources found within an ahupua‘a range from streams, fertile agricultural lands for planting food crops and plants for medicine and material goods, wetlands, fishponds, sand dunes, and stone quarries for adze making. The activities of the people within the ahupua‘a were under the direction of an appointed chief known as an ali‘i ‘ai ahupua‘a, or konohiki. There was a constant sharing of food and useful products between families and the families paid taxes to their ali‘i ‘ai ahupua‘a or konohiki in the form of their handcrafts and the products cultivated from their farms or caught from the sea.

On the island of Maui, there is a unique situation in the moku of Lāhainā whereby the ahupua‘a are segregated and do not run continuously from mauka to makai. Rather, you may find three of the same ahupua‘a names in different regions of the moku. For example, the ahupua‘a of Polanui can be found in the upper mountain region, in the plains, and another near the shoreline. There are more ahupua‘a in the moku of Lāhainā than any other moku in Hawai‘i, surpassing 70. Understanding the ahupua‘a system of Lāhainā is one of the most complex and fascinating cultural features of Maui.

‘Ili: ‘ili are small strips or subdivisions of land found within an ahupua‘a. Like the ahupua‘a, these lands also had specific names which were usually connected to a particular plant, cultivated crop, geological feature, or a particular activity. An example of this is on Maui would be the ‘ili of Lo‘iloa which is found within the valley of ‘Īao in the moku of Wailuku. Lo‘iloa consisted of numerous lo‘i kalo for which this name represents. Sometimes ‘ili run mauka to makai and are called ‘ili pa‘a or a fixed land section. If ‘ili consisted of detached pieces of land, it was known as ‘ili lele or lele which means that they jump around. This also means that ‘ili with the same name could be along near the coast, another in the valley, and a third section in the upland forest. There were also ‘ili kūpono or shortened to ‘ili kū, which were subdivisions within an ahupua‘a yet independent of it and its chief. Anything that these lands provided went directly to the ali‘i nui.

Other Land Terms of Importance: There were even smaller parcels of land that were found within ahupua‘a and ‘ili. These lands were also of great importance and usually referred to cultivated plots of land. The mo‘o was the next in size to the ‘ili and was set aside for cultivation only. Inside of a mo‘o were even lesser tracts of land called paukū which were also set aside for cultivation. The patches of land cultivated by the common farmer for their chief or landlords were called kō‘ele. During and after the time of the Māhele of 1848, farmers worked only on Friday’s for their landlords and these patches became known as Po‘alima, meaning Friday. The smallest unit of land was called a kīhāpai, and was cultivated by a tenant-farmer for himself and his family. Other small plots of lands for farming were lo‘i, māla, and kula.

3.4 IMPACTS ON HAWAIIAN LAND TENURE DUE TO GREAT MĀHELE

Māhele Nui (Great Māhele): The foreign population greatly increased during the early years of King Kamehameha III (Kauikeaouli), around the 1820s. At the same time, the Hawaiian population was decreasing mainly due to introduced diseases and psychological conditions. Many foreigners put pressure on the chiefs and Hawaiian Kingdom to provide them land to establish port towns, stores, businesses, schools, and churches particularly in Honolulu, Lāhainā, and Hilo. Foreigners began to demand the right to own land outright. Some of them saw the possibilities in types of agriculture, such as growing sugar cane, which would require large tracts of land in order for them to profit.

In 1848, Kamehameha III (Kauikeaouli) introduced the Great Māhele which divided the lands for the first time and allowed individuals to own the lands that they lived or worked on. The Great Māhele or “not so Great Māhele” as it is sometimes known, divided the lands into Crown Lands (King’s Lands), Government Lands, Konohiki Lands, Fort Lands, School Lands, and Kuleana lands. Approximately 1,000,000 were reserved by Kamehameha III as Crown Lands, 1,500,000 acres were given by the king to the government and people, and less than 30,000 acres of kuleana land was awarded to the native tenants. Kuleana lands were considered some of the best land for cultivation of kalo and other crops. Kuleana lands also had specific rights to them, especially as it pertained to water from streams and ‘auwai. The awarding of these lands brought to an end the ancient system of land tenure in the Hawaiian Kingdom. The Māhele which was thought of by the Kingdom of Hawai‘i to be the best solution for their citizens to own land, it has also created a multitude of challenges regarding ownership that continues to exist up until today.

Kuleana Lands: The final enactment of the Māhele process included the determination of land interests for the Makaʻāinana (commoners who were usually farmers and fisherman). The Kuleana Act was authorized by the Land Commission on August 6th 1850. The role of the Land Commission was to award fee simple title to hoaʻāina (native tenants) for their plots of land. The tenant farmer could apply for his own plot of land which was called kuleana. Kuleana lands could come from lands of the mōʻī (king), aupuni (government) or aliʻi (chiefs). Hoaʻāina were not required to pay a commutation tax since the konohiki of the ahupuaʻa or ʻili / ʻili kūpono in which the kuleana was located, was responsible for the commutation. If the kuleana owner died and had no heir, the kuleana reverted back to the owner of the ahupuaʻa or ʻili / ʻili kūpono.

Kuleana lands were some of the most fertile and richest lands in Hawaiʻi due to their high productivity of food crops based on the natural resources surrounding them (i.e. streams, irrigation ditches, springs, etc.). Restrictions on kuleana lands included that kuleana could not include the land in which a hoaʻāina had actually cultivated plus a house lot no more than a .25 acres. Another restriction was that hoaʻāina were required to pay for a survey of the lands as well as bring forth two witnesses of the surrounding area to testify to the tenant's right to the land. These testimonies which were called Native and Foreign Testimonies, provided some of the most extensive knowledge-base of that particular parcel being claimed by the native tenant. This included documenting loʻi kalo, other forms of farming plots, salt ponds, house sites, springs, rivers, ʻauwai, burials, etc…)

It is estimated that 8,205 awards were given by the Land Commission, 7,500 awards involved kuleana lands. Only 26 percent of the adult male native population of that time received kuleana lands. The 26 percent equated to only 28,600 acres of land which is much less than one percent of the total land. One of the main reasons why so little kuleana claims and so little kuleana awards were secured is due in most part to the lack of understanding of the laws or lack of money to pay for surveys. Others felt that to claim land was an act of betrayal to the chiefs or they feared reprisal from the chiefs. Many Hawaiians were unable to support themselves in a cash economy system as well as their departure from rural lands and community to find jobs in the cities. One other major reason the hoaʻāina received so little land was that kuleana grants were severely limited by the "really cultivated" clause of the act.

The Kuleana Act of 1850 also protected the rights of tenants to gain access mauka to makai and the ability to gather certain materials from that ahupuaʻa. However, the Kuleana Act did not allow hoaʻāina to exercise other traditional rights, such as the right to grow crops and pasture animals on unoccupied portions of land in an ahupuaʻa.

3.5 FOLLOWING THE GREAT MĀHELE

After the Land Commission dissolved in 1855, 1.5 million acres of land had been distributed to the aliʻi or konohiki, another 1.5 million acres had been set aside as aupuni / Government Lands, approximately 1 million acres had been retained by the mōʻī / king, and only 28,600 acres had been claimed by the makaʻāinana / hoaʻāina under the Kuleana Act.

The rights of Hawaiians and their connection to the ʻāina began to diminish while the rights of Westerners were increasing concurrently. In 1846 an act was authorized for Government Lands under the Kingdom of Hawaiʻi to be sold. Within just about four years, over 27,000 acres of land

had been sold, establishing a precedent for alienating Hawaiian lands. In 1850, another landmark decision was made in which any resident of Hawai‘i and regardless of citizenship could convey land. These changes set the precedence for extensive amounts of land and title to be transferred from Hawaiians to Westerners.

4.0 SETTLEMENT PATTERN OF WAILUKU (NĀ WAI ‘EHĀ)

The moku (district) of Wailuku (also poetically known as Nā Wai ‘Ehā) contained four ahupua‘a (land divisions). Starting from the south to the north, the four ahupua‘a are described as Waikapū, Wailuku, Waiehu, Waihe‘e. These ahupua‘a traditionally provided mauka (mountain) to makai (shoreline) access for Hawaiians. This in turn provided households, communities and individuals resources to maintain self-sufficiency and to grow thriving populations. Archaeological and historic evidence substantiates the significance of Nā Wai ‘Ehā and populations that grew beyond the shorelines of Mā‘alaea in Waikapū, Kahului in Wailuku, Ka‘ehu in Waiehu, and Kalae‘ili‘ili in Waihe‘e.

“Kaulana ‘o Nā Wai ‘Ehā” “Famous are the Four Great Waters of Waikapū, Wailuku, Waiehu, and Waihe‘e.” this well-known saying attests to the traditional, historical, and cultural significance of the four ahupua‘a within the moku of Wailuku and the abundance of fresh water resources that it provides. Wailuku or Nā Wai ‘Ehā, was once the largest continually cultivated lo‘i kalo (wetland kalo) growing region in all of Hawai‘i (Handy and Handy 1972). It also served as the primary ritual, political, and population center of Maui (Tengan 2004). The vast water resources of Mauna Kahālāwai (West Maui Mountains) supplied these four streams with the life giving waters of Kāne. This allowed the Hawaiian population of this area to develop expansive irrigation and agricultural systems unique to Hawai‘i. The rich history of Nā Wai ‘Ehā, is directly linked to the abundance of wai. Hawaiians thrived for hundreds of years and for many generations in this region by farming wetland kalo, fishing in natural and manmade inland fishponds, gathering native stream life such as ‘o‘opu, hīhīwai, and ‘ōpae, and collecting drinking water from pūnāwai (springs). Large populations solely depended upon water availability for their food sources. In the ahupua‘a of Waikapū, over 1,400 lo‘i kalo were documented via Māhele records from the 1850s. The current Wailuku Town according to Handy and Handy (1972) is constructed on old lo‘i kalo terraces, that were once fed by ‘auwai (irrigation ditches) with water drawn from Wailuku Stream. Large and expansive ‘auwai in Wailuku such as Kama and Kalani were modified for reuse when commercial sugarcane companies were established. Photographs document the extent of these lo‘i kalo in Wailuku even 100 years after the introduction of commercial sugarcane companies. In Wailuku, only about 1% of the original lo‘i kalo terraces exist and the extent of these are found in the upper reaches of ‘Īao Valley.

Given the extent of viable traditional agriculture prior to western contact, it is not surprising that a sizable population base would have resided in the area. Both Wailuku and the broader West Maui are associated with a number of ali‘i suggesting the central nature of Nā Wai ‘Ehā as a political power (Kirkendall 2011). Nā Wai ‘Ehā was home to the royal compound of Maui for many of Maui’s ali‘i. Kaka‘e was one of Maui’s notable ali‘i whom the famed “‘Īao Needle” is named after. He was the brother of Kaka‘alaneo and resided in the valley just south of ‘Īao at a place called Ka‘alāholo. The ruling chief over most of Maui when Captain Cook arrived in 1778 was Kahekili,

whose home was in the ahupua‘a of Wailuku (Kamakau 1992). Kalaniopu‘u controlled the windward districts (Beaglehole 1967).

Nā Wai ‘Ehā boasted the largest amount of heiau (religious temple) which stresses upon the relationship Hawaiians had with water and land resources. Where large populations existed due to extensive agricultural sites, religious structures were needed to pay homage to Lono, god of fertility and agriculture. There were a total of 36 heiau that were documented in Nā Wai ‘Ehā alone (Tengan 2004). These surveys were done in the early 1900s which was 120 years after western contact. It is likely that there were more heiau however with the onset of the sugar industry, many were plowed under to make way for sugarcane fields.

Figure 1. 1st Wailuku Sugar Co. Mill and lo‘i kalo terraces in foreground circa 1865 (Bishop Museum)

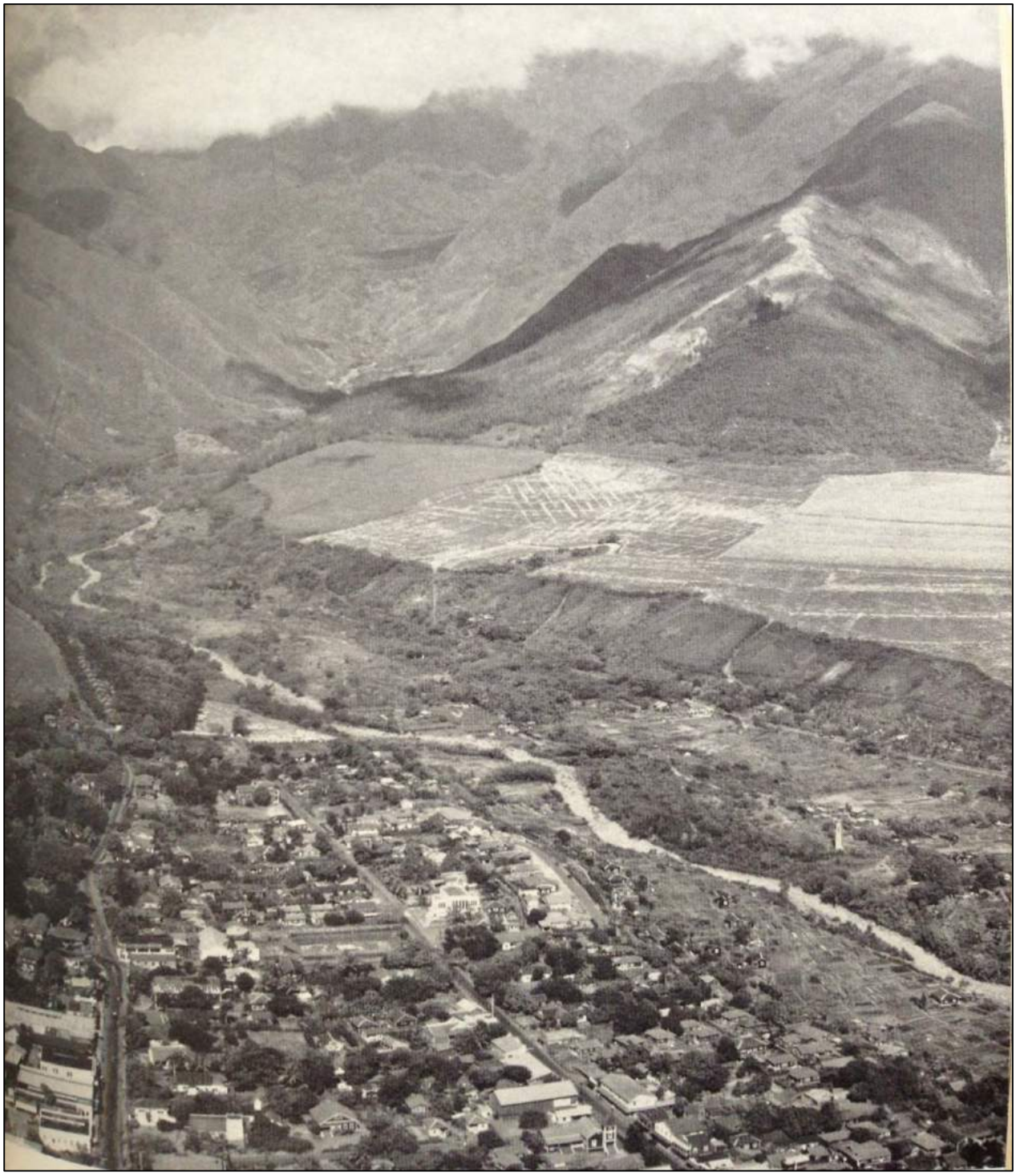


Figure 2. Aerial view of Wailuku Town, stream and remnant loʻi kalo terraces in 1940 (Stearns)

5.0 INTRODUCTION TO WAIKAPŪ

Waikapū is the first of four ahupuaʻa (land divisions) in the moku (district) of Wailuku, poetically known as Nā Wai ʻEhā (Waikapū, Wailuku, Waiehu, Waiheʻe). This district is located within the southern portion of the West Maui Mountains range named Mauna Kāhālawai (Ashdown). Waikapū is known for its gusty wind named Kokololio. Waikapū i ka makani Kokololio (Waikapū of the gusty wind) (Pukui #2911)

5.1 MEANING OF NAME

Waikapū means "waters of the conch", which was named after a sacred conch that was blown in the upland reaches of the valley by Hawaiians of that district. The name of Waikapū is described in detail from a Hawaiian Language Newspaper (Ka Nūpepa Kūʻokoʻa) dated September 21, 1872 and titled Nō Waikapū (Concerning Waikapū).

Nō Waikapū

ʻO Waikapū, e ʻōlelo ʻia nei, he wahi pana nō ia i kapa ʻia e kekahi poʻe o ka wā kahiko, a laha loa mai a hiki i kēia wä, ma muli o kēia inoa. ʻO kēia wahi nō hoʻi ʻo Waikapū, he wahi ana ia, aia i loko lilo o ke kahawai, ua mile paha a ʻoi aku ka loa mai ke kulanakauhale aku.

Aia ma ka ʻaoʻao hema o ua kahawai nei, he ana, a i loko o ua ana nei he pū, a e kani mau ana ʻo ia i nā wā a pau me ka ʻike ʻole ʻia e ka lehulehu, a he makāula naʻe no Kauaʻi ka mea nānā i hoʻolohe mai i ke kani o ua pū nei, a ua ʻimi mai ʻo ia me ka manaʻo e loaʻa.

Aia hoʻi ma ka ʻaoʻao hikina ʻākau o ua kahawai lā, mai kahi aku o ka pū e kani nei, a aia hoʻi ma luna aʻe o ka pali, he ʻīlio, ʻo Puapualenalena kona inoa, a no kona lohe nō hoʻi i ke kani o ua pū nei, ua ʻimi ikaika ʻo ia i kahi e loaʻa ai, ʻaʻohe naʻe he loaʻa iki, ʻoiai ua makaʻala loa nā mea nānā ua pū nei ma ke kiaʻi ʻana, akā, ua hoʻomau nō naʻe ua ʻīlio nei ma ka hoʻomakauliʻi ʻana i wahi e loaʻa ai.

A no ka manaʻo paha o ua mau mea nei nāna ka mea kani, ʻaʻohe kupua e lilo ai o kā lāua milimili, no laila, ua hoʻāʻo lāua ma ka hoʻohemahema liʻiliʻi ʻana, ʻaʻohe naʻe he lilo. Akā, i loko naʻe o ka lā i lilo ai iā Puapualenalena, ua palaka loa lāua ma ka hoʻomanaʻo ʻana. A no ka lilo ʻana o ua pū nei iā Puapualenalena, mai laila mai ke kani ʻole ʻana a hiki i kēia lā.

Ua lohe ʻia kona leo ma nā wahi a pau o kēia mau mokupuni, a ua lilo ia i mea hoʻouluhua i ka manaʻo o kekahi poʻe. A no kēia pū mai i kapa ʻia ai ka inoa holoʻokoʻa o Waikapū. ʻO ia ihola ka moʻolelo no kahi i loaʻa mai ai kēia inoa. He wahi mākaʻikaʻi nui ia nō hoʻi kēia e nā malihini e makemake ana e ʻike.

Concerning Waikapū

The Waikapū now being discussed, is a legendary place named by some of the ancients, and has remained until this time. This place, Waikapū, has a cave away up the stream, the distance perhaps a mile or more from the village.

On the southern side of the river, is a cave, and inside of this cave is a pū, or conch, and it sounded all the time unseen by the people, and it was a makāula, or prophet, from Kauaʻi that was the one who heard the sound of this pū, and came to seek it with the idea of obtaining it.

On the northeast side of the stream, on the opposite side of the conch that sounded above the pali, was a dog, Puapualenalena was his name, and because of hearing this pū, he sought diligently to find it, but did not succeed because those who guarded the pū were very watchful. But, this dog kept studying ways of obtaining it.

And because perhaps the keepers of the pū believed that no supernatural being would succeed in taking it away, they then tried to be a little careless, yet it was not taken. But the day Puapualenalena did get it away, they had been utterly careless. And since Puapualenalena took the pū, it sounds no more to this day.

It used to be heard everywhere in these islands and was annoying to some people. From this pū, the whole of the place was named Waikapū, Water of the Conch. That is the story of how this place got its name. It is a place greatly visited by strangers who wish to see it.

(W.K Kaualililehua, Nupepa Kuokoa, 9-13-1872) (Translated by Elspeth Sterling, Revised by Hōkūao Pellegrino)

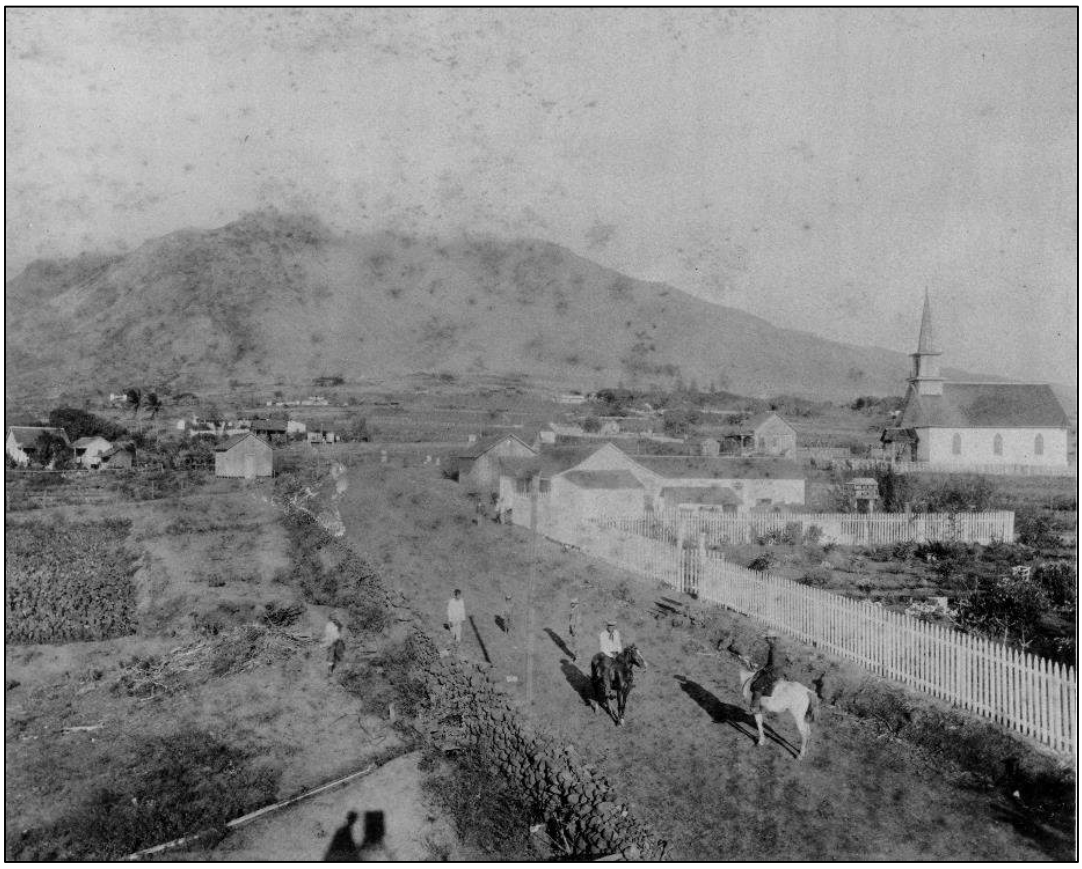


Figure 3. Waikapū Town along Waikō Road with Waikapū Protestant Church in background circa 1890 (Bishop Museum)

5.2 CULTURAL AND HISTORICAL BOUNDARIES

The traditional palena ʻāina (boundaries) of Waikapū originate from the highest peak on Hanaʻula which stands at 4,456 feet in elevation (Pukui, Elbert, Mookini). The boundary extends downward to a ridge known as Kalapaokaʻīlio, located slightly above Wailuku Heights Development followed by Pōhākoʻi, which is situated south of Kuʻikahi Road and the Honoapiʻilani Highway Intersection. It subsequently moves east to Kaʻōpala located at the Central Maui Baseyard, travels south to Kīheipūkoʻa near Keālia and the Sugar Beach Condominiums, and westward to Kapoli Spring adjacent to Buzz's Wharf Restaurant. The traditional boundary then veers north to a once famous cinder cone known as Puʻuhele and finally returns westward by means of four additional cinder cones (Puʻuhona, Puʻulūʻau, Puʻumoe, and Puʻuanu) on the Hanaʻula mountain range. (See Figure 3 for description)

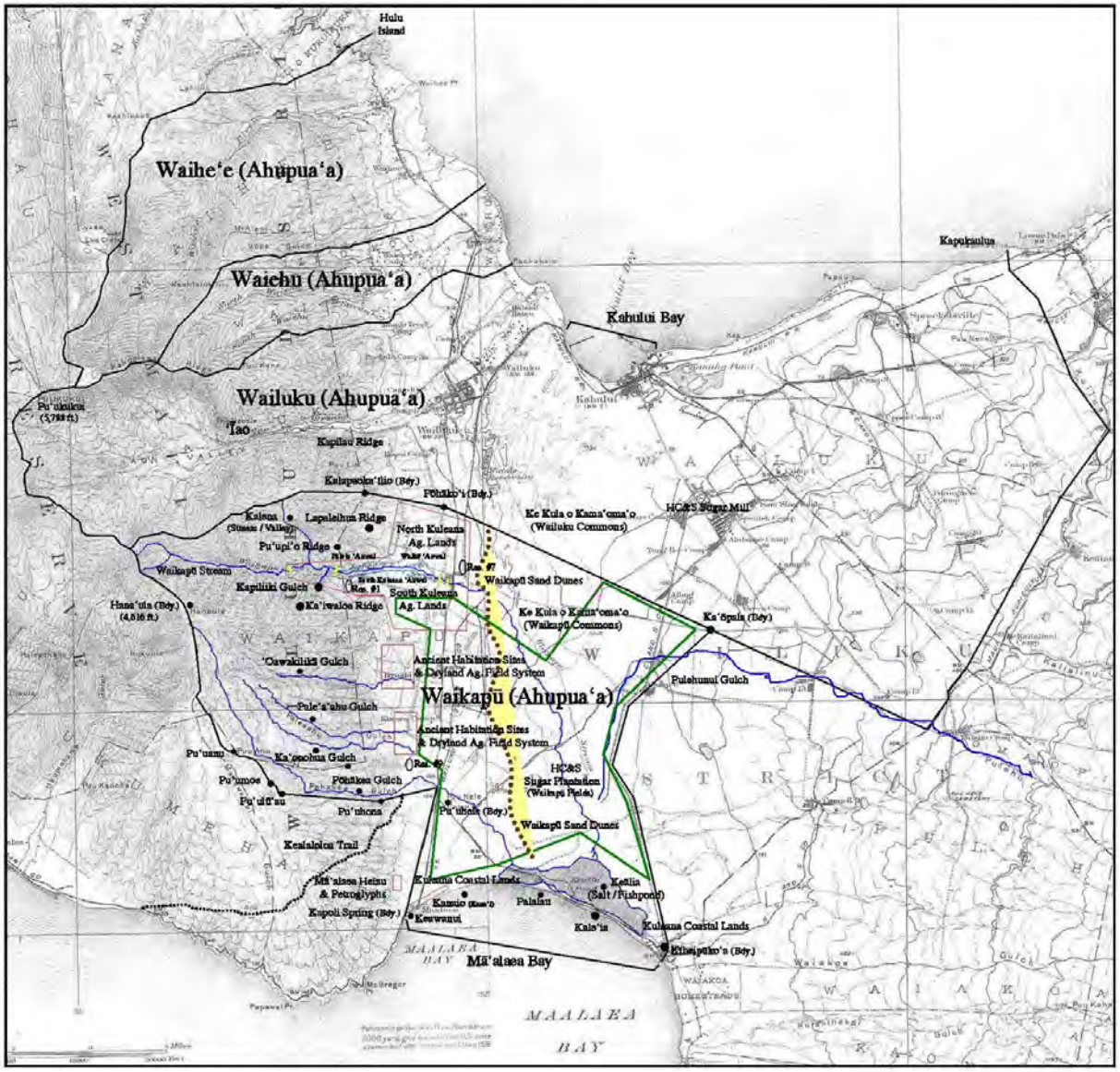


Figure 4. Palapala Hiʻonaina ʻŌiwi o Waikapū (Cultural Landscape Map of Waikapū) (Hōkūao Pellegrino 2013)

6.0 CULTURAL AND NATURAL LANDSCAPE

The natural environment of Waikapū is very diverse. It was historically and currently is an integral component of the cultural landscape. The total land mass of Waikapū, the southernmost ahupuaʻa in Nā Wai ʻEhā consists of 15,684 acres from mauka to makai (mountain to the sea). Waikapū is situated between latitudes north 20°47ʻ30" and south 20°52ʻ30", west 136°and east 156°27ʻ30"m and can be located on the U.S.G.S. 7.5 minute series topographic maps of Māʻalaea and Wailuku Quadrangles on Maui. The boundaries (fig. 4) are defined by historical map references and boundary commission determinations established in the mid to late 1800s.

6.1 KAI (COASTAL REGION)

The coastal region of Waikapū is located at Māʻalaea Bay. This area is expansive and historically provided an abundance of fish and other marine resources for Hawaiians living along the shore and inland (Interview: William Garcia). There were a number of fisheries documented on historical maps (see figure 4). On the western portion of Māʻalaea was an ancient fishing village which included fishing koʻa (fishing shrines), kauhale (housing compounds), tool making sites, heiau (ceremonial centers), and kiʻi pōhaku (petroglyphs). At the center of this fishing village was once a fresh water spring named Kapoli. Kapoli was used as a boundary point between the ahupuaʻa of Waikapū and the ahupuaʻa of Ukumehame, Lāhainā. Between the boundary of Kapoli Spring to the West and Kīheipūkoʻa on the east, was Keālia, once Maui's largest wetland. An ancient inland fishpond and famous salt ground were located in and around Keālia. On the western edge of Keālia was a puʻu (cinder cone) named Puʻuhele. This puʻu was culturally significant due to the spiritual connection it had with the people of Waikapū as well as it being a significant traditional boundary marker. (Sterling)

Kapoli and Waikui Spring

There were three big rocks in front of Kapoli Spring used by Old Hawaiians when placing the piko of a newborn child in an empty hollow and then placing a stone on top of it. The people believed that this would ensure that the child would always be with the mother and will not desert the parents during their lifetime. Kapoli Spring accompanied a pūnāwai (pond) and the entire place around the spring (which was about the size of a small courtroom) is what is called Kapoli. Just beyond the Waikapū boundary is the ahupuaʻa of Ukumehame, where there was another spring called Waikui that had less water in it than Kapoli Spring. These are the only two springs along the coast of Waikapū that were known. During the high water, salt water invaded Kapoli Spring. Kapoli Spring also varied in terms of size; in the spring it was larger and in the summer and fall, it became smaller.
(Kamaka Kailianu - Boundary Commission Hearing No. 230. 1935)

Notes on Māʻalaea

Inez Ashdown, a well-known Maui informant, reported in 1971 that she was shocked to find the Māʻalaea village stones carried away by the original Harbor contractor in 1952, after she had surveyed and marked over 40 cultural sites for preservation. The piko stone and adze sharpening stone in front of Buzzʻs Wharf

restaurant are the only remnants of the ancient village. Kapoli Spring was covered up by the harbor's restrooms and cesspool. The harbor was built by a culture that had just won a war against mighty nations and then declared war again, but on the natural and cultural environment.

(Inez Ashdown, Notes on Māʻalea, 1971)

Figure 5. Māʻalaea Bay circa 1918 (Bishop Museum)

Winslow Walker who studied archaeological sites on Maui, notes an unnamed heiau and petroglyphs located "a quarter-mile from the village of Māʻalaea at the base of the foothills of the West Maui Mountains." It is hard to decipher whether Walker is referring to the ancient Hawaiian village that once existed at Māʻalaea or to the historic wharf and related structures which were built at a later time. Both sites however are identified by State site numbers 1441 and 1287. The following describes in further detail the cultural features that Walker observed and noted in the Māʻalaea coastal region.

Habitations in Māʻalaea

Walker located house and shelter sites at Māʻalaea (1931). He described their location near about two miles west of Māʻalaea village to McGregor's point, there are house and shelter sites….in great number above the road. At least forty-five were noted. It seems that Walker uses Māʻalaea Village to refer to the historic wharf, commercial buildings and native houses shown on Jackson's 1883 government survey. The wharf, although dilapidated, was still present in 1902 and the construction of the present harbor begun in the 1950s (Joerger and Kaschko, 1979), presumably in the same location. The southern portion of Walker's house and shelter sites was grouped under State of Hawaiʻi site number 50-50-09-1441 and called the McGregor Point C-Shapes during the 1973 state-wide inventory survey, while the northern portion of these same sites is called the Māʻalaea Complex and assigned site number 50-50-09-87 (DLNR 1973). It would appear that no dating has been done at this complex of sites.

Ko‘a

Walker also described a ko‘a or fishing shrine at Mā‘alaea (1931) which was likely destroyed or buried or may be part of the Mā‘alaea Complex but is not relocated by anyone else. Walker explains “One of the most interesting ko‘a found was the one near the ancient village on the slopes above Mā‘alaea Bay. It has the shape of a horseshoe 8 ½ feet long. A semicircular wall 2 feet high and the same in thickness encloses a platform of rocks not more than one foot above the ground. The flat area of this platform is 6 feet wide and consists of a row of small stones set on edge. Chunks of coral were strewn over the platform and in one corner a quantity of fish bones and shells were found. This is the only ko‘a site on West Maui which can be recognized with any certainty, through doubles there were many more which have now been destroyed” (p. 61 photo B.M. 14705) (Walker 1931:58)

Petroglyphs

There are 2 State sites 50-6-09-1169 with 8 petroglyphs and 50-50-09-1199 with 10 petroglyphs. Walker assigns the heiau a field number (#1) and it is the only archaeological site located on his survey map. He also provides a scale drawing of the heiau and its spatial relationship to numerous petroglyph boulders. The heiau had not been assigned individual state site numbers and are not specifically noted in the inventory survey although it is possible that one or both are inadvertently included in State site no. 50-50-09-1287. The petroglyphs have received greater attention since Walker’s survey and have been notated in a number of publications.

Grinding & Piko Stones

There are 2 cultural stone features that were documented in the village of Mā‘alaea. The first being State site no. 50-50-09-1286 which was a hoana or grinding stone and State site no. 50-50-09-1440 which was a piko stone. The two boulders with known cultural significance are at Mā‘alaea Harbor near the current Buzz’s Restaurant. The hoana was a stone in which ko‘i or adzes were sharpened on the other being a depository for the piko or umbilical cords of newborn children. During the Boundary Commission testimony indicates placing the piko of a child “would ensure that the child will always be with the mother and will not desert the parents during their lifetimes”. The grindstone was initially removed from the ocean during the construction of Mā‘alaea Harbor. It is unclear where the piko stone was originally located. There was a piko stone described in the Boundary Commission testimony as originally located at Kapoli Spring. This may likely have been one in the same.

Figure 6. Māʻalaea Petroglyphs in 2004 (Landraff)

Figure 7. Hoana grinding stone in 2012 (Hōkūao Pellegrino)

The ʻili of Keālia was a significant cultural and natural resource for the ahupuaʻa of Waikapū. It was Maui's largest wetlands spanning over 500 acres. (U.S. Fish and Wildlife) Keālia literally means salt encrustation and was known for making excellent salt by Hawaiians and for trading with early explorers. (Sterling) Keālia is the name and site of a former loko iʻa puʻeone or inland fishpond. At one time, it was probably full of awa (milkfish) and ʻamaʻama (mullet). Keālia was fed by intermittent and perennial streams from both Mauna Kahālāwai and Haleakalā, a watershed spanning 56 square miles. Waikapū Stream was the main source of fresh water for Keālia followed by Paleʻaʻahu and Pōhākea intermittent streams from Mauna Kahālāwai. (U.S Fish & Wildlife) There was one intermittent stream from Haleakalā which fed Keālia. There are numerous references for the name of the stream which derived from the Pūlehunui ahupuaʻa in the moku of Kula. In an 1870 Waikapū-Pulehunui boundary dispute, the names of the stream that fed Keālia from Haleakalā was referenced as either Pūlehunui, Kaʻōpala, or Kailinawai. These names derived from native tenants from both Waikapū and Pūlehunui ahupuaʻa.

There were numerous kuleana land claims in the ʻili of Keālia on the southeast and southwest boundaries; that of Kapoli, Māʻalaea and Kīheipūkoʻa. There was a total of 22 moʻo paʻakai (salt lands/ponds) that were claimed during the Māhele. Paʻakai or salt was an important part of the Hawaiian diet and was used to cure fish and preserve foods. When early explorers, missionaries, and whalers arrived in Hawaiʻi, salt became an important resource for tradiing.

Salt Pans at Keālia

> Feb. 1, 1817, we now made sail towards Mowee (Maui), our ship, as usual, full of natives. Next morning we passes Morokenee (Molokini), and made sail up Macherey (Māʻalaea) Bay; Here we lay until the 6th, and took on board a great quantity of hogs, salt, and vegetables. This bay is very deep and wide, and nearly divides the island, there being but a narrow neck of land and very low, keeping the two parts of the islands together. There is good anchorage; and the only danger arises from the trade winds, which blow so strong at times as to drive ships out of the bay with two anchors down; it lies N.E. and S.W. and is well sheltered from every other wind. The neck of land is so low, and the land so high on each side, that the N.E. trade comes through like a hurricane. ON this neck of land are their principal salt-pans, where they make most excellent salt. Our next station was in Lehina (Lāhainā) roads. This beautiful village has the appearance of a find garden, laid out with the greatest taste in fish-ponds, tarrow (kalo) patches, cane patches, groves of bread fruit and plantain trees, so delightfully arranged that nothing can surpass it. On the 9th, the brig, full of hogs and natives, got under way from this romantic spot, bound for Woahoo (Oʻahu).
>
> **(P. Corney, Voyages in the Northern Pacific. Narrative of Several Trading Voyages From 1813 to 1818)**

Figure 8. Portion of Keālia Wetlands circa 1890 (Bishop Museum)

Currently, Keālia is no longer an active fishpond nor a permanent wetland mainly due to a number of human impacts. Since the mid to late 1800's, Waikapū Stream has been diverted almost entirely for sugar cultivation. The redirection of stream flow has shrunk the size of Keālia down to less than 100 acres. The water that exists in Keālia is provided by two wells that are pumped daily along with intermittent rainfall. Waikapū Stream along with the intermittent streams only reach Keālia in torrential rain events, in which stream water flows over and beyond sugar plantation diversions. Keālia is currently managed by U.S. Fish and Wildlife Services as a native bird sanctuary and is home to a number of endangered native birds species and other native species that utilize the wetlands annually. (U.S. Fish and Wildlife)

Figure 9. Aerial shot of the Keālia Wetlands in 2012 (Hōkūao Pellegrino)

Figure 10. Palalau estuary located south of Keālia Wetlands in 2011 (Hōkūao Pellegrino)

Figure 11. Waikapū Stream flowing out into Māʻalaea Bay via Keālia Wetlands 2011 (Hōkūao Pellegrino)

6.2 KULA (PLAINS REGION / ISTHMUS)

Prior to Western contact, the isthmus or plains located between Mauna Kahālāwai and Haleakalā were called Ke Kula o Kamaʻomaʻo or Kamaʻomaʻo. (Pukui) Following Western contact, they were called the Waikapū Commons. It was the largest desert plains in Nā Wai ʻEhā. It included a prominent sand dune system that extended from Waikapū to Waiheʻe. The sand dunes served as a final resting place for a multitude of iwi kūpuna (ancestral bones) who once lived in this region. The sand dunes of Nā Wai ʻEhā and especially those in the ahupuaʻa of Waikapū were key battle ground areas prior and during the time of Kamehameha I. (Sterling) There were noted trails that Hawaiians would utilize within Kamaʻomaʻo from Waikapū to the moku of Kula or Honuaʻula and its many ahupuaʻa. (Government Survey Maps) There were no documented land claims in the Kamʻomaʻo portion of Waikapū. Other than the expansive sand dune system, intermittent and perennial streams flowing from Mauna Kahālāwai and Haleakalā into Keālia, Kamaʻomaʻo was dry, desolate, and was likely a forest of native shrubbery. There were numerous Hawaiians who had kuleana land claims in both Waikapū and Kula (Creed). The claims noted wetland kalo cultivation in Waikapū and ʻuala cultivation in Kula. Kamaʻomaʻo was also known as a leina a ka ʻuhane, or a leaping off place for Maui where the soul after death found its way to the afterworld. This would be similar to that of the leina of Puʻu Kekaʻa in the moku of Kāʻanapali. It seems that Kamaʻomaʻo was a place to pass through rather than a place of residence or activities. Kamaʻomaʻo was later called the Waikapū Commons when it was utilized by the Waikapū Sugar Company under William Cornwell and Hawaiian Commercial Sugar Company under Clause Spreckels. The famed Puʻuhele (Traveling Hill) existed on the outskirts of Kamaʻomaʻo on the way to Māʻalaea. It was an important vantage, boundary and later survey point for Waikapū.

> **Ke Kula o Kamaʻomaʻo**
>
> The worst fate that can befall a soul is to be abandoned by its ʻaumakua and left to stray, a wandering spirit (kuewa) is some barren and desolate place, feeding upon spiders and night moths. Such spirits are believed to be malicious and to take delight in leading travelers astray; hence the wild place which they haunt on each island are feared and avoided. Such are the plains of Kamaʻomaʻo on the island of Maui….
> **(Beckwith 170:154)**

> **Legend of Puʻuhele – The story of a hill that moved over Maui and helped to win a war**
>
> Schoffers (atheists) will say the old Hawaiian predictions are mere superstitions, while a modern "malihini" might murmur "What a lotta bunk!" The "kamaʻāina" looks wise and listens, for he knows of too many predictions and legends which have come true, and therefore he cannot be an unbeliever.
>
> Many years ago there was a cinder hill at the junction of the Kīhei and Wailuku roads. It could be seen from all points and so some people would translate the name of it, "Puʻuhele," as "starting point." The fact that this hill was also the pointer for the old horse trail from the plain across the West Maui Mountains to Olowalu and thence to Lāhainā, also made this translation feasible. Another translation was "moving hill," since "puʻu" means hill, and "hele" means to go or move. Some

thought that the name was given to the hill because cinders have a way of shifting, but the old legend has it that some ancient "kahuna" or native priest, predicted that one day Puʻuhele would move over to the island of Maui.

Another idea was that perhaps Puʻuhele was not actually a dead volcanic cone, but would someday erupt and its lava would pour out over the plain between West Maui and Haleakalā.

What actually happened to Puʻuhele was in all probability never thought of by anyone prior to World War II, and if the predicting Kahuna could have seen the men of the Navy, C.B.s. Army and Marines while they blasted and used bulldozers and cranes and all the rest of their construction machinery, he might have thought that he himself was "seeing things."

"But, his prediction came true, as Hawaiian predictions have a way of doing, for the cinder cone from Puʻuhele have been hauled by truckloads to every district of Maui!"

They went into the macadam (asphalt) on which the radar station at the Summit of Haleakalā is located; into the roads of the NCD Base a Kamaʻole; the roads of NAS Puʻunēnē and Kahului; helped to make passable many of the roads leading into Army and Marine camps all over the Plain and on the mountain slopes from Waikapū to Hāna, and Māʻalaea Bay.

Puʻuhele was once the Survey Point for central Maui but the cinder cone land mark is now a huge pit with mounds of unwanted rock and soil piles around it, and fence enclosing all, with a gate sign saying "kapu."

Some time the cinder vein must come to an end, and the old residents of Maui hope that the pit will be filled in and smoothed over, and that the authorities may remember the past kindly by placing a marker there to say that this was the site of Puʻuhele, the hill that moved all over Maui, made a legend come true, and helped to win a War.
(Inez Ashdown, Maui News: 2-13-1946)

Puʻuhele

Puʻuhele, is a hill at Waikapū, Maui that was roughly 65 feet tall. You cannot claim a circuit of Maui unless after you have been all around, you circle the hill of Puʻuhele, then climb to the top and proclaim, "Ua puni o Maui iaʻu."
(Theodore Kelsey Collection, Place Names, Hawaiian Ethnographical Notes, I:819)

Puʻuhele is no longer a puʻu (hill) rather it is an abandoned open pit mine over 100 ft. deep. The old access road enters at the southeast corner and proceeds along the east and north edge to the bottom of the pit. This cone has been quarried for cinder since the 1940's to such an extent that only a deep pit remains in place of the former puʻu.
(Folk and Hammatt, 1992:24)

Some Noted Battles of Hawaiian History – Battle of Waikapū Common

When Kalani‘ōpu‘u had made all preparations for renewal of the war with Maui, already referred to, his army consisted of six divisions, each known by an individual name; two regiments of nobles, called ‘Ālapa and Pi‘ipi‘i, and a life guard composed of members of the royal family, called Keawe, and had as his high priest Holoae, with the celebrated war-god Kā‘ili (Kūkā‘ilimoku?).

Kahekili was well advised of these preparations of Kalani‘ōpu‘u and sought to be prepared to cope with his adversary whenever the attack should be made. He33 had as his aid the O‘ahu King, Kahahana, and his predecessor’s hight priest Kaleopu‘upu‘u. Fornander gives the following graphic account of this tragic event:

“In 1776, Kalani‘ōpu‘u embarked his forces and landed them without resistance in the Honua‘ula district, from Keone‘ō‘io to Makena. Plunder and spoliation marked his arrival, and the country people fled to the woods and mountain ravines for shelter. Taking part of his forces around by water, Kalani‘ōpu‘u landed again Kīheipūko‘a, near the Keālia or salt marsh between Kalepolepo and Mā‘alaea. The landing being effected early in the day, it was resolved to push forward at once, and on to Wailuku, where Kahekili was residing, became the war-cry of the day. The detachment of regiment know as ‘Ālapa, mustering eight hundred men, was selected for this hazardous expedition, and with high courage they started across the isthmus of Kama‘oma‘o, now known as the Waikapu Common, determined, as the legend says ‘to drink the water of Wailuku that day.’ This regiment was considered the bravest and best of Kalani‘ōpu‘u’s army, every man in this ranks being a member of “la haute noblesse” of Hawai‘i. They are said to have all be of equal stature and their spears of equal length; and the legend represents their appearance- with their feather cloaks reflecting the sunshine and the plumes of their helmets tossing in the wind – as a gorgeous and magnificent spectacle.

Little did this gallant troop apprehend the terrible fate that awaited them. Little did Kalani‘ōpu‘u know the wily warrior with whom he was contending, Kahekili distributed his forces in various directions on the Wailuku side of the Common, and fell upon the Hawai‘i *corps d’armee* as it was entering among the sand-hills south-ease of Kālua (‘ili), near Wailuku. After one of the most sanguinary battles recorded in Hawaiian legends. And deeds of valor that await but another Tennyson, the gallant and devoted ‘Ālapa were literally annihilated; only two out of the eight hundred escaped alive to tell Kalani‘ōpu‘u of this Hawaiian Balaclava, and the only prisoner brought alive to Kahekili was Keawehano, a chief of Hilo, and he died of his wounds before he could be sacrificed at the heiau by the victors. This battle is called the Ahulau ka Pi‘ipi‘i i Kakanilua – A slaughter of the Pi‘ipi‘i warriors at Kakanilua.

When in the evening of that day, the news of the battle brought to Kalani‘ōpu‘u at Kīheipūko‘a, where he and the royal family and the main body of his army were encamped, consternation and sorrow filled his mind at the loss of his gallant eight

hundred. A council of war was called in the night. In that council it was resolved to march the entire army of onto Wailuku the following day, and by a hold attack, retrieve the fortunes of the previous day.

Kahekili had not been idle during the previous night. Distributing his own forces and the auxiliary Oʻahu troops, under the Oʻahu kind, Kahahana, among the sand-hills, from Waikapū to Wailuku, which skirts that side of the common, and stationing a reserve force at the turn of the Waikapū Stream, he awaited the approach of the enemy coming from the Keālia salt ponds. Long and severe was the contest, but again the Hawaiʻi army was beaten back with fearful slaughter; but, although victorious, the battle must have cost Kahekili dearly, for it is not mentioned that the pursuit of the fleeing remnant of Kalaniʻōpuʻu army was ever very close or protracted."

Conditions of peace were subsequently negotiated with Kahekili by Kiwalaʻō the tabued heir and son of Kalaniʻōpuʻu and nephew of Kahekili, whereupon Kalaniʻōpuʻu returned to Hawaiʻi. The defeat and humiliation so rankled in his mind that a year later he embarked again with force and attacked various points of Maui, but only to meet with reverses in nearly his entire circuit of the island, and which culminated in the capture of the fort Kaʻuiki (Hāna), already given.
(Thomas G. Thrum, Thrum's Hawaiian Annual, 1889)

Waikapū Battle

Later in the same century, during the reign of Kahekili, at a time when King Kalaniʻōpuʻu of Hawaiʻi was warring with Maui, a Hawaiʻi warrior named Kekūhaupiʻo took a stand, "at Kamāʻalaea (Māʻalaea) on the ridge of Puʻuhele," where he fought the Maui warriors. This single event was probably part of the battle spoken above when Kalaniʻōpuʻu landed his magnificent army on the other side of Māʻalaea at Kīheipūkoʻa and sent his men across the plains of Kamaʻomaʻo in order to engage the fierce warriors of Kahekili in the Wailuku area.
(John Papa ʻĪʻī, Fragments of Hawaiian History, 1959)

Hewahewa koa o ka moku ʻilima: The deranged warrior of the ʻilima thicket (jokingly given to Kekūhaupiʻo after his fight at Puʻuhele with the Maui warriors during Kalaniʻōpuʻu war against Kahekili in the 18th century.
(William Folk, Hallett Hammatt, Archaeological Surveys at Māʻalaea, 1989)

Waikapū is also connected with the battle of Kepaniwai which took place around 1790. Smith Wong recounts that "Kepiʻiʻāina claimed the mountains to Waikapū, hid, and prepared to throw boulders down on the advancing enemy" However, the warriors of Kamehameha were victorious and moved on to conquer Oʻahu and the rest of the islands.
(Smith Wong 1992:A3)

Samuel Kamakau describes the death procession to ʻĪao valley in Wailuku in 1793 that commenced in Waikapū. A number of ʻili (subdivision) and other important place names were notated in this Waikapū reference.

…Haleki‘i in Kukahua. There Kekaulike died, and the sound of lamentation for the dead arose. Then, fearing the arrival of Alapa bent on war, the chiefs cut the flesh from the bones of Kekaulike in order to lighten the load in carrying the body to ‘Īao (for burial). Placing the remains on a canoe, they sailed and landed at **Kapoli** in **Mā‘alaea** and thence went to **Pu‘uhele**, to **Kaluamanu**, to **Waikapū**, to **Wahanemaile (Wahinemaile)**, to **Kaumu‘īlio**, to **‘Aoakamanu**, to **Pu‘uelinapao**, to **Kaumulanahu**, to **Kapōhāko‘i**, to Kālua, to Kekio, to Kama‘auwai, to Kahua, to Ka‘ilipoe, to Kalihi, to Kalua‘oiki, to Kihahale, stopped at ‘Ahuwahine, laid him down at Lo‘iloa, and put him away at Kapela. It was in the month of March, 1736 that Kekaulike died (bold letters used to emphasize Waikapū names).
(Samuel Kamakau, Rulling Chiefs of Hawai‘i. 1992)

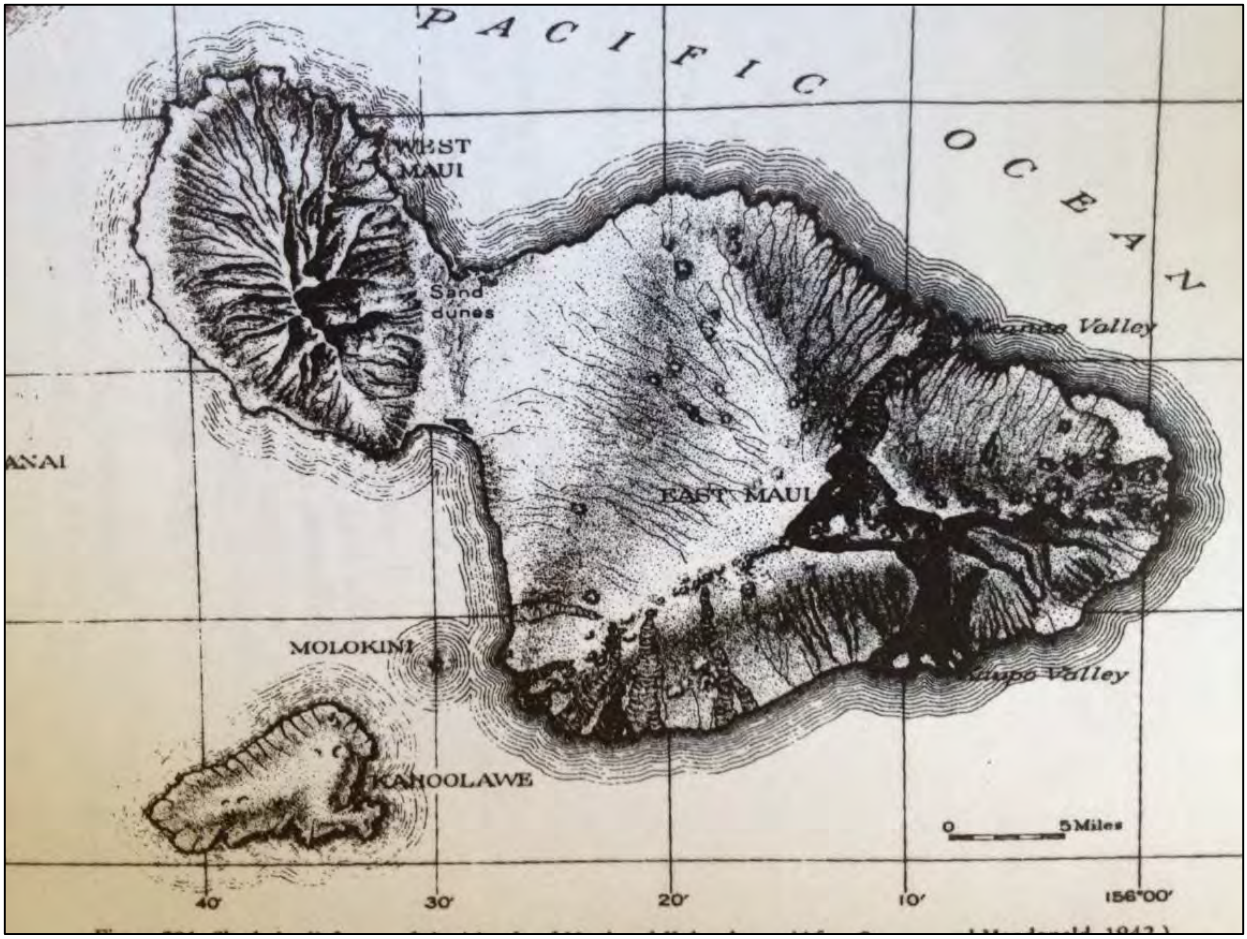


Figure 12. (Map showing Nā Wai ‘Ehā sand dune system across the Kama‘oma‘o Plains (Stearns)

Upwards of the culturally significant cinder cone known as Puʻuhele, there are four additional cinder cones along the boundary of Waikapū going up towards Hanaʻula Mountain Range; Puʻuhona, Puʻulūʻau, Puʻumoe, and Puʻuanu.

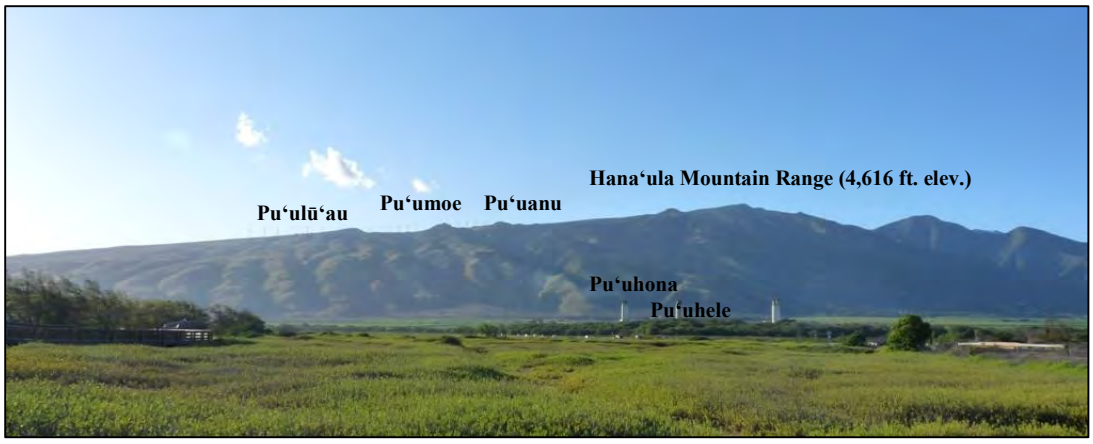


Figure 13. Hanaʻula Mountain Range with associated cinder cones (Hōkūao Pellegrino 2011)

6.3 UKA (UPLAND REGION)

The uka or upland section of Waikapū encompasses both the Hanaʻula mountain range (4,616 ft. elev.) located on the south side of Waikapū Valley and the Kapilau mountain range (4,426 ft. elev.) on the north side of Waikapū Valley. Waikapū Valley divides both Hanaʻula and Kapilau. The mountainous and valley area is comprised of the most extensive amount of cultural sites and features in all three regions. There are four gulches with intermittent streams within Hanaʻula; Pōhākea, Kaʻonohua, Paleʻaʻahu, and ʻOawakilikā, followed by Waikapū valley and its perennial stream. (see figure 4.)

Cultural resources found within the uka region include house and temporary habitation sites, agricultural sites (both wetland and dryland cultivation), ʻauwai irrigation ditches, heiau, burials, trails, caves, petroglyphs, and stone walls. A number of these cultural sites were claimed by Hawaiians during the Māhele. Majority of all cultural sites are located in and around Waikapū valley and stream and are associated with intensive loʻi kalo cultivation. It is likely the heiau or ceremonial sites were dedicated to Lono (one of the four main Hawaiian pantheon gods) as a means to increase production and rainfall. The land and soil in Waikapū are rich and fertile. The Waikapū Stream provided a constant source of fresh water that once fed over 1,400 documented loʻi kalo on and estimated 800 acres of land.

6.3.1 WATERSHED

Within the Waikapū watershed lies an abundance of wai (water). The mean annual rainfall in the upper reaches of Mauna Kāhālawai near Puʻukukui (5787 ft. elev.) is close to 354 inches compared to that of Waikapū Town, which has an average of 20 inches (Creed 1993). On the Kamaʻomaʻo Isthmus and near the shore of Māʻalaea, 16 inches of rain falls annually (Creed 1993). The rainfall in March is the wettest period in the mountains where it is, however, always wet; December and January are the wettest months for Waikapū Town. While May to September there is almost no

rainfall. The climate changes radically from desert-like conditions at the shore to the tropical rainforest of the upper valley. Traditional Hawaiian agriculture adapted to such land and water conditions until large-scale introduced plantation agriculture cultivation needed more water than the Waikapū Stream could provide.

The upper regions of the Waikapū watershed had an abundance of endemic and indigenous plants which were utilized for various cultural purposes by Hawaiians of this ahupuaʻa. The dryland forested areas were dense with koaiʻa (*Acacia koa*), ʻaʻaliʻi (*Dodonaea viscosa*), and alaheʻe (*Psydrax odorata*). All of these tree species would have been used for house construction. The stems of the olonā (*Touchardia latifolia*), a wet forest native plant would have been used for making cordage. Other native plants of importance that were commonly found in the Waikapū watershed was koʻokoʻolau (*Bidens spp.*) and māmaki (*Pipturus albidus*), used for lāʻau lapaʻau (medicinal purposes). In the low lands of Waikapū, dry gulches, and entrance of Waikapū Valley is wiliwili (*Erythrina sandwicensis*) which was used to make papa heʻe nalu (surfboards).

Figure 14. Dense native koaiʻa forest area located near project site in 2010 (Hōkūao Pellegrino)

6.3.2 WATER RESOURCES

Waikapū Stream was and continues to be an important cultural resource and part of the cultural landscape. Waikapū Stream flows on average of 3-4 MGD (Million Gallons per Day), which classifies it as a small perennial stream (USGS). It flows continuously above the diversions located in the stream built by the former Wailuku Sugar Company. Thousands of years ago and prior to Hawaiian colonization, Waikapū Stream flowed northeasterly and into Kahului Bay. This flow

created a narrow break in the coral reef which was later used by ships to enter safely into the Kahului harbor in the early 1800's. (Stearns) For at least the last two thousand years, Waikapū Stream has flowed through the plains of Kamaʻomaʻo and into the wetlands of Keālia. Mauka (mountain) to makai (sea) flow allowed Keālia to swell with water and then empty into Māʻalaea Bay. The Waikapū stream was an important resource which allowed Hawaiians of Waikapū to develop an extensive complex of wetland kalo. This enabled them to sustain and grow their community. According to oral accounts and scientific data, Waikapū stream contained native stream life such as the ʻoʻopu and ʻōpae. (Oki, Wolff, Perreault) Gathering and eating these aquatic species helped feed the pre and post contact populace of Waikapū.

Most references to the water resources of Waikapū, mention that of Waikapū Stream only. The ahupuaʻa of Waikapū consisted of a very unique watershed in which it received stream flow from both Mauna Kahālāwai and Haleakalā mountain ranges. Perennial and intermittent streams all flowed into the wetlands at Keālia which then flowed out into Māʻalaea Bay through the muliwai (estuary) of Palalau. Waikapū Stream is the only perennial or year round stream in Waikapū. Intermittent streams south of the Waikapū Stream derived from gulches; ʻOawakilikā, Paleʻaʻahu, Kaʻonohua, and Pōhākea. The intermittent streams originating on Haleakalā were Pulehunui (see section on Keālia). When rain is heavy enough, all streams and gulches will flow and enter Keālia and flow out into Māʻalaea Bay.

Because Waikapū Stream was the only perennial stream, it was the only stream that sustained stream life, such as ʻoʻopu and ʻōpae. (Oki, Wolff, Perreault) It is not known whether hīhīwai inhabited this stream. At the lower reaches of stream and within Keālia Pond, awa (milkfish) and ʻāholehole (mullet) could be found. It was and also is a place which consisted of a great number of native birds such as ʻaukuʻu (night herron), aeʻo (stilt), and ʻalae keʻokeʻo (coot). (U.S. Fish and Wildlife) Wai was a valuable resource in Waikapū which provided a thriving habitat for native stream life, native birds and insects, brackish water fish, limu (seaweed), and reef life.

Waikapū Stream experienced some of the earliest impacts and changes due in part to the establishment of Maui's first sugar plantation; Waikapū Sugar Company, started by James Louzada and Henry Cornwell. Diversions built by Wailuku Sugar Company disrupted the Waikapū Stream and cut off the mauka to makai stream flow to Keālia. Native stream life began to decline and the wetlands of Kēalia which depended upon the stream flow started to stagnate and dry up. The only time in which Kēalia swells with water is if it rains heavily in that vicinity or torrential rains occurs in the mountainous region where flash flooding occurs and flows over all three major diversions.

Waikapū Stream is currently 100% diverted due to the highest diversion. Water that flows below the diversion enters via a small tributary named Kalena, which flows at a rate of 0.5 mgd. (Oki, Wolff, Perreault) Historically there were many kuleana lands in the vicinity of Kalena. In an interview conducted in 2003, the late Solomon Viela shared a story about the tributary known as Kalena. This name can be found on maps dating as far back as 1888. Solomon Viela talked about his childhood days in the 1930s and 40s and how he spent time in the area of Kalena, where his kūpuna (elders) resided and farmed at that time.

Figure 15. Waikapū Stream above highest diversion in 2012 (Hōkūao Pellegrino)

Figure 16. Waikapū Stream being cut off at highest diversion in 2012 (Hōkūao Pellegrino)

Figure 17. Kalena Tributary flowing into dry Waikapū Stream below dam diversion in 2012 (Hōkūao Pellegrino)

Figure 18. Lowest Waikapū Stream diversion located along Honoapi‘ilani Highway in 2012 (Hōkūao Pellegrino)

6.3.3 PRE-CONTACT HAWAIIAN AGRICULTURE

The interior portion of the Waikapū watershed allowed for extensive traditional pre-contact ‘auwai (irrigation systems) which irrigated vast amounts of land for kalo cultivation. The Waikapū Stream once flowed mauka to makai (mountain to the sea) through the plains of Kama‘oma‘o, into the

Keālia fishpond / wetland / estuary, and emptied into Māʻalaea Bay. Hawaiians also utilized the fresh water resources of the Waikapū Stream for loʻi kalo (wetland taro) cultivation. Ancient ditches called ʻauwai were built to bring a portion of stream water into traditional kuleana farm lands. This network of ʻauwai would allow a percentage of stream water to be diverted, put into irrigated loʻi kalo terraces, and return to the stream following. Konohiki (land managers), luna wai (water superintendents) and mahiʻai (farmers) worked together by ensuring water efficiently flowed in and out of loʻi kalo. The water was then immediately returned to the stream to ensure no negative impact would occur on the stream resources as well as those farms utilizing the water below. A conservative estimate confirms that at the time of the Māhele of 1848, over 1,400 loʻi kalo were under cultivation throughout the Waikapū ahupuaʻa on a total of about 800 acres.

The origin of kalo was and continues to be a fundamental aspect of the Hawaiian culture and the genealogy of the Hawaiian people. At one time, there were over 400 varieties of kalo, however with the decline of kalo cultivation, only 84 traditional heirloom varieties continue to exist. Farming kalo was accomplished utilizing two methods; loʻi (flooded field / patch) and māla (non-flooded upland garden that received sufficient moisture from rainfall). Both styles produced high yields. In Waikapū, loʻi kalo was the dominant method of farming due to the once abundant fresh water resources of the Waikapū Stream.

By the early 1900s however, the cultural landscape had increasingly changed due to impacts of the sugar plantation and the amount of water resources used grow this export crop. A visitor to Waikapū in the late 1860s wrote, "the vestiges of extensive wet kalo plantations, are now almost obliterated by sugar-cane cultivation; a few here and there are preserved in plantation camps and under house and garden sites along the roads. The waters of this great stream, now utilized for irrigating a great acreage of sugarcane, was formerly diverted into loʻi." The decline of kalo cultivation was prevalent throughout Waikapū and Nā Wai ʻEhā and elsewhere on Maui. Waikapū no longer was a thriving and self-sufficient ahupuaʻa. Sugarcane production in Waikapū used these same ʻauwai systems, cemented them over, and diverted stream water away from kuleana lands and into reservoirs. The plantation system directed water away from the stream rather than the efficient system of agriculture that Hawaiians practiced. Sugarcane cultivation in Waikapū destroyed most of whatever traditional lands and ditches lay within, as plowing and land clearing left no traces of former traditional agricultural use.

In 2013, fewer than 15 loʻi kalo on a total of 2 acres of kuleana land are in cultivation compared to the 1,400 loʻi kalo that were under cultivation 160 years ago. The lack of water in the Waikapū stream forced many Hawaiian families to stop cultivating kalo. Many kuleana lands were adverse possessed or purchased for a minimal amount by the sugar plantations in order to gain access to traditional irrigation ditches and fertile lands for the thirsty cash crop. Descendants of the original kuleana farm land owners in Waikapū make up less than 1% of the residences.

Currently, there are ongoing efforts in the Waikapū ahupuaʻa to revitalize the water resources of the Waikapū Stream and to restore those remaining kuleana lands with loʻi kalo. The community members in Waikapū are once again trying to return to a self-sufficient ahupuaʻa that it once was.

Agriculture

Waikapū is land bound. The waters of its great stream, now utilized for irrigating a great acreage of sugar cane, formerly was diverted into loʻi and its overflow was dissipated on the dry plains of the broad isthmus between West and East Maui.
(E.S.C. Handy, Hawaiian Planter: 1930)

Taken altogether in terms of areas cultivated and number of communities, Maui certainly ranked last. In comparison with other islands, it must have had a smaller population. There were two areas, however, in which population was concentrated. One was in "the Four Wai" (streams) – Waikapū, Wailuku, Waiehu, Waiheʻe – the four largest streams and loʻi areas on windward West Maui, which were contiguous. The other was Lāhainā.
(E.S.C. Handy, Hawaiian Planter: 1930)

Taro terraces - Kahakuloa to Waikapū
Sweet potato - coastal throughout; lower Wailuku and Waikapū
Banana - valleys and wet coasts throughout, median forest zones up to 3,000 feet elevation
Wauke - valleys and damp kula lands in western Maui
Olonā - median forest zone throughout
ʻAwa – interior wet valleys and lower forest zones throughout
(E.S.C. Handy, Hawaiian Planter: 1930)

This section, with its abundant stream that has cut its canyon deep into western Maui's second highest range, gives its name to the last of "The Four Streams." Spreading north and south from the base of Waikapū to a considerable distance below the valley are the vestiges of extensive wet plantations, now almost obliterated by sugar-cane cultivation; a few here and there are preserved in plantation camps and under house and garden sites along the roads. Among these gardens there are a few patches of dry Japanese taro. Far on the North side, just above the main road and at least half a mile below the entrance of the canyon, an extensive truck garden on old terrace ground shows the large area and the distance below and away from the valley that was anciently devolved in terraced taro culture. On the south side there are several sizable kuleana where terraces are now used for truck gardening. In the largest of these are few old patches are flooded and planted with Hawaiian wet taro, and there is some dry Japanese taro. Several terraces are used as ponds planted in lotus for their edible seed. There were probably once a few small terraces on the narrow strips of valley bottom in the lower canyon.
(E.S.C. Handy, Hawaiian Planter: 1930)

Figure 19. ʻAuwai system along Waikō Rd. which fed numerous loʻi kalo circa 1900 (Maui Historical Society)

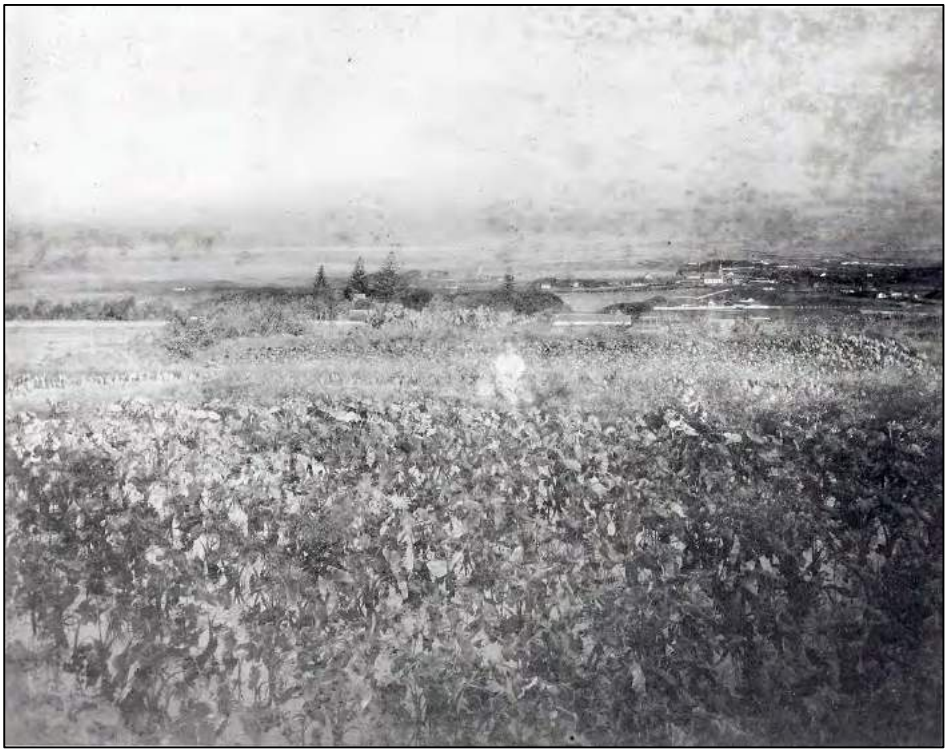


Figure 20. Loʻi kalo above Waikapū Town near edge of Wailuku Heights circa 1890 (Bishop Museum)

6.3.4 OTHER CULTURAL SITES OF SIGNIFICANCE

Archaeological records for the Waikapū ahupua‘a provides important data that describes pre-contact settlement patterns and timelines. There has been numerous archaeological surveys conducted as early as the beginning of the 20th century. Thrum and Stokes were specifically interested in documenting the remains of heiau. Walker's survey set out to document the everyday types of human endeavors, such as habitations and fishing shrines, as well as clarify and expand the previously recorded data. Handy and Handy described their contemporary (1930s) agricultural systems and describe the information they gathered of the traditional agricultural methods and knowledge. These early records provides us with the only information we have of sites that have since disappeared. Since carbon dating was not available before the 1950s, the earliest record of sites since then has to be compared with what remains to estimate times of origin. Folk and Hammatt, Kennedy, and Brisbin et.al. have conducted recent archaeological studies in Waikapū and although the percentage of total area surveyed for archaeological purposes is probably very slim, a vast and rich distribution of life is shown by what has been found.

Upland Agricultural Field System and Settlement

Prior to the 1991 establishment of the current King Kamehameha and Kahili Golf located just south of the Waikapū Valley, were remnants of a pre-western contact Hawaiian settlement. It included habitation, heiau, and agricultural sites. Alan Haun (PHRI 1989) registered four sites in his interim Waikapū Partners Golf Course study, and he dates them from the 15th through 19th century, and in one case from the 17th century into the 20th century. Majority of these sites were obliterated due to the construction of the Golf Courses, however some sites still remain and are visible. It is thought that this settlement and associated cultural features may have been utilized prior during the early settlement of the Waikapū Valley. The agricultural system that was analyzed prior to construction was thought to have been one of the largest dryland field system in Nā Wai ‘Ehā. During the Māhele of 1848, there were no claims connected to this area and no accounts of Hawaiians living in that area. It is likely that this area was abandoned when Hawaiians moved further north and into settled in Waikapū Valley where water resources were more readily available for more intensive farming.

Thrum's study deals exclusively with heiau and he reported the presence of four in Waikapū, two in village area and two at or near the shore but he saw only portions of the larger village one. Neither was carbon dated before it was destroyed by the plantation.

Heiau

Two heiau were reported as at Waikapu, formerly, one below the road abreast of Thomas Everett's of large size, and one below the Catholic Church, a small structure working probably in conjunction with the larger one. Portions of the large one was said to be still seen, but the small one was all destroyed. The names of these were forgotten. Unfortunately no evidence was found in confirmation of this report nor anyone who had knowledge thereof. The same relates to an alleged

> heiau, each, formerly at Puʻuhele, at Māʻalaea, at Kīhei and at Kalepolepo, of small size, and a larger one at Kulaʻihakoko, but no one else seems to have heard of them **(Thrum 1909-1918:59)**

Since the ahupuaʻa of Waikapu has sheltered valley, shoreline, and open country it possibly had all the types of houses Walker describes:

> Maui houses were of two types. In the sheltered valleys, where there was abundant vegetation, the houses were built of light pole frames thatched with pili grass. The house was built on a stone pavement to raise it slightly above the level of the damp ground. Matting covered the floor, but in the sites by the shore pebbles and coral were, in general, substituted for the stone paved floor. Only five of these grass houses are still to be seen on Maui, and none of them are inhabited. In the open country exposed to driving wind and rain, houses were built with thick stone walls and only the roofs were of grass **(Loc. Cit.:68).**

LCA 432 (Sylva) Mahuka testifies in 1847 that on the land there are 2 mud houses and a grass house built by "that person" (Sylva?). So while no grass houses were still in use in 1931 when Walker did his inventory, there were still grass houses in use at the time of the Mahele. Keoni Kewini also notes the presence of a pili grass house on LCA 76.

Waikapū was the southernmost ahupuaʻa and was adjacent to the ahupuaʻa of Ukumehame in the moku of Lāhainā. Hawaiians that needed to travel in both directions utilized an ancient trail named Kealaloloa. (see figure 3.). It was also known as the Lāhainā Pali Trail.

> Lāhainā Pali Trail descends towards the subject property from the heights of the Kealaloa Ridge. This trail "….is an illustration of 19th century craftsmanship, which in a sense (given the fact that the trail was built less than 50 years after Western contact) is an extension of traditional Hawaiian craftsmanship adapted to new circumstances"
> **(Kennedy and Trimble 1992)**

Kennedy in 1992 conducted a survey at 1070 to 1100 feet above sea level and saw several caves near the vertical slope across the stream channel which lay to the south. These caves have not been surveyed and there is no record yet encountered of their use.

The puʻe one (sand dune) system of Waikapū was also extensive. Prior mention describes the sand dune system beginning in the northern most ahupuaʻa of Waiheʻe in Nā Wai ʻEhā and ended just shy of Keālia (see figure 11.). Most of all of the sand dune system has been destroyed. The only remnant portions of the sand dunes in Waikapū is where the current Japanese / Hawaiian cemetery is located on East Waikō Road. There is a reference in Grant 2747 to Eugene Bal in the 1850s that there were ancient Hawaiian burials in that portion of the sand dune.

7.0 WAIKAPŪ SUGAR PLANTATION HISTORY

The first accounts of growing sugar cane by foreigners in Waikapū was Antone Catalena in 1823. Reports say that he made an excellent syrup from the cane produced on his land. Waikapū Plantation was founded several years later. It was formed by a series of purchases that began when James Louzada acquired the estate of the late Circuit Court Judge John "Ione" Richardson. The Richardson family were long time Waikapū residents. Apparently the first resident with that name was George Richardson, who was born in Ireland and died in Waikapū in 1835, leaving a Hawaiian widow named Kaneole. Their son or grandson, John Richardson, is named in several places on the Wailuku Sugar Plantation map. His land became available for sale through tragic circumstances, when Richardson committed suicide at age 35 by hanging himself from a tree on his cattle range in Kula. According to an 1860 Pacific Commercial Advertiser article, "He had been laboring for some time under a mental aberration, caused, it is said, by domestic troubles," This was depression resulting from the death of his wife, Dorcas (Doreka Ilai), in 1857 and their four-year-old daughter Fanny in 1859. The newspaper said Richardson had been a member of the House of Representatives, recently promoted by the king to a seat in the House of Nobles, and was considered "one of the most promising and intelligent of his race."

James Louzada, a native of New York, had arrived in the Islands in 1834. He acquired Richardson's estate but was not his first stake in Waikapū land. A copy of a March 15, 1844, deed from Charles Kanaina to Louzada, translated from Native Register, Volume I, page 175, reads as follows:

> I hereby give two ʻili's of mine at Waikapū, ʻAoʻaokamanu and Puahinakao, to James Louzada to live on under me, as the natives of Hawaiʻi do. If he does wrong under the law, his occupation thereof shall end. Furthermore I shall have the Thursdays and the Fridays [tax days] of the land, and he shall be responsible to me. Furthermore he shall give the tribute to the tax collector, as formerly paid by these lands. Furthermore, e like nō me ka lā me ʻai kahiko (the ancient ways of the land shall be followed) Furthermore if it comes to us that he petitions as a foreigner (does not follow Hawaiian custom) then his occupation of the land shall cease. Furthermore if the lunas object to this grant of land, then it shall cease and the land be returned to me.

In a column by Mrs. D.P. Penhallow titled "Waikapū, Maui: a Sketch" in the February 3, 1926, Maui News provides more details about the evolution of the Waikapū Sugar Plantation.

> As with much of early Hawaiian history, so it is with Waikapū. Definite dates of events are hard to fix and the sequence of them not always clear, but as Waikapū was first in this section of Maui in war so, evidently, was it the first to produce sugar and cattle. A Spaniard named Antone Catalina made cane syrup at Waikapū in 1823, which was apparently the beginning of the sugar industry in the Wailuku District. James Louzada came over from Waimea, Hawaiʻi, a number of years later, established a cattle business, opened a store and began cultivating cane on a large scale. The date is not definite but he erected a stone mill with oxen for motive power on the premises known as Halepālahalaha at the entrance to Waikapū Valley, located

> on its northern slope. It is reputed that Louzada's Hawaiian wife, Kapu, lost an arm while tending the mill.
>
> Following this mill a steam driven one was erected in 1862 near the present road to Lāhainā, just north of the stream crossing . . . the store referred to was the first in the district, people going from Wailuku to make purchases there. The store building was located on the lower corner of the Pia Cockett premises and remained as a landmark until a few years ago. The cattle industry flourished and also, many fine horses were produced, horseracing being a feature of Waikapū for years. . . . Aside from its commercial aspect, there was much of romantic interest attached to Waikapū. Kalākaua spent some of his leisure time with the Cornwells, who kept open house, and it has been featured in song and story. Its romance was of the past, which belonged to its day and age. Of this there are but slight reminders evident only to those who can picture it as it was.
> **(February 3, 1926, Maui News)**

James Louzada's acquisition of additional land in 1862 apparently was unplanned, simply a response to a promising opportunity.

> Mr. James Louzada, happening to be in the vicinity, heard that there was to be an auction sale of the estate of the late John Richardson, and attracted by curiosity attended it. A good frame house and lot was put up for sale, but nobody wanted it. Seven hundred dollars only were bid, and Mr. L. thinking it a safe investment, took it at a few dollars over that sum, and for a few hundreds also purchased the taro lands belonging to the estate. Thus, without any intention of buying when he went to the sale, he found himself possessed, for the paltry sum of $1,200, of a good dwelling house and some of the finest cane land on the island. He was not long in finding out that he had located over a mine destined to be as productive as a gold mine, nor in making his plans for the future. Associating himself with his brother-in-law, Henry Cornwell, Esq. [married to Louzada's sister Adelia], formerly of this city [Honolulu], he set to work to erect a mill and commence the manufacture of sugar, the natives and foreigners in the village promising to plant cane on their own lands. Two years have passed since the lucky purchase of this property occurred, and already he has sent to market some 400,000 pounds of sugar, worth perhaps $25,000, though his mill has been in operation only about eight months.
> **(April 9, 1864, Pacific Commercial Advertiser)**

It was further expressed that a great deal of change in the village of Waikapū occurred since "we last rode past it" four years ago, when "there was nothing here to attract a stranger--a few thatch houses with one or two frame buildings, scattered among taro patches were all that one would notice in passing. Now a tall chimney attracts for miles the eye of the traveler and the dark smoke, growing up in clouds from its top, tells plainly of the industry, capital and enterprise that center here." The visit to the mill was further explained:

Mr. Cornwell and his son William, who were hard at work turning cane juice into gold. The mill consists of a large building in the form of an L, on a hill slope, which facilitates the work very much. The machine is driven by a 36 horse engine, built by Mr. Henry Hughes of this city, who also constructed all the machinery used on this plantation. Everything about the mill is of Hawaiian manufacture, which can be said of but a few sugar manufacturers on the islands. The capacity of the mill is about four thousand pounds of sugar per day, though, by working nights, which is sometimes done, five thousand pounds can be got off. To obtain this product, Messrs. Louzada and Cornwell employ about seventy field and mill laborers, of whom forty are females, who are engaged on account of the scarcity of men. . . .The land at Waikapū consisting of a gentle slope from the base of the mountain to the road, irrigated by the Waikapū river, is admirably adapted to sugar culture, producing, when well cared for, very heavy crops. The extent of land suitable for cane is limited only by the amount of water obtainable for irrigation. The proprietors of the mill have purchased land largely since they began operations and have now some 200 acres. They purchase cane from the natives, paying generally about one hundred dollars an acre for the standing crop, taking it off at their own expense. The sugar boiling department is under the charge of Wm. Cornwell, who possesses all the activity, industry and perseverance of his father and uncle. The high reputation of the sugar made at this mill is the best recommendation that a sugar-boiler can wish.

About a mile back from the mill, and on an elevation overlooking the whole country, stands the house of the late Mr. Richardson, the sale of which we have already referred to, now occupied by Mr. Cornwell and his family. It has been much improved, by additions, and forms one of the pleasantest residences we have ever seen. From its front veranda, a most beautiful scene is had--the village and mill buildings, the plain, Kahului Bay on the left, Kalepolepo Bay at the right, and the whole of Mt. Haleakalā, with its villages on its side--are all in view. Were we to select a site for a country home, it would be this charming spot in Waikapū, and we congratulate Mr. and Mrs. C. and their family on possessing so healthy and delightful a home, where in and around the dwelling every comfort and luxury is provided. The traveler, who enjoys, as did we, the pleasure of a short sojourn here, and an acquaintance with those who show such refinement and taste, and who welcome visitors with such cordial hospitality, will leave their pleasant home with many regrets. Such residences and such homes we trust will spring up in every district.

What a change has taken place in Waikapū within two years! Where were a few taro patches, half cultivated by Lazaroni, a village has sprung up, with its sugar mill and buildings, its waving cane fields and busy laborers, scattering industry, thrift and contentment everywhere. Here where a few hundred dollars worth of taro were formerly raised, forty thousand dollars' worth of sugar may now annually be made and sent to market.

A planter's life, however, is no playspell. Messrs Louzada and Cornwell and everyone else engaged on the estate work hard--up early in the morning, and late at night, they earn every dollar they receive. Although the first outlay in commencing a plantation is heavy--and few estates are set in operation with less than forty or fifty thousand, and from that to one hundred thousand dollars--yet when once completed, the income promises to be large, and on most plantations will amount to at least twenty-five per cent on the investment, when well managed. This estate, thus far, has cost its proprietors nearly fifty thousand dollars and it is safe to say that it will produce annually at least forty thousand dollars, at present prices of sugar."

(April 9, 1864, Pacific Commercial Advertiser)

Figure 21. Early Waikapū Map showing Waikapū Sugar Mill (DLNR Survey Office)

7.1 SUGAR PLANTATION AGRICULTURE HISTORY

Specified below is a detailed timeline of the establishment of the Waikapū Sugar Company, its evolutions and final demise.

1823 Cane syrup and molasses was made by a Spaniard named Antone Catalena.

1828 Small wooden mill worked by oxen was established by Antonio Silva.

1847 Coffee was planted for the first time in Waikapū.

1848 Great Māhele Land Division was imposed by King Kamehameha III (Kauikeaouli). Foreigners and Hawaiians for the first time were allowed to own land that they were cultivating and living on.

1857 Henry Cornwell and family from Long Island New York arrived in Hawai‘i.

1860 James Louzada originally from New York City moved from Waimea, Hawai‘i to Waikapū, Maui and began cultivating sugarcane on a larger scale. He erected a stone mill with oxen for motive power on an ‘ili (subdivision) named Halepālahalaha, situated near the entrance of the Waikapū Valley. It was reputed that Louzada’s Hawaiian wife Kapu, lost an arm while tending the mill.

1862 Waikapū Plantation is formally started by James Louzada and his brother-in-law, Henry Cornwell. They purchased 1,000 acres from the late John Richardson for $1,200. One of the first steam-driven mills in Hawai‘i was erected at the plantation by Honolulu foundry James Hughes. William H. Cornwell (16), son of Henry Cornwell also became interested in the sugar business. Waikapū plantation changed ownership a number of times. The Macfarlanes became interested and eventually formed a corporation. It later passed into the control of Wailuku Sugar Company in 1894.

Figure 22. William H. Cornwell

1862 Wailuku Sugar Company was established by James Robinson & Co., Thomas Cumming, J, Fuller and C. Brewer & Co.

1863 Waikapū Plantation sent its first sugar (200 tons) to market. It was worth $25,000.

1864 About 200 acres of land were cultivated in sugarcane. The Waikapū Sugar Plantation also purchased sugarcane from native kuleana lands at $100.00 per acre. The land suitable for irrigating sugarcane was limited by the amount of water available in the Waikapū Stream.

1866 Mark Twain (Samuel Clemens) arrived in Waikapū and stayed with the Cornwell Family.

1868 Henry Cornwell cultivated 300 acres of sugarcane out of his 1,000 acres of good agricultural land. Water used in irrigation was not sufficient to assure cultivation of more than 300 acres at a time profitably. Yields averaged four to five tons of sugar per acre.

1877 Waikapū Plantation owned by Henry Cornwell was sold on February 24th for $175,000, with the original proprietor retaining an interest. The purchasers were William H. Cornwell (son) and George W. MacFarlane. Waikapū Plantation was capable of producing 1,000 tons annually. If more water was brought in to these lands, 2,000 tons of sugar could be produced.

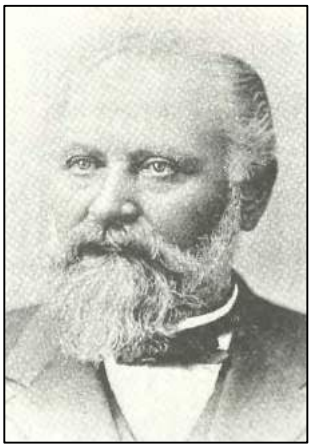


Figure 23. Claus Spreckels

1878 Claus Spreckels who arrived in Hawai‘i in 1876 from California paid Henry Cornwell $20,000 for an undivided half interest in the Waikapū Commons Lands. It totaled roughly 16,000 acres. At about the same time, Spreckels leased from the Hawaiian Kingdom the adjacent Wailuku Common Lands, for 30 years, at $1,000 per year. This area was about 24,000 acres all together. Both land and water rights were also involved.

1878 Ha‘ikū Ditch was complete and led to other large and important ditch projects in various parts of the islands. The most important of which was that of HC&S Co. for the irrigation of their large projected sugar plantation upon the Waikapū Common, Maui.

1879 The co-partnership that existed between the undersigned and known as Waikapū Sugar Plantation Company was dissolved by mutual consent, and it was continued by W. H. Cornwell and George W. MacFarlane under the firm name of Cornwell & Company (H. Cornwell, W. H. Cornwell and G. W. MacFarlane).

1880 Waikapū Proprietors, W. H. Cornwell & G. W. Macfarlane owned 20,000 acres. 600 acres were under cultivation and suitable for sugar planting, provided that artesian wells proved to be a success on Maui, which it was confidently expected to be the case. Manager W. H. Cornwell Jr., Agents, G. W. Macfarlane & Co., estimated yields for the season at 900 tons. The capacity of the mill was 8 tons. There were 130 men employed and 200 yoke of oxen. The plantation was believed to be one of the richest and most valuable in the Hawaiian Islands.

1881 First outer island artesian well was drilled at Waikapū Plantation by McCandless Brothers.

1882 HC&S Co. established a new plantation on the Waikapū / Wailuku Common Lands. Claus Spreckels obtained outright title to the Waikapū Common lands.

1889 Waikapū Plantation produced 900 tons of sugar.

1889 “Spreckels Buys Waikapū Plantation.” The sale of the half interest in the Waikapū Plantation, owned by Major W. H. Cornwell, was purchased by Col. Claus Spreckels. It was reported that the figure for the half interest was about $120,000. The remaining half was held by G. W. MacFarlane and Company, and was probably purchased by the same party. Major Cornwell continued to be the manager. Waikapū was an incorporated company, 2,500 shares at $100.00 each. The crop for the current year was about 1,000 tons. The purchase of the plantation, by capitalist Col. Spreckels, indicated that he had a firm faith in Hawaiian sugar property, and that the proposed changes in the American tariff would not ruin sugar planters.

1890 The sale of the one-half interest in Waikapū Plantation was made by George W. MacFarlane to Col. Claus Spreckels, the latter having previously purchased the other half from the Cornwell Estate in July.

1891 Waikapū Plantation produced 1,000 tons of sugar.

1892 A lawsuit regarding cane grown on land known as Waikapū Commons was instituted by Col. Claus Spreckels of HC&S Company. The defendant in the case was Col. George W. MacFarlane of Waikapū.

1893 Waikapū Plantation produced 534 tons of sugar.

1894 Wailuku Sugar Company purchased Waikapū Sugar Company in February. The purchase included 2,500 shares at $42.00 per share. It was difficult to bring cane from Waikapū to the Wailuku mill, therefore Manager Charles B. Wells was authorized by the board of directors to make the best terms possible with HC&S Co. to grind the Waikapū cane.

1894 Waikapū Plantation produced 786 tons of sugar.

1895 The first crop of the combined Wailuku, Waiheʻe and Waikapū plantation produced 4,939 tons of sugar.

1895 Wailuku Sugar Company completed a survey for a railroad line to Waikapū. This line would be 20,800 feet in length. Claus Spreckels gave Wailuku Sugar Company a warranty deed for the rights-of-way it needed for a railroad line toward both Waiheʻe and Waikapū for $600. Wailuku Sugar Company considered the purchase of W.H. Cornwell lands in Waikapū, known as the ʻili of "Aikanaha".

1901 The Wailuku Sugar Company directors offered HC&S Co. 5/12 of Waiheʻe Ditch water (6. p.m. to 4 a.m.), in exchange for all of their lands at Waikapū, Māʻalaea and Wailuku in July. HC&S Co. was to pay 5/12 of the expense of maintaining the new ditch.

1904 James W. Taylor, civil engineer for Wailuku Sugar Company, arrived to superintend the construction of a large ditch (Waiheʻe Ditch) from the head of Waiheʻe Valley to the Waikapū lands in September.

1905 Construction of the Waiheʻe Ditch commenced; this was the direct result of an agreement to exchange land and water rights between the Wailuku Sugar Company. The final settlement, after years of litigation, was the following division of the water: 7/12 to Wailuku Sugar Co. and 5/12 to HC&S Co. James Taylor made the survey for the Waiheʻe Ditch which cost $160,000 and delivered 50 million gallons of water per day.

1907 On May 15, the new Waiheʻe Ditch was opened. It was witnessed by representatives of Wailuku Sugar Company and HC&S Company, citizens of Wailuku and neighboring towns and the first party of Congressmen from Washington, who were visiting the islands.

1907 Wailuku Sugar Plantation worked on the tunnels and ditches in development of the water supply for its fields, from ʻĪao and Waikapū Valleys.

1910 New plantation cottages were built and the spur track at Waikapū was extended another half mile.

1912 Wailuku Sugar Company directors voted to purchase 9,995 shares in the Waikapū Agricultural Company, Ltd. which represented an investment of about $50,000.

1914 The lower branch railroad line at Waikapū was extended 1,800 feet.

1915 Kona storm hit the plantation from Waikapū to Waiheʻe.

1916 Severe storm struck Maui in January; 30 inches of rain fell and severely affected the Wailuku Sugar Company.

1916 Wailuku Sugar Company board of directors voted for an option to extend the present lease of the lands of the Waikapū Agricultural Company, and that Wailuku Sugar Company dispose of up to 51% of the stock it owned in the Waikapū Agricultural Company.

1918 "Storm Brings Down Old Waikapū Smokestack" The old smokestack which marked the site of the original Waikapū sugar mill, and for many years was a conspicuous and picturesque landmark, topped over in a Kona gale storm on Monday night (Nov. 18th). The mill was one of the first sugar mills on Maui and had a capacity of 40 tons of sugar per year. The Waikapū plantation by that time was part of the Wailuku Sugar Co. holdings.

1919 Two new dispensaries were built, one at Waikapū and the other at Waiheʻe.

1919 The main camp at Waikapū was enlarged by bringing in six houses from Puʻuhele Camp.

1921 2,365 feet of the upper Waikapū Ditch was lined with Armco Iron flume to overcome excessive seepage losses in the ditch.

Figure 24. W.S.Co. workers fluming cane by Reservoir #1 in 1940 (W.S.Co.)

1921 Wailuku Sugar Company directors approved in August the purchase of 5,100 shares of the capital stock of Waikapū Agricultural Company, Ltd., which was held by various outside owners, at $10.00 per share. On September 1st, the Waikapū Agricultural Company was sold to Wailuku Sugar Company.

1933 A new intake was constructed for the Everett Ditch on the north side of Waikapū Valley.

1934 An agreement between Wailuku Sugar Company & HC&S Co., permitted the transportation of excess water to Waikapū reservoirs for night storage.

1947 Wailuku Sugar Co. ceases its use of railroads, replaces saddle horses with pickup trucks, and began selling its plantation homes.

1949 Wailuku Sugar Plantation Co. Directors visit Waikapū

The Board of Directors of Wailuku Sugar Company and guests visited the company on March 16, 1949. The picture was taken with Waikapu Valley in the background. Left to right are—Harold T. Kay; Mr. Sammons, President of the United States Bank of Portland, Oregon; Carter Galt; Mark A. Robinson; G. R. Ewart, III; Theodore A. Cooke; Robert McCorriston; Philip E. Spalding; Robert G. A. Crowe; Carl Daiss, vice president Wells Fargo & Union Trust Company of San Francisco, Calif.; Edward W. Carden; Staff Austin; Heaton L. Wrenn; and Alva E. Steadman.

Figure 25. W.S. Co. Board of Dir. visit Waikapū in 1949 (W.S.Co.)

1955 The old Waikapū stable area was subdivided for house lots.

1959 Sugar beet plants were grown in experimental plots at Waikapū.

1972 Everett Ditch was abandoned due to a landslide which buried the intake

1984 Wailuku Sugar Company dissolves and becomes Wailuku Agribusiness Co. (subsidiary of C. Brewer) and starts planting pineapple and macadamia trees.

1988 Wailuku Agribusiness Co. harvested last sugar cane.

1990 Wailuku Agribusiness begins liquidating portions of Waikapū lands to HC&S for further sugarcane production and large developers.

Figure 26. Preparing Waikapū Subdivision for house lots in 1955 (W.S.Co)

2005 Wailuku Agribusiness Co. becomes Wailuku Water Company and started selling water that was diverted from plantation ditch systems in Waikapū, Wailuku, Waiehu, and Waiheʻe Streams (Nā Wai ʻEhā)

2005 Earthjustice and OHA on behalf of Hui o Nā Wai ʻEhā and Maui Tomorrow petitioned Hawaiʻi State Water Commission to return diverted Nā Wai ʻEhā Stream water back into the streams since Wailuku Water Company was no longer using the water for sugarcane, pineapple, or macadamia trees.

2007 Nā Wai ʻEhā Contested Water Rights Case begins on Maui.

2008 The Hawai‘i State Water Commission unanimously designates Nā Wai ‘Ehā Streams a Water Management Area. Wailuku Water Company seeks status as a public utility co. under the PUC and was later denied.

2009 Contested Case Hearing Officer proposed specific amounts of water to be returned to the streams or Interim In-stream Flow Standards (IIFS). Waihe‘e (10 mgd), Waiehu (3.5 mgd), Wailuku/‘Īao (13 mgd), and Waikapū (4 mgd).

2010 Water Commission makes final decision and rejects Contested Case Hearing Officer’s proposed Interim In-stream Flow Standards (IIFS) leaving two out of four streams dry. Restored stream flow amounts were Waihe‘e (10 mgd), Waiehu (2.5 mgd), Wailuku/‘Īao (0 mgd), Waikapū (0 mgd).

2011 Hui o Nā Wai ‘Ehā and Maui Tomorrow appeal final decision and requests restoration of all four streams.

2012 Hawai‘i Supreme Court hears case and finds that the Hawai‘i State Water Commission, Wailuku Water Company and HC&S failed to protect the rights of kuleana lands and Native Hawaiians who utilize stream water for traditional farming as well as protecting native stream life. The Hawai‘i Supreme Court asks Hawai‘i State Water Commission to vacate their decision and to revisit the case.

Figure 27. Waikapū Sugar Company with Waikapū Valley in the background circa 1890 (Bishop Museum)

8.0 WAIKAPŪ TOWN AND COMMUNITY

In the early 1900s, besides Waikapū being the home to one of the earliest sugar plantations, the town grew substantially. This was due to early plantation camps such as Kimura, Puʻuhele, Hyashi, Japanese and Filipino Camps. There were two open air theatres in Waikapū, both being near the old Furokawa and Sakamoto Store. A famous horse race track was situated where the current Waikapū Garden subdivision is. In the ʻili of Kuaiwa towards the top of West Waikō Road, was the old Ah Fat Chinese Store, known for good coffee and ʻono saloon pilot crackers. Along the old Waikapū Government Road was the Waikapū Protestant Church built in 1866 and Waikapū Elementary School established in the 1890s. The Protestant Church along the Old Waikapū Government Road was turned into a hospital facility during World War II. Near the end of the old Waikapū Government Road was an ancient boundary site, marked by a large hoana (grinding stone). A Mormon Church was located on the old Keanini-Enos kuleana land of Nohoʻana. The Rogers family who were also long time Waikapū kamaʻāina raised cattle, pigs, chickens and built a slaughter house near the Waikapū Stream in the ʻili of Kuaiwa and Pilipili.

At the top of West Waikō Road was the former Cornwell Estate which King Kalākaua would frequent during his visits in the 1800s. He rested there and at times gambled too. Mark Twain (Samuel Clemens) also paid a visit to the Cornwell family in Waikapū in the mid1800s and fell in love with the quaint village lifestyle. The Vida ʻohana are long time Waikapū residents who descend from the Shaw and Cockett family genealogy. They have perpetuated a very important cultural practice of raising pigs. Maui's first airport was built in 1929 near the coast of Māʻalaea but later condemned in 1938 because of its unsafe conditions. The present Maui Electric Company plant in Māʻalaea is situated on the old airport.

Today in 2013, the cultural and natural landscape has dramatically changed in Waikapū. The thriving fishing village at Māʻalaea has now turned into a harbor, condominiums, and a shopping and recreational center. The once flourishing Kapoli Spring has been covered over by a public restroom. Keālia Wetlands do not swell with the water from the once flowing streams of Mauna Kahālāwai and Haleakalā. The 65 ft. cinder cone famously known as Puʻuhele has been excavated and scattered throughout Maui. It is now used as a dumping ground for construction waste. Majority of the sand dunes have been plowed under for sugarcane cultivation or built upon for development. Sugarcane still grows throughout the Waikapū ahupuaʻa utilizing a large portion of the fresh water resources from Waikapū Stream. The prominent loʻi kalo complexes that once dominated the Waikapū landscape are now fragmented in and around housing developments and commercial agricultural ventures.

Figure 28. Ancient Waikapū ʻauwai restoration in 2004 (Hōkūao Pellegrino)

Efforts are being made by the Waikapū Community Association members and residents to perpetuate the rich cultural history of Waikapū. It is an active community group that are trying to bridge the country lifestyle with the many newcomers who are calling Waikapū home, in an effort to continue the cultural and historical identity of this ahupuaʻa.

9.0 TRADITIONAL HAWAIIAN USES AND PRACTICES IN PROJECT AREA

The proposed Waikapū Country Town Development is situated in the ʻili (subdivisions) known as ʻAikanahā, Kaumuʻīlio, Luapueo, Koʻolau, Kaloapelu, ʻĀhuakōlea, Kaʻōpala, Kaʻalaea, Kamaʻuhāliʻi, Pikokū, ʻŌlohe, Waihalulu, Kamaʻūhāliʻi. It is known that these lands were being utilized by Hawaiians prior to Western contact and settlement in Waikapū – TMK (2) 3-6-05:007 por., (2) 3-6-005-007, (2) 3-6-04:006, (2) 3-6-04:003. One pre-contact account of this area is that of the burial procession of King Kekaulike in the mid 1700s. The ʻili of Kaumuʻīlio was specifically referenced during that procession.

The most noted accounts of the lands within the project area came during the Māhele of 1848 kuleana claims. Because these lands were situated adjacent to the Waikapū Stream, numerous habitation and agricultural sites were established. According to the Indices of Māhele Awards in this area of Waikapū, there were a total of 74 ʻāpana (parcels) of lands claimed. In these claims made by Hawaiians and a few none Hawaiians, the overall use of these lands were for cultivation of wetland and dryland kalo. Almost every Native and Foreign Testimony, provided evidence that these lands were used for some form of agriculture. (see specific parcel details in the Index of Māhele Lands Awarded in Project Area) Many of these lands also included ʻauwai or irrigation ditches, which were used to feed their loʻi kalo and other crops. The Waikapū Stream was the main source of fresh water for these lands. House sites were also claimed in numerous parcels which would indicate that many Hawaiian families resided near or at their farm. Two known burial grounds were specified in two separate land claims on lands owned by the developer of this project, however they are outside of the project region.

The surrounding area of Waikapū contained land claims and uses similar to that of the project region. This included over 100 land claims. There were heiau or ceremonial sites probably associated with agriculture in a few of the adjacent lands. Unfortunately, many of them have been destroyed and/or there is little or no information about them. It is likely that those that lived within the project area prior to western contact did utilize them for religious purposes.

Further detail on each of the land claims made during the Māhele within the project area can be found within the Index of Māhele Lands Awards.

Figure 29. Ancient loʻi kalo situated within the ʻili of Nohoʻana directly across project area (Hōkūao Pellegrino)

10.0 CURRENT USES AND TRADITIONAL PRACTICES IN PROJECT AREA

The Waikapū Sugar Company and successors, Wailuku Sugar Company, HC&S, Maui Land & Pine, Wailuku Agribusiness and Wailuku Water Company have drastically impacted the cultural landscape of the project area for well over 150 years. Almost every Māhele claim awarded in the project area and their traditional uses has been obliterated by sugarcane and pineapple cultivation. The only remaining intact Māhele kuleana lands on this parcel of land are those found along the Waikapū Stream, and one such parcel of land is being utilized in its traditional form which is the upper most kuleana parcel awarded to Kupalii (LCA 3546). It is currently being leased and managed by Hui Mālama o Waikapū where a few of the loʻi kalo have been restored as well as a native dryland koaiʻa forest. Other lands adjacent to the project area are also being revitalized and used as they once were during the Māhele. These kuleana lands are inhabited and cultivated by Eassie Miller Jr. and ʻohana, Kauihou-Crabbe ʻohana, Alves ʻohana and Smythe ʻohana. These adjcacent project land owners are continuing to practice their traditional and customary rights by accessing kuleana water via ʻauwai, cultivate loʻi kalo and maintaining cultural sites such as family cemeteries. Directly across the Waikapū Stream and in close proximity to project area are the Riyu, Pellegrino, Soong, Dickson, Roger and Harders ʻOhana, whome also practice their traditional and customary rights by accessing kuleana water via ʻauwai, cultivating loʻi kalo and other traditional crops for cultural practices.

The Waikapū Stream is an important culture resource that plays an important role in the current traditional practices of this area. During the interview process, both Eassie Miller Jr. and Wally Rogers mention gathering ʻoʻopu and ʻopae which are both native aquatic species from the Waikapū Stream. Because of the current diversions and lack of mauka to makai connectivity, this cultural resource has drastically diminished and Waikapū residents are no longer able to gather from the stream to sustain their families anymore. The water that does flow in the stream is minimal and is has a great impact on the traditional and customary practices of loʻi kalo and other crop cultivation for subsistence purposes.

Waikapū Valley is another cultural resource which is used for traditional gathering of lāʻau lapaʻau or medicinal plants as well as native plant and tree seeds used for propagation by Hui Mālama o Waikapū and other kamaʻāina of Waikapū. Traditional varieties of kalo and maiʻa (banana) grow in areas throughout the valley and families still gather them as a food source. Olonā (*Touchardia latifolia*) is an endemic plant highly prized for preparing traditional fiber material. Members of Hui Mālama o Waikapū have consistently gathered material over 20 years for making cordage.

The kuleana lands that were claimed in the project area were impacted by plantation at a very early period of time, therefore many kamaʻāina of Waikapū have no recollection of specific traditional practices other than sugarcane cultivation and cattle grazing in the project area. There are however 3 kuleana lands still owned by descendants of the original claimant Ehunui (L.C.A. 2499 and Grant 1513) found within the project area. Although they were utilized for commercial sugarcane and pineapple production, the lands may possibly be in jeopardy or directly impacted by the development.

Hawaiian informants that were interviewed for this project remembered cultural practices on kuleana lands being cultivated around the project area but no accounts of traditional practices on the land actually being proposed for development. For this specific reason, one must rely on the historical accounts made within the Māhele claims to gain a better understanding of traditional and uses and practices of these lands.

11.0 ORAL INTERVIEWS

Ethnographic interviews and field visits were conducted with knowledgable individuals. Those interviewees that had participated in the study were either born and raised in Waikapū, is a current land owner in Waikapū, and/or has extensive knowledge of the ahupuaʻa and cultural resources of this area. Additionally, these oral interviews reflect the recollections of many native Hawaiian families with generational links to the ahupuaʻa of Waikapū. Individuals completely understood that conducting the interviews was for the purpose of completing a Cultural Impact Assessment for the Waikapū Country Town Development.

Interviews were conducted, in order to demonstrate who, where and how traditional cultural practices are taking place in and around the specific project area. These interviews are an integral component of a Cultural Impact Assessment (CIA). The methods used follow the Office of Environment Quality Control guidelines for assessing cultural impacts. The purpose of the CIA is to identify traditional cultural practices which could potentially be compromised by proposed development projects, and to comply with the Hawaiʻi State Department of Health Act 50.

The CIA guidelines state that project properties as well as surrounding property areas, shall be studied to determing the potential for significant and/or adverse effects on cultural practices of the community and State from the proposed construction or development. Furthermore, these guidelines also recommend personal interviews be conducted with knowledgable informants and traditional cultural practioners, concerning the cultural practices identified for the area.

On April 26th 2000, Governor Ben Cayetano signed Act 50 into law. The following CIA investigations are intended to satisfy Act 50, which has the stated purpose to:

> (1) Require that environmental impact statements include the disclosure of the effects of a proposed action on the cultural practices of the community and State; and (2) Amend the definition of "significant effect" to include adverse effects on cultural practices.

In order to perform the CIA/CIS investigation, attempts were made to contact various individuals that were knowledgable of the Waikapū ahupuaʻa and project area specifically. Many ʻōlelo Hawaiʻi (Hawaiian language) terms are used throughout the report. The depth of the Hawaiian language is such that, often, much is lost in translation to English. In order to understand the depth and breadth of the Hawaiian language, many terms were left in their Hawaiian form, translated and placed in parentheses.

11.1 Faith Fukuko Epp (Mother) & Dawn Pualani Naomi Mahi (Daughter)

Biographical Overview: Faith Fukuko Epp and Dawn Pualani Naomi Mahi have genealogical ties to Waikapū on their paternal side of the family through their father and grandfather Joseph Puleloa. The great grandfather of Joseph Puleloa (deceased) was Ehunui who received two kuleana parcels of land in the Māhele of 1848 (LCAw: 2499, R.P. 4070 AP 1 &2) and Grant 1513. Although, both were born and raised on the island of O'ahu, they currently own the two kuleana parcels of land in Waikapū, Maui which are situated within the boundaries of Waikapū Properties LLC. These lands are currently TMK: (2) 3-6-05:009 (0.06 acres) and TMK: (2) 3-6-05:010 (0.5 acres).

HP: What is your full name?

FE & DM: Faith Fukuko Epp and Dawn Pualani Naomi Mahi

HP: When were you both born?

FE & DM: I was born on December 21, 1959 (Faith Epp) and I was born on November 22, 1980 (Dawn Mahi).

HP: Where were you born?

FE & DM: We were both born in Honolulu, O'ahu.

HP: What ethnic background are you?

FE: I am Japanese and Hawaiian

DM: I am Japanese, Latino and Hawaiian

HP: Where were your parents born?

FE: Waikapū, Maui and Pepe'ekeo, Big Island

DM: Honolulu and Los Angeles, California

HP: Do you have any siblings? Where were they born?

FE: I have 1 brother and he was born in Honolulu.

DM: I have1 half sister and she was born Honolulu.

HP: What language did your parents and grandparents speak?

FE: My dad spoke Hawaiian, Japanese and English; Mom spoke Japanese and English

DM: My Mom spoke Japanese and speaks English, Dad speaks Spanish and English

HP: Do you currently live in Waikapū or have you lived in Waikapū before? If so, beginning in what year to what year?

FE & DM: No.

HP: Do you have a genealogical connection to Waikapū? If so, how and through whom?

FE: Yes, my father Elijah (Dawn's grandfather) was born in Waikapū. He was full Hawaiian. His mother Ka'ailā'au was born on the land as well and was given land there from Mahi, her father. I am adopted, however, there are other descendants of this genealogical line through my father's brother.

HP: What part of Waikapū were you and/or your family raised in? (Waikō Road, Plantation camps, near Honoapi'ilani highway, Waikapū Valley, etc..)

FE: My father Elijah was born and raised where there is currently an empty field ma uka of the Maui Tropical Plantation, close to the Waikapū stream.

HP: Did your parents, grandparents, relatives tell you any stories about Waikapū?

FE: Not many stories except for some family stories that don't relate to the 'āina.

HP: What were some important landmarks that you remember in Waikapū (stores, churches, cemeteries, schools, plantation camps, sugar mills, heiau, farms, houses, etc…)?

FE &DM: We are pretty sure that Elijah our father/grandfather, was Mormon and attended the Mormon church that used to be in Waikapū across the Waikapū Stream from the project area.

HP: What are the names of some family members that grew up around the area that you lived?

FE: Elijah Kaleikauikawekiu Mahi (Kaulei), his parents were Emily Ka'ailā'au Mahi from Waikapū and Lui Kaulei from Hāna.

HP: Do you still have family living in Waikapū. If so, who and where do they live?

FE: No! Our family hasn't lived on the land since Elijah's childhood, however we still own the parcels of land and pay the taxes.

HP: Do you remember kuleana lands, sugar cane, ranching, and/or taro patches, etc…in this area?

FE & DM: We don't know, but in our genealogy Elijah was born and raised in Waikapū and his

parents were plantation laborers in the area

HP: Currently there is large scale development being proposed on the south side of Waikapū Stream in and around the current Maui Tropical Plantation and both sides of the current Honoapi‘ilani Highway. Please see 2 page attachment to email. Ma uka of the Honoapi‘ilani Highway 80 rural/farm lots, 253 single family homes, 100 cottage/town homes, a commercial business area and parks and open spaces are being proposed. Makai of the highway are 700 single family homes, 300 cottages/town homes, 35 country town commercial business, parks, and open spaces, and a school.

HP: What are your thoughts about the scale of this project? Do you feel that it will have an impact on known / or unknown cultural sites?

DM: I feel like this is a large scale project that will irrevocably change Waikapū. We are currently in the process of researching our genealogy and understanding our ties to Waikapū. My understanding is that our family's kuleana land lies inside the area slated for development. We still pay taxes on the property. I am not sure the extent of the development or its effects, but I feel like this development could reduce or destroy our potential ability to reconnect to the land where our ancestors were born and lived their lives. If we were able to live on the land again we would want to do so in a manner that respects the agricultural past of our ancestors and the current resources of the ‘āina. The stream by our property hardly seems to flow and I know there is a water shortage on Maui. How can this development be a good idea?

HP: Do you think that this development will change the character of Waikapū? If so, how?

DM: From what I've experienced in Waikapū it has a rural, small community feel. From the description of this large-scale development that community feeling will be obliterated.

HP: If there are cultural sites in the area to be developed, should they be preserved?

DM: Cultural sites should be preserved. So much of the land's historic characteristics have been destroyed by modern ag practices and housing development, anything that is left deserves to be preserved for the generations to come.

HP: Is there anything else that would like to share about Waikapū and/or anything related to this development?

FE & DM: We appreciate the opportunity to provide some small comments regarding this area and its history, and our family's connection to Waikapū.

11.2 Waldemar "Wally" Frank Rogers

Biographical Overview: Waldemar "Wally" Frank Rogers is a part Hawaiian resident of Waikapū who was born, raised and currently lives directly across the lands of Waikapū Properties LLC and the Waikapū Stream. He and his family (Rogers and Harders) own over 25 acres of land on the north side of the Waikapū Stream on kuleana lands they received at the time of the Māhele of 1848. Their family continue to farm their lands traditionally with loʻi kalo and other food crops that utilize water directly from the Waikapū Stream via a kuleana ʻauwai (irrigation ditch).

HP: What is your full name?

WR: Waldemar F. Roger

HP: What does the F. stand for?

WR: Frank

HP: What year, when were you born?

WR: September 13, 1944. I am 70 years old.

HP: Were you born here in Waikapu?

WR: No, I was born in Wailuku, The hospital by St. Anthony, Malulani Hospital

HP: What is your ethnic background

WR: I am English, Hawaiian, Portuguese, French, that's all I can remember. There could be some Irish in there too, I don't know. I think my mother had some Irish, but I'm not sure.

HP: And your mother and father, what were their names and where were they born?

WR: Edmond H. Rogers is my dad, he was born on Maui.

HP: Was he born here in Waikapu?

WR: That I don't know. And then my mom we know was Wynona Church and she was born on Maui too. But she went to school in Honolulu, Oʻahu for a couple of years.

HP: And you went to school on Oahu? So where did you start off school?

WR: Wailuku Elementary, Kaunoa School, and then Punahou for High School.

HP: Did all three of your siblings go to Punahou?

WR: All three. But they said don't tell anybody you went to Punahou, because I was such a bad student. I don't tell anyone I went there.

HP: What are your siblings names?

WR: Edmond Jr. Rogers and Zelie Harders (Rogers). They might call her Elizabeth as her official name. I only know her as Zelie.

HP: Did your parents and grandparents speak any other language, other than English?

WR: I don't think so, they may have spoke a little Hawaiian, but I don't think so.

HP: You currently live in Waikapū. How long have you lived in Waikapū? Did you live anywhere else, besides when you went to school on Oahu?

WR: Yeah, I went to school (college) in California for a couple of years and lived in Scandinavia for a year.

HP: Were you in the military?

WR: Yeah, during Vietnam. I was in the National Guard Call Up. I was in Wahiawa for 10 months and Vietnam for another 10 months.

HP: Where did you live following Vietnam

WR: When I came back from Vietnam, I moved to New York. I went taking Photography school I went to. And that's where I met this guy from Scandinavia and he was going back and I didn't like New York. So I thought…

HP: What year was that in?

WR: In 1971 maybe. My timeline is not good anymore. It was around 1971

HP: Following your trip to Scandinavia, you came back to Maui. Did you live in Waikapū? Were your parents still alive?

WR: Yes, they were alive and I moved back to Waikapū and started the piggery.

HP: Where was the piggery located?

WR: Where Funai Nursery is now.

HP: Wasn't slaughter house located here by the stream?

WR: The slaughter house was right there, just to the left of that mango tree. And then the road, there used to be a big hill up here before. And when Grandpa built this subdivision he

grated it all down. And then the dirt road to come down, came right by this ʻulu tree. So it came right where my deck is. That's where the road came in. Then there was a house probably right over here. On the bank, they had pigs over here. But that was a long time ago. Oh and they had pigs over here too, this side. And then the rest of it was all Okinawans. They were growing vegetables.

HP: So they were leasing or renting from your parents?

WR: Yeah, they were renting. It was like two dollars a month or something in those days. And because these Okinawans didn't have any money. Everything they grew, they ate. What extra than they would sell. Basically, so they could survive.

HP: Were there any markets in Waikapū? Or did they go to Wailuku Town?

WR: I don't know if you remember Sakuma. No, Sakuma was probably. I think he was here when you were small. But he was right across from Aunty Pat's. That's where he was. There was a house there. He had one of those old Model T Fords with the small little box on the back. When he would go to Wailuku He would take it to that old market. On Vineyard Street, when you go by Good Shepard Church. Just in the back there, there was a market there. That's where he used to sell all his stuff. Cause I remember he never had enough room in the back. He would put it all in burlap bags. He put it all on the flared fenders and tie it to the fenders. He was the most comical thing. But back then wasn't that funny, cause that's how it was and you would see him going about 5 miles per hour, *bububububu*. But what they didn't eat they sold. They all had few pigs. They had the meat and then the extra pigs, they would sell them.

HP: Who besides yourself worked at the slaughter house?

WR: I was small when the slaughter house was there.

HP: Was it there before you went off to Vietnam? And then when you came back you worked there?

WR: The slaughter house was gone way before that. I don't know when they took that down.

HP: When you moved back in the 70ʻs it was gone?

WR: Was long gone. Even when I was at Punahou. I would say it was gone in the 50s.

HP: But your mom and dad started the slaughter house?

WR: Yeah

HP: Were your grandparents born and raised here in Waikapū?

WR: No

HP: What was their names?

WR: I never knew them. They were all gone by the time we were kids. Except I knew my dad's mother. She was a Rego. I don't know, she could've been born on Maui.

HP: You have all the genealogy?

WR: Yeah Zelie would know.

HP: Did your parents ever tell you any stories about Waikapū, related to the names or names of the mountains, ridges?

WR: No

HP: When you were growing up what were some of the important landmarks in Waikapū? Stores, churches cemeteries…..?

WR: They used to have the church with the big steeple (Waikapū Protestant Church). And they had Waikapū School. When I was small kid, the school was still there, but they didn't use it.

HP: What happened to it? They just tore it down?

WR: They tore it down. Was a nice little school. Had a nice playground in front.

HP: Do you remember how many classrooms?

WR: I think maybe there were three or four classrooms. It was all just one building. I don't know if you've seen a picture of it. It had like a nice little veranda in the front. I don't know what they did for lunch. I don't know if they had to bring their own lunch. I don't think they had a cafeteria.

HP: There was a cemetery too, right by the church?

WR: Yeah, there is.

HP: Do you remember any other cemeteries in this vicinity?

WR: There is one up by Avery Chumbley's place. The Cornwell Family. That's the only ones I know of in this area. Oh, and the Vida's have a cemetery too on their property.

HP: Were there any plantation camps in Waikapū when you were growing up, that you can recall?

WR: No, only across the highway (East Waikō Road). That was plantation before in the old days.
HP: Were there any names for those plantation camps?

WR: I don't know. Flo Nakama would know.

HP: By that time when you were growing up, the Waikapū Sugar Mill was already closed. No remnants?

WR: Oh yeah. But somebody told me there was a dairy up here too. I said what, I never heard of no dairy. Some guy came and was looking for some bottles from this dairy. I said what?

HP: Above Avery Chumbley's side?

WR: I'm not exactly sure. I think it was where Mike Erwin lives. Down below the McLean's place. I think it was in there. That is what somebody was telling me. But I have no idea. That was the first I ever heard about some dairy. Some Portuguese family was running it. I don't know who would remember. I think it was probably even before Zelie's time that dairy was there. Maybe Zelie might remember.

HP: Other than the piggery and slaughter house, were there any other farms that you can remember in Waikapu at the time? Like even on our property?

WR: When I was a kid they were still growing taro. I don't know if Enos family themselves. I think they leased it out to maybe two or three different guys who just had a couple plots. Each one they had their goats and pig pen. It was all, you know.

HP: What about up above? There was sugar cane up all around Waikapū at that time when you were growing up.

WR: They just had the luna's houses up there, where Randy Piltz and them live. That was all the housing that was up there. That was all for the plantation. And then where Avery Chumbley lives on that side, that was there too. But it was all for the bosses, all the lunas and the guys who were running the departments.

HP: Do you remember any farming across the river on the south side?

WR: The only thing I remember is sugar. Just sugar across the river. It was total, 100% sugar.

HP: Was the Shimizu Family farming?

WR: Yes, right were they are, exactly the same

HP: Was Uncle Bolo Riyu farming as well?

WR: He was farming too. He gave up after a while and his brother came. Who is living up there now?

HP: Uncle Bolo's wife still lives there, Katherine Riyu. Dustin Vegas is now farming kalo on her land

HP: What were some of the things you did in your past time while growing up?

WR: We were lucky. We never got stuff from the store. We would get a ball but maybe that was it. We had horses, the stream, the pūnāwai, we would go fish inside. There was goldfish in there. You could see the gold on the top of the water. There was tilapia too. We went hiking up the stream. We would make tin boats from metal roofing. I think back at how much fun that was. We used to make our own pop guns from the bamboo. We would chase each other on horses and "pop pop" at each other. My dad used to come with a new skin ball each year. It was like four or five bucks. He said if we lost the ball tomorrow, boy you would have a long way. We used to play in the yard by the ditch. It was all pasture on this side. If you hit the ball over the ditch, a long one, we would spend hours looking for the ball. We used to tape the ball just to make it last throughout the year. There was no such thing as "Dad I lost the ball". He wouldn't go and buy another one. He would say… "tough shit boy". That's how it was back in the day. When your parents said something, that was it. There was no negotiating. It was a done deal. That's how it was with my dad. Kid's look at me today like we are nuts. When the ball rolls down the street now, the kids just let um roll down the road.

HP: Was there any stores when you were growing up in Waikapū?

WR: Furokawa Store is on the Wailuku side of the street where 808 Café was. Sakamoto Store was after the bridge. Before my time there was an open air theatre across the street. There were two. One next to Furokawa store and one across the street. We used to walk down. No more street lights at night in those days. When we went home, it was dark, so we used to run.

HP: How many people could the theatre hold?

WR: There were bleachers, so maybe 200 people?

HP: What did they sell at Furokawa and Sakamoto Store?

WR: Furokawa had much more. They both mostly dry goods, snacks, candy. No food there! Can goods and snack stuff.

HP: What are some of your fondest memories of Waikapū?

WR: I think remembering how good we had it. In those days, you would see other kids with toys, bicycles, and you know….we would get kind jealous. At this point in my life, I look at it now and I think we had it better.

HP: Did you family have any special traditions in Waikapū?

WR: We always had the imu for New Years. The main house where Cindy Padget and family lives was where the party's were. We had the kālua pit by the side of the house near the kitchen and the ʻulu tree is today. It's all filled in now. We used to have to go down to the beach to pick up the rocks for the imu. Ted and Zelie got married there. We had a number of weddings there over the last 50 years.

HP: As we move more specifically towards questions regarding the development project? What cultural and natural resources do you remember? Specifically cultural sites in Waikapū, such as heiau, wind names, ʻauwai, streams, taro patches, springs, fishponds, etc..

WR: I don't know too much.

HP: What was Māʻalaea like when you were growing up?

WR: We used to go fishing down there all the time when we were kids.

HP: What did you go fishing for?

WR: Whatever kine fish, manini, weke. We used to ride our bikes to Māʻalaea because it was all downhill. Then we would call grandpa to come pick us up in his truck. It wasn't easy getting back home to Waikapū on the bike with the strong winds.

HP: Was the harbor built yet when you were young?

WR: The main jetty was built.

HP: There used to be a spring there, do you remember anything about Kapoli spring?

WR: I remember somebody telling me there was a spring. A freshwater spring under the water.

HP: Do you remember any of the families that lived down in Māʻalaea?

WR: Jimmy Ono ran a store, Māʻalaea Store. Kono or Kano, a Japanese family lived there. The Nagamine's that lived up at the farm knew all those guys and would call them before we went fishing to see what the water was like. There weren't many people living down there. It was basically the pier and Jimmy'a Māʻalaea Store. There weren't any condos.

HP: What about Keālia?

WR: I don't remember anything about Keālia. We drove past it when we went to Kīhei, but we never really paid attention to it.

HP: Do you know of any heiau?

WR: I don't know about any heiau here in Waikapū that existed in my time.

HP: Have you heard of Hana'ula?

WR: No.

HP: Back of the valley, where Everett Ditch starts? Does the name Kalena Stream ring a bell? How about a ridge named Kaiwaloa across from Reservoir #1 on the Mā'alaea side of Waikapū Stream?

WR: No

HP: Do you remember any natural disasters in Waikapu during your lifetime?

WR: Not since I was born. The worst storm I can remember was in 1980. They said it wasn't really a hurricane but it sure felt like one.

HP: I heard about that and remember my parents saying boulders crossed the road.

WR: I don't know about that. I've never seen this river overflow. I had the house we are currently living rented out at the time to two single girls. They were really scared during the this storm. There was a lull for 2-3 hours and then it came back again. The houses were shaking.

HP: What was the Waikapu stream like when you grew up? Was it flowing, diverted by plantations, did it only flow at certain times?

WR: Back when I had the pigs in the 70s, it was the same problem. We couldn't get enough water. At night, they took 100% of the water. During the day they let a quarter of it go. Sometimes it was so low, the water wouldn't get down here until noontime. I used the water to clean my pens. It would take a lot of water to flush all of my pens out. I had a little lagoon I used to pump water to flush all the pens out, but the lagoon had to be pretty full to get enough water.

HP: What did you do to get more water if the stream wasn't flowing?

WR: Once in a while, I would call them. But they completely controlled the water.

HP: What was the stream like back then compared to today?

WR: Today, this is more water than we used to get.

HP: Do you remember the dams growing up?

WR: When we were kids we really didn't pay attention to the dams. I remember where the ditches were, but I never knew their names.

HP: Everett ditch?

WR: Is that the one that goes to the top of Wailuku heights? When we were kids it was always flowing. The other one above the pūnāwai and another flume where they could cut the water off and let it go back to the stream. The one I used to open was down below.There was a road- water could go back down or to the fields. There was a chute back to the stream. That is the one they would open to give us water. Even in those days it was hell to get water.

HP: Remember any of the workers' names?

WR: The only man I used to deal with was a short little chubby Japanese man, friendly. He's still around. Sometimes, I used to go around 5:30 and drive up there to pull the gate. I only needed the water 2-3 times a week to wash the pens. When you would come out in the morning there wasn't one drop in the stream. It was bone dry.

HP: When did they start to release more water?

WR: As long as the company was controlling it, it didn't matter how much volume there was. They only gave you some during the day. One day the guy came and asked me, How come you opening the gate? I told him, by the time you give me water it is 4 or 5:00. How am I supposed to do my work? You don't own the water. You supposed to let the water run 24 hours. I am not afraid of Wailuku Sugar. After that, it got a little better. In the olden days, the plantation used to intimidate everyone. They never had a right, but they just took over the water.

HP: Do you remember any native stream life?

WR: I remember some ʻoʻopu, very few. All inside the river here. But once they started completely cutting off the water from the stream, there was no more.

HP: When did you help with the pig pens?

WR: After my grandpa was retired, that's when I took care of the water.

HP: Who would help you clean out the poʻowai or care for the ʻauwai?

WR: I used to have to go clean out the ʻauwai, usually by myself. Once in a while Bolo would come around to help. Shimuzu would come out and help sometimes. Back then everyone would spray herbicide, so the banks would stay clean. But when I started taking care of the banks, I knew the herbicide was bad and you could get it in trouble, so I would keep it clean by hand. Back then there was no more weedwacker, only sickle.

HP: What was growing on the neighbors' lands.

WR: Shimuzu was farming taro. Bolo started farming. Soongs never used their property. The Tom's had water rights too, but they used to rent it out. Had to clean it from Bolo's all the way to the Rosario's.

HP: Did the water always go down by Aunty Pat's property?

WR: Always went through Aunty Pat's.

HP: Was there sugar cane after Aunty Pat's?

WR: As far back as I can remember there were only houses I remember.

HP: The sugar company never maintained the 'auwai?

WR: Not when it came through private property.

HP: Do you remember the ditch on that side?

WR: The ditch came right through those trees there. I never knew those guys. That side of that stream, we never really went.

HP: How big was the 'o'opu you used to catch?

WR: Small kind. Don't remember which kind. Had 'opae too, but I don't remember seeing any.

HP: Large scale development, where the current Maui Tropical Plantation is. After looking at the development map, do you remember anything else in this area?

WR: No, I don't remember anything.

HP: Is it true that your family scattered their ashes by Reservoir 1?

WR: A little trail All the ashes go down the stream. Grandma Rogers was the first one, then Aunty Pat, my sister, and brother-in-law will go all at one time. Aunty Darlene's mother and father are up there too. It is one certain area we go and we scatter the ashes and throw flowers. That is where we will all end up. As long as they don't cut off access, as long as the ditch is there, we can get there. It is a beautiful spot.

HP: Do you have any thoughts about the impact of the project?

WR: There is no question that there will be an impact. It looks like it is pretty thought out, but I still rather see trees besides that. From what I understand, not in my lifetime, both sides of the road will be developed all the way down. But even when I was a little kid they only

had Wailuku Heights with only two roads. When I was little we used to ride horses up there. I used to tell people it would be all houses one day and look now.

HP: Do you feel like this development will affect your family's way of life?

WR: The traffic and maybe some convenience store, so we don't have to run to Wailuku. I don't think it will do us any good. I don't see any benefit for us.

HP: If there could be some benefit, like a resource or something in return? Mike's been talking about putting water back into the stream, since he is drilling wells.

WR: Putting water back would be better. But you have to give and take. I won't see the change.

HP: Is there anything else about Waikapu that you'd like to share?

WR: Just lucky we live here, very fortunate.

HP: What year did you go to Oahu for high school?

WR: I started in eighth grade and graduated in 1963. I was at Punahou for five years.

HP: And how many years were you away from Hawaii?

WR: Came back in 1971 or 1972, so 13-14 years.

HP: When did your dad subdivide this area?

WR: I don't remember the timeline. But I remember them working on it.

HP: Was the land subdivided for rentals?

WR: All subdivided and sold for lots. He kept some and gave each of his children a plot.

HP: When did you meet Aunty Darlene?

WR: We've been together for 27 years.

HP: Well I appreciate your time. Mahalo nui!

11.3 Muriel Kaohulani Enos Prager

Biographical Overview: Muriel Kaohulani Enos Prager was born and raised in Waikapū on kuleana land that her family received at the time of the Māhele of 1848 through her great great grandfather Kuolaia (L.C.Aw. 3110, R.P. 3152, AP. 1 &2) and great great grandfather Nahau (L.C.Aw. 3340, R.P. 3115, AP. 1-3), and Kalawaia (L.C.Aw 3103, R.P. 3127, AP. 1) A portion of these lands are owned by her daughter Dalani Kaye Prager (Kauihou) and granddaughter Ka'iulani Kauihou-Crabbe. These lands are currently situated on the south side of the Waikapū Stream, adjacent and surrounded by Waikapū Properties LLC and found within TMK (2) 3-6-05-014) (0.48 acres), TMK (2) 3-6-05-066 (0.04 acres) and TMK (2) 3-6-05-067 (1.26 acres).

HP: What is your full name?

MP: Muriel Kaohulani (Enos) Prager

HP: When were you born?

MP: I was born on Dec 10, 1932

HP: Where were you born?

MP: I was born at Malulani Hospital in Wailuku, Maui

HP: What ethnic background are you?

MP: I am Hawaiian, Portuguese, Caucasian.

HP: Where were your parents born?

MP: My mother, Emily Aulani Wilson was born in Makawao and my father Arthur Kamaka Enos born in Waikapū on the land that you live on currently.

HP: Do you have any siblings? Where were they born?

MP: I have 4 sisters, 1 brother. They were born in Wailuku and Waikapū

HP: What language did your parents and grandparents speak?

MP: On my paternal side, my grandma spoke only Hawaiian, Dad also spoke Hawaiian but encouraged the kids to only speak English. He said that as people came to Hawaii from around the world they would most likely speak English. On my maternal side, everyone spoke English.

HP Do you currently live in Waikapū or have you lived in Waikapū before? If so, beginning in what year to what year?

MP: I lived in Waikapū at the ʻili of Nohoʻana from 1937 to 1943.

HP: Do you have a genealogical connection to Waikapū? If so, how and through whom?

MP: My fathers side of the family, Enos and Keanini families was the Waikapū connection. Nahau Keanini received the Land Commission Award to the ʻili of Nohoʻana in Waikapu. His daughter Ella Kaohulani Keanini married Huakini Enos Jr. They were my fathers parents.

HP: What part of Waikapū were you and/or your family raised in? (Waikō Road, Plantation camps, near Honoapiʻilani highway, Waikapū Valley, etc..)

MP: They lived off Waikō Road, the Nohoʻana kuleana land.

HP: Did your parents, grandparents, relatives tell you any stories about Waikapū?

MP: There was an airplane that crashed in the mountians, and Dad knew the terrain there so they went to rescue the person. There was a Chinese family that lived in back of their house. Our family would go cut an ironwood tree for Christmas.

HP: What were some important landmarks that you remember in Waikapū (stores, churches, cemeteries, schools, plantation camps, sugar mills, heiau, farms, houses, etc…)

MP: There was a Mormon church on our property. According to my mother's account, "My Husband's parents lived near the Waikapū Church. In fact, the property that the Church is on, was their property and they gave it to the Church to build that chapel on. In about 1966 we heard that the Church was going to sell it. So we wrote to the mission president and asked if we could buy it, and so we have bought the church. The chapel still stands on the property. (this was in 1981 when this interview was done with my mother – Emily Enos) There is a family cemetery next to the church as well.

HP: What are the names of some family members that grew up around the area that you lived?

MP: Nahau Keanini/Kalua Kailianu Hoopii -- Ella, Lulu, Alice, Arthur, Kuikuiehu Keanini Huakini Enos Sr./Kahaleaua -- Alai, Huakini Jr, William, John, Joseph, James, Sarah Enos Huakini Enos Jr./Ella Kaohulani Keanini -- Arthur, Edmond, John Enos Huakini later divorced Ella and married her sister Lulu, but then divorced her and remarried Ella.

HP: When you grew up in Waikapū, what kinds of things did you do in your pastime?

MP: I worked in the taro patch and played by the river when it wasn't raining.

HP: Did you go to school in Waikapū? If so, who were some of your classmates and/or teachers?

MP: No, I went to school in Wailuku, ʻĪao for kindergarten, and then Kaunoa until 8th grade Mrs. Huffy in kindergarten, Mrs. Kennedy in 6th grade at Kaunoa, an English standard school, was only school you could chose to go to Maui High or Baldwin High after.

HP: Describe a typical day in the life of the family when you were growing up in Waikapū?

MP: We worked in the taro patch, cared for the farm animals, pigs, chickens. On Saturdays we would go pick a certain weed in the cane fields to feed the pigs and then go to family land at Māʻalaea to get kiawe beans to feed the animals. This was before the war. After PH a plane landing was build in front of the Māʻalaea house. We would water the garden and tend our vegetable patches.

HP: What are some of your fondest memories of Waikapū?

MP: Christmas was a fun time. We would make cookies and candy and go with dad to get Christmas tree, make ornaments for it and make presents for each other. Mom was so creative and the older sisters would make the meal, younger kids would do dishes, sit and listen to the radio, dad would play saxaphone and mom play piano while the 6 kids would sing. Dad would play sax as the kids would fall asleep. There was always music in the house. Dad had a swing band and played for the service men during the war.

HP: Do you still have family living in Waikapū. If so, who and where do they live?

MP: Only you folks that live on the land.

HP: Were there any cultural sites and/or resources that you were aware of in Waikapū (Example: heiau, archaeological sites, winds ʻauwai, streams, taro patches, kuleana lands, burial sites, caves, fishponds, springs, fishing grounds, etc….) If so, could you briefly describe where they were located and if they were in use at that time that you grew up in Waikapū?

MP: Aunty Alae was a kahuna lāʻau lapaʻau who often cared for the family using traditional herbs. She lived up the road past the church.

HP: Do remember any Hawaiian place names in Waikapū? (Example: Kalena, Hanaʻula, Keālia, Māʻalaea, Kapoli, Kaiwaloa, etc…..)

MP: We had family land at Māʻalaea

HP: Do you remember any natural disasters in Waikapū? (Example, floods, storms, hurricanes, tsunami)

MP: Just during heavy rains, the river would flood and it was hard to cross over the board that lay across the river.

HP: What was the Waikapū Stream like when you were growing up in Waikapū? Was it

flowing? Was it diverted by the sugar plantation? Did it flow only at certain times?

MP: The stream always flowed, don't remember it being dry or how much water was necessarily in it.

HP: Do remember any ʻauwai (traditional irrigation ditches – used for taro farming, etc..)?

MP: Yes, they were all intact and active in and around our land.

HP: Did you go down to the stream or use the ʻauwai? If so, what for?

MP: Yes, for the taro patches.

HP: Did you or your family ever gather anything from the Waikapū Stream or ʻauwai for food? If so, do you remember what it was? (Example: ʻoʻopu, ʻōpae, hīhīwai, etc…)

MP: We used to get hīhīwai, ʻoʻopu, and snails from the taro patch

HP: Currently there is large scale development being proposed on the south side of Waikapū Stream in and around the current Maui Tropical Plantation and both sides of the current Honoapiʻilani Highway. Mauka of the Honoapiʻilani Highway 80 rural/farm lots, 253 single family homes, 100 cottage/town homes, a commercial business area and parks and open spaces are being proposed. Makai of the highway are 700 single family homes, 300 cottages/town homes, 35 country town commercial business, parks, and open spaces, and a school.

HP: Do you remember kuleana lands, sugar cane, ranching, and/or taro patches, etc…in this area?

MP: My family had large taro patches that were only for family use, not sold.

HP: If do not currently live in Waikapū, what age were you when you moved away?

MP: I was age 10 when I left but I always went back to visit family until I left to go to college

HP: What was your reasoning for leaving Waikapū?

MP: We moved because my family moved to Wailuku...mom was café manager for ʻĪao school and we lived at the big house in Wailuku on Vineyard Street. This house was torn down.

HP: If there are cultural sites in the area to be developed, should they be preserved?

MP: This issues need to be handled appropriately.

HP: If you currently live in Waikapū or have land, how will this project affect you and your

‘ohana, as well as your land and resources?
MP: I am no sure!

HP: Is there anything else that would like to share about Waikapū and/or anything related to this development?

MP: I loved living there in Waikapū, surrounded by food. My dad loved to fish at Mā‘alaea. W had big farm with the extended Enos family, dads brothers and their families.

11.4 Dalani Kaye Prager (Kauihou) Tanahy

Biographical Overview: Dalani Kaye Prager (Kauihou) was born and raised in San Diego, California. Her mother is Muriel was born on kuleana land that her family received at the time of the Māhele of 1848 through her great great grandfather Kuolaia (L.C.Aw. 3110, R.P. 3152, AP. 1 &2) and great great grandfather Nahau (L.C.Aw. 3340, R.P. 3115, AP. 1-3), and Kalawaia (L.C.Aw 3103, R.P. 3127, AP. Dalani and daughter Ka‘iulani Kauihou-Crabbe currently own the above kuleana parcels of land. These lands are currently situated on the south side of the Waikapū Stream, adjacent and surrounded by Waikapū Properties LLC and found within TMK (2) 3-6-05-014) (0.48 acres), TMK (2) 3-6-05-066 (0.04 acres) and TMK (2) 3-6-05-067 (1.26 acres). Dalani and her daughter Ka‘iu have worked closely with Waikapū Properties LLC to secure these aforementioined lands while deeding one of the parcels to them. They are currently in the process of moving back to Maui and restoring the traditional lo‘i kalo agricultural sites situated on their land along with the kuleana ‘auwai (irrigation ditch) which once fed their taro patches.

HP: What is your full name?

DT: Dalani Kaye Prager (Kauihou) Tanahy

HP: When were you born?

DT: I was born on July 22, 1961

HP: Where were you born?

DT: I was born in San Diego, California.

HP: What ethnic background are you?

DT: Hawaiian, Portuguese, Caucasian

HP: Where were your parents born?

DT: My Mother, Muriel K. Enos was born in Wailuku, Father, Daniel B. Prager was born in San Diego

HP: Do you have any siblings? Where were they born?

DT: I have 2 sisters and 1 brother-San Diego.

HP: What language did your parents and grandparents speak?

DT: They spoke English.

HP: Do you currently live in Waikapū or have you lived in Waikapū before? If so, beginning in

what year to what year?

DT: No

HP: Do you have a genealogical connection to Waikapū? If so, how and through whom?

DT: My grandfathers side of the family, Enos and Keanini families. Nahau Keanini received the Land Commission Award to Noho‘ana in Waikapū. His daughter Ella Kaohulani Keanini married Huakini Enos Jr. They were my father’s parents.

HP: What part of Waikapū were you and/or your family raised in? (Waikō Road, Plantation camps, near Honoapi‘ilani highway, Waikapū Valley, etc..)

DT: Our ‘ohana lived along waikō road on your ‘āina of the Noho‘ana kuleana land.

HP: Did your parents, grandparents, relatives tell you any stories about Waikapū?

DT: Unfortunately not too much

HP: What were some important landmarks that you remember in Waikapū (stores, churches, cemeteries, schools, plantation camps, sugar mills, heiau, farms, houses, etc…)

DT: We had heard about the property but were more familiar with the family house in Wailuku

HP: What are the names of some family members that grew up around the area that you (mom) lived?

DT: Nahau Keanini/Kalua Kailianu Hoopi‘i==Ella, Lulu, Alice, Arthur, Kuikuiehu Keanini
Huakini Enos Sr./Kahaleaua===Alai, Huakini Jr, William, John, Joseph, James, Sarah Enos
Huakini Enos Jr./Ella Kaohulani Keanini===Arthur, Edmond, John Enos
Huakini later divorced Ella and married her sister Lulu, but then divorced her and remarried Ella.

HP: Do you still have family living in Waikapū. If so, who and where do they live?

DT: Yes, you…..Hōkūao Pellegrino and your family at Noho‘ana

HP: Currently there is large scale development being proposed on the south side of Waikapū Stream in and around the current Maui Tropical Plantation and both sides of the current Honoapi‘ilani Highway. Please tale a look at the 2 page map. Mauka of the Honoapi‘ilani Highway 80 rural/farm lots, 253 single family homes, 100 cottage/town homes, a commercial business area and parks and open spaces are being proposed. Makai of the highway are 700 single family homes, 300 cottages/town homes, 35 country town commercial business, parks, and open spaces, and a school.

HP: Do you think that this development will change the character and cultural features of Waikapū? If so, how?

DT: I think so, it will add more urban/suburban sprawl.

HP: If you currently live in Waikapū or have land, how will this project affect you and your ʻohana, as well as your land and resources?

DT: We have bought our moms interest in the family land in Waikapu and own in in partiality with Mike Atherton. We are currently trying to obtain control over the entire property to hold for our family, since it is still kuleana land.

HP: Is there anything else that would like to share about Waikapū and/or anything related to this development?

DT: I was never really aware of this particular property until my mom inherited it from her mom. When we first went to see it there was no way to access it and it was all overgrown. She was not able to see the property, the way she remembered it, since she had moved away to go to college. She has been able to visit Nohoʻana now that your family has cleared and restored it. When she inherited it, it was also owned by Wailuku Sugar, then Avery Chumbley, and now Mike Atherton. I told her to continue to pay the taxes on it and wait and see what will happen. Even though it's not within the development, that property specifically is not in the development path because it is right along the river. I hope to be able to work out something with the developers to be able to utilize the land somehow.

HP: Mahalo for your time.

DT: Mahalo nui!

11.5 Florence Kamie Nakama

Biographical Overview: Florence Kamie Nakama was born and raised in Waikapū. Her family is Japanese and worked for the Wailuku Sugar Company while living a portion of her life in the Japanese Plantation Camp. She currently lives along South Waikō Road. Florence has an expansive knowledge base of the post-contact historical sites within Waikapū that are mainly associated with the Wailuku Sugar Plantation era.

HP: What is your full name?

FN: Florence Kamie Nakama

HP: When were you born?

FN: April 14, 1939

HP: Where were you born?

FN: In Wailuku, the Manulani Hospital.

HP: What are your ethnicities?

FN: Okinawan

HP: Where were your parents born?

FN: My father was born in Okinawa. My mother was born on Oahu, but was taken back to Okinawa. She returned to Hawaii after she married my father. I think she was 17.

HP: When did they move to Maui?

FN: They moved to Lahaina first to work in the plantation. Then he moved here to Waikapū. He worked for Wailuku Sugar.

HP: What did he do for the company?

FN: My father used to do the watering. He was like a ditch man or an irrigation specialist. I can't remember the name for it. Depending on that he would get paid more or less.

HP: Did they live in this house?

FN: This house was rebuilt, but they lived in this area in the plantation camp. I can't remember the year, but it was when Wailuku Sugar Company was selling the land.

HP: What was the name of the plantation? Was it Hiyashi? Or Kimura

FN: I can‘t remember the name. Hiyashi Camp was later and down by nuber 8 pūnāwai. I don’t know Kimura. It must have been before.

HP: Was this considered a camp?

FN: Yes, maybe it was called Waikapū Camp or Japanese Camp.

HP: Do you have any siblings?

FN: I have a brother and a sister. My sister lives on Oahu and my brother in Waiolani, Edgar.

HP: What languages did your parents speak?

FN: They spoke Okinawan, but when they moved here they lost it. When they moved here, they spoke mostly Japanese. My father would speak English more than my mother.

HP: Did you learn to speak both languages?

FN: No, my father said we didn‘t have to go to Japanese school because it was an English speaking world. There was no sense, even though I wanted to.

HP: What were some of the things that you recall about Waikapū?

FN: Across the way was a pasture, where Waikapū Park is. Where the houses are now there used to be gardens. The families could raise vegetables and grow things

HP: Were there any stores nearby?

FN: Furukawa store was the first store before the river and Sakamoto store was where the gift or dress shop or something.

HP: Where were the open air theaters?

FN: The theater I know was the one that showed regular films. People came from all over because people smoke, since it was an open-air theater. It was where Bob and Winnie live, the two story house. They said across the street was a Japanese theater that the Sakamotos used to run, but I never went there. Next to that, the Sakamotos also had a service station. It was only a gas station, they didn‘t fix cars.

HP: Was the St. Joseph’s church still there?

FN: Yes, but it was farther down. At the dirt road, there used to be a bar. I don‘t remember the name. Naokis used to be there too. And then across, next to Sakamoto store was a barber shop, a pool hall, and a liquor store. I don‘t remember who owned the liquor store, but Barbara Sakuma used to work there. The Sakuma family used to live across from Patty‘s

place. Barbara was the youngest of the family.

HP: Where do they live now?

FN: I think they are all gone. I don't know if the grandchildren recall that place because they are so much younger?

HP: Was there anything up Waikō Rd. beside the Waikapū Protestant Church? Do you remember the Mormon Church?

FN: There was a Mormon Church next to the Tom's house, where Greg Chow's house is now. Those were his grandparents. And the Enos lived down there.

HP: Do you remember the Enos?

FN: I remember Ku'ulei, Maile, and Viola. I remember those three, but the rest, I'm not sure.

HP: Were they farming in that area?

FN: Yes, the Matsui family used to farm on your property. I think all of the children are gone. The Matsui family is related to Howard Nakamura's wife. She was a Matsui from Ma'alaea, but they are cousins I think.

HP: When you were growing up, this area was all sugar cane? Was Maui Tropical Plantation all sugar back then?

FN: The Maui Tropical Plantation area was all sugar. There was a road going up to another reservoir up there, Reservoir 1.

HP: Do you remember any other Hawaiian families that lived around here?

FN: Not really. There was a man named Fege, he was a veteran I think. His grave is around here.

HP: Do you remember a Solomon Vierra or Viella? He grew up at the top of Waiko Rd.

FN: I remember the Kai'liponis and the Richards family. They were at the top of the road.

HP: Were they farming back then?

FN: I don't think so. I remember my father and Mr. Oshiro used to work for Eddie Rogers. I think they used to have cattle up there. They used to work for him part time.

HP: Do you remember any archeological sites or cultural sites, like heiau?

FN: No heiau. Just the graveyard down there.

HP: I know majority of the graves are Japanese, but was their any Hawaiian graves?

FN: The man I mentioned earlier, named Fege. I don‘t know if it was his first name or last. He was a veteran. Too bad, Mr. Sakamoto would put flags and flowers on his grave because he was a veteran. Another family that used to do that too, maybe the McLean family would do that. And other families did that too, there several.

HP: What did you do to past time in Waikapū growing up?

FN: We used to go down to the river, it was a big thing. I used to go down and catch fish.

HP: Do you remember what kind of fish?

FN: Guppies, I guess.

HP: What was the stream like when you were growing up?

FN: There was more water, that’s for sure. We used to have to be careful.

HP: Where did you used to go.

FN: We would just stay on this side. They had a lot of plum trees. We used to climb and pick the plums and put them into jars with sugar and shake them up.

HP: Was that reservoir always there?

FN: Yes, that is where we learned to swim in the reservoir. It was like a swimming pool. We Weren’t supposed to go down there. We used to catch frogs because there used to be grass down there. We would use a red piece of fabric to catch them. Some people would eat it. Only once, I tried fried legs in Honolulu. It was a delicacy.

HP: What was Mā‘alaea like back then? Was the harbor there?

FN: I think it was there, but not as built up as it is today.

HP: Any families that you knew down there?

FN: Only the Matsui and Nakagawa. Their family were fishermen. The Ono family used to run that store.

HP: Did you ever go to Keālia?

FN: Not really.

HP: Do you remember Puʻuhele, the hill? Was it there?

FN: It was, the people were using it for something. They dug it up for something. There was gravel there.

HP: Do you remember any native stream life?

FN: Oh yeah, ʻoʻopu and ʻopae. We used to catch it, but never ate it. The ʻoʻopu were kind of small, 3-4 in. Then later we found out when we went to lūʻau, we were eatting it all along. My concern is the stream it used to be flow much more than it is. The stream had a side stream on the other side of the park. I donʻt know where it was diverted, it used to flow into #5. The main stream used to go to Maʻalaea, but not the side stream. Especially if it rained, the river would be full. The river always had water.

HP: Do you remember any natural disasters?

FN: I remember the road got washed away. I think John Yoshizawaʻs car or truck got stuck in there.

HP: Did you go to Baldwin?

FN: I went to Baldwin, then 4 years at Washington State. I spent 1 year on Molokaʻi teaching, my first year teaching. By then, I had lost my father, so only my mother was living here. My brother was still in school then.

HP: When did you move back here?

FN: In 1962 I moved back and taught at Kīhei Elementary. I retired from Lihikai. Kīhei was a small community. The first two years I taught two grades. Then it turned into teaching on grade only.

HP: So you basically lived in Waikapū your whole life?

FN: Yes

HP: What were some of the first big changes you saw in Waikapū?

FN: It was the homes that came up here. Some of the homes came from Hiyashi Camp.

HP: When was Waikapū park built?

FN: Earlier than the 80s. Too bad it is such a small park.

HP: Was it built because of the plantation?

FN: I guess so. The county shouldʻve bought that park down there.

HP: What are your thoughts about this project? This will probably the largest project because they are looking over 1,000 homes.

FN: There will be a park right? And this is all towards Māʻalaea?

HP: Yes, there will be a school here, single-family homes, a county park, rural lots (showing her on the map)

FN: Well people are looking for places to live.

HP: Will it change the character of Waikapū?

FN: Not anymore than what has already happened/

HP: Anything youʻd like to see preserved?

FN: When they do all this, where is the water going to come from?

HP: I know they were talking about using well water and not surface water.

FN: They always say it is going to be affordable, but even that is expensive. If we want local people to stay too, we have to make it so that they can find a place to live.

HP: Do you remember anyone growing taro?

FN: Only the Enos, thatʻs it. The Tatsumis used to garden up there where the Shimuzus were.

HP: Do you know any other cemeteries, like the Cornwell cemetery?

FN: Iʻve just seen it. It is more by Averyʻs property. Didnʻt Cornwell have a mill?

HP: He started the first Waikapū Sugar Mill.

FN: Across there used to be a stable. There were horses that they used to carry the sugar. I think Wailuku Sugar owned them.

HP: Did you ever ride horses?

FN: Not there. I think that is where the trucks used to park. It was like their base yard. I donʻt recall the mill there.

HP: Any other memories of Waikapū that you can recall?

FN: You know further up, the road by Maui Tropical Plantation, before #1 punawai. There were homes over there. The Otsumora family, Oka family, and one more family used to garden

over there. The area used to be full of gardens.

HP: Did you ever know the Mahi or Puleloa family? Joseph Puleloa?

FN: There was an Adams family. They used to live where the Vidas are. The Vidas had the piggery. The Rosarios were up there too, I think.

HP: Were there any dairies in Waikapū?

FN: Wailuku Sugar used to deliver, but it came from Waiheʻe. This whole area was sugar. The land was strictly used for sugar cane.

HP: When did the fields go to pineapple?

FN: When Wailuku Sugar closed, I guess. Wasnʻt it Maui Pine that started leasing the land?

HP: How about the old Waikapū school?

FN: Which one? There was one over here. I donʻt know what happened to the one by the church. It was a new building. I used to walk up there all the time to go to school. It went up to third grade. Then I went to Wailuku Elementary. Mrs. Tom was a first and second grade teachers. Mrs. Tokonaga taught 3rd. Mrs. Tokonaga was Donald Tokonagaʻs wife. Sarah Jeanʻs mother-in-law. She has since passed. Gregʻs grandmother.
There was a larger baseball park down there too. The Watanabe family used to live there and they were Japanese teachers. There were two classrooms. The Japanese school was an English speaking school too, the boyscouts would use it also. Then later they built the school up there. It was a nice building. They had a big building that was like a play area. I donʻt know why or when they got rid of it. My brother went straight to Wailuku Elementary, by that time the school was closed.

HP: Do you remember the horse race track?

FN: No, I didnʻt know about that. But a lot of people donʻt remember the school and a good size ball park.

HP: Anything else youʻd like to share?

FN: If we can get places for our people to live. The way Spencer homes makes the people live for 10 years, that would be good, so they canʻt turn around and sell it right away.

11.6 Eassie "Ace" Archibald Moliola Miller Jr.

Biographical Overview: Eassie "Ace" Archibald Moliola Miller Jr. was born on Maui and raised mainly in Kahului (NASKA). He lived a portion of his childhood in Wailuku on lands that were passed down to him and extended family that were received at the time of the Māhele of 1848 to Kaaa (L.C.Aw. 3105, R.P. 3154, AP. 1) and Keawe (L.C.Aw. 3520, R.P. 3135, AP. 1). These lands are currently situated adjacent to Waikapū Properties LLC on TMK (2) 3-6-05:019 (3.404 Acres) and TMK (2) 3-6-06:026 (8,650 Sq. ft.). These aforementioned lands are currently being traditionally being cultivated in loʻi kalo (taro patches) fed by the Waikapū Stream via the South Waikapū Kuleana Ditch.

HP: What is your full name?

AM: Eassie "Ace"Archibald Moliola Miller Jr.

HP: Is Archibald a family name?

AM: Yes. When I went to a family reunion, there were 13 Archibalds.

HP: When were you born?

AM: 1952

HP: Where were you born?

AM: It says Malulani Hospital in Wailuku.

HP: What ethnic backgrounds are you?

AM: Basically, Hawaiian and Caucasian. My last name is German.

HP: Where were your parents born?

AM: My mom was born here on Maui in Waikapū and my father on Kauaʻi?

HP: What were your parents names?

AM: My motherʻs name was Beatrice Hussey and my fatherʻs name was Eassie Miller.

HP: Do you have any siblings?

AM: I have like 10 siblings. I am the oldest of 4.

HP: Did your parents or grandparents speak any other langauges than English?

AM: Mostly Hawaiian. They only spoke secretly in Hawaiian, so we couldn‘t understand.

HP: You were born in Wailuku, but where were you raised?

AM: I was raised in NASKA (Naval Air Staition Kahului)

HP: Did you ever live in Waikapū?

AM: Yes, up Waikō Rd., when I was age 7-9. I lived right across from the old Protestant Church. I was staying with my Aunty Ku`ulei with my mother, when my parents were getting a divorce. This was the old Enos property that you live on today.

HP: Where did you move to after that?

AM: Back to NASKA, then I went to Kamehameha Schools. I started there my freshman year and graduated in 1970.

HP: What did you do after you graduated?

AM: I went to Cal-Poly in graphic arts. I used to work at Ace Printing here on Maui when I moved back.

HP: Your genealogical ties to Waikapū were through which parent?

AM: My mother‘s side, my grandfather signed it over to her.

HP: What was your grandfather‘s name?

AM: Albert Hussey. He established himself here. It was a big clan of them. He moved from Kailua.

HP: Did he marry into the Ka‘a‘a family?

AM: Yes, my grandma was a Ka‘a‘a.

HP: Are either of your parents alive?

AM: No, they have passed.

HP: Did your parents ever tell you any stories of this place? Who was living on this land?

AM: No one. My grandfather built this house with me in 1978. Only the old house was here. Joe August was living in that older house. He is a retired judge here on Maui.

HP: What year was the older house built in?

AM: In the 1920s.

HP: Who lived in it before Judge August?

AM: I don‘t know. My grandfather‘s sister, Beatrice Kailiponi married David Kailiponi who was the executive of the property. We would only come up here to visit.

HP: Was anyone farming the land back then?

AM: Yes, but not much kalo.

HP: Was this all in sugar cane?

AM: Yeah, it was all sugar.

HP: When did it become pineapple?

AM: In the 1980s, I was in the mainland.

HP: Was this when you were at Cal Poly?

AM: No, I went to Cal Poly in 1971, 1972 and then I came home.

HP: What year did you move back to the mainland?

AM: I moved back up around 1981 and moved back around 1991.

HP: Did you move back to Waikapū?

AM: No

HP: Do you have children?

AM: One son, Kilohana, he is the financial guy at MCC. He is 33.

HP: Is your family Mormon?

AM: Yes, my family is all Mormon.

HP: Do you remember anyone farming up here?

AM: There were farms everywhere. All of the Japanese families had gardens. They knew what they were doing, all natural.

HP: What did you do when you came up to Waikapū?

AM: We would play in the river.

HP: Any traditions that you had here?

AM: First, we had to visit the graves.

HP: Do you remember any cultural or agricultural sites?

AM: No, as a small kid you can only do certain things.

HP: The know the names of the ridge Kuaiwa and the mountain here named Hanaʻula. Did anyone talk about place names with you?

AM: No, but there are so many stories. The meaning of Waikapū is known as this to one person and something else to another.

HP: Do you remember any natural disasters?

AM: We used to have bad Kona storms. Trees would fall down.

HP: When you came up here did you use the old road?

AM: We used to go behind Makimoto's house. They lived here for a long time.

HP: What was the stream like?

AM: It was way better. It had plenty more water. No one was taking it like they are now.

HP: Was your ʻauwai always flowing?

AM: Yes, it was coming from Reservoir #1. I donʻt like that it is coming from #1, itʻs not coming in to the taro patches as clean like the stream.

HP: The reservoir was built before the 1900s?

AM: Yeah or even before that. The plantation needed the water.

HP: Do you remember any stream life?

AM: Oh yeah, the river had plenty of ʻopae. The stream was different before. There were more holding ponds. The water had to be 4ft deep or more for them to live, it couldnʻt be shallow.

HP: Do you remember the stream going down to Kealia?

AM: Yeah, it mixed with the ocean.

HP: Did you used to go fish there?

AM: Oh yeah, if we weren‘t at NASKA, we were at Mā‘alaea. The very first restaurant going toward Mā‘alaea was where my grandparents‘ house was. There was a Japanese family and then Jimmy‘s store. That is it.

HP: Do you remember Kapoli Spring?

AM: No, the only freshwater came from the river.

HP: What are your thoughts on this project? Do you feel it will impact your life here or resources?

AM: I think Coach (Mike Atherton) is educated enough to do something the right way. He tries to do what he says. Where will you put all of that sewage?

HP: Go between here and Wailuku?

AM: Here and Wailuku Terrace. I keep the water flowing and keep the kalo for a cultural aspect here. My kupuna are happy. The taxes were zoned ag, losing equity??

HP: What is the total acreage of this kuleana?

AM: 3.8 acres and it goest all the way to the stream. I have another two pieces, about 10,000 ft. attached, past the graves.

HP: Mahalo nui for your time.

11.7 Wallette Pualani Lyn-Fah Garcia Pellegrino

Biographical Overview: Wallette Pualani Lyn-Fah Garcia Pellegrino was born and raised in Wailuku. She moved to Waikapū 46 years ago and lives adjacent to kuleana land that was received at the time of the Māhele of 1848 on the north side of the Waikapū Stream directly across land owned by Waikapū Properties LLC. Wallette's son Hōkūao Pellegrino (author of CIA), daughter in-law Alana Kaʻōpūiki-Pellegrino and family live on their family kuleana land that was first claimed by Kuolaia (L.C.Aw. 3110, R.P. 3152, AP. 1) Nahau (L.C.Aw. 3340, R.P. 3115, AP. 1). These lands are currently being farmed with loʻi kalo and other crop cultivation by her entire family on lands known as Nohoʻana. They receive water via the north kuleana ʻauwai (ditch system) which begins 3 properties above theirs. Wallette is a retired U.H. Maui College Professor.

HP: What is your full name?

WP: Wallette Pualani Lyn-Fah Garcia Pellegrino

HP: When were you born?

WP I was born on November 5th 1940.

HP: Where were you born?

WP: I was born at Malulani Hospital, Wailuku, Maui.

HP: What ethnic background are you?

WP: Hawaiian, Chinese, Portuguese, French, English

HP: Where were your parents born?

WP: My father (Walter Frank Garcia) was born in Wailuku; mother (Elinor Kyau Ho Garcia) born in Honolulu.

HP: Do you have any siblings? Where were they born?

WP: I have none.

HP: What language did your parents and grandparents speak? Parents spoke English.

WP: My paternal grandmother spoke Hawaiian and English; paternal grandfather spoke English. Maternal grandmother and grandfather spoke Chinese.

HP: Do you currently live in Waikapū or have you lived in Waikapū before? If so, beginning in what year to what year?

WP: I have lived in Waikapū since 1968 at 1420 Kilohi Street.

HP: Do you have a genealogical connection to Waikapū? If so, how and through whom?

WP: My Great-great-grandfather (Edward Hubbard Bailey) and spouse (Emale Kane Bailey) had land in Waikapū.

HP: What part of Waikapū were you and/or your family raised in? (Waikō Road, Plantation camps, near Honoapi‘ilani highway, Waikapū Valley, etc..).

WP: I was raised in Wailuku with many visits to Waikapū because of family connections. Have resided in Waikapū since 1968.

HP: Did your parents, grandparents, relatives tell you any stories about Waikapū?

WP: Yes. Mainly about the families of Waikapū; the Protestant church; the Mormon Church.

HP: What were some important landmarks that you remember in Waikapū (stores, churches, cemeteries, schools, plantation camps, sugar mills, heiau, farms, houses, etc…)

WP: There were taro patches and Mormon church on West Waikō Road; Waikapū stream; ‘auwai or open ditches adjacent to Waiko Road; open air theatre on main highway; many small mom-and-pop stores on highway; liquor store which my grandfather used to run; old rock walls on Waikō Road; plantation manager’s home on Waikō Road; old Protestant Church on Government Road (attended services, luau, parties there) with cemetery adjacent to it; Edmund Rogers house; Quonset huts; St. Joseph Church; plantation dispensary; Filipino clubhouse.

HP: What are the names of some family members/friends that grew up around the area that you lived?

WP: Edmund and Winona Rogers; Arzaga family; Uncle Leonard Sonny Gomes; Minnie Gomes; Uncle Tula and Aunty Helen Enos; Rosario family.

HP: When you grew up in Waikapū, what kinds of things did you do in your pastime?

WP: I did not live in Waikapū as a child but visited often because of the Enos and Ah Nee families. We would also drive from Wailuku to the open air theatre. Wearing our pajamas, we’d sit on bleachers or rocks, battling mosquitos while the old movies played. One of my uncles helped with a liquor store that my grandpa Garcia was involved in; I would come to Waikapū with my father to the store and hang out.

WP: After we moved here in the 60’s, we remembered places like the Snakepit, the Hot Dog Show, Furukawa Store which became Waikapu Stop, Isenberg’s sign shop, and other small businesses. The plans for the original Maui Tropical Plantation property were discussed by

the community because what was proposed did not seem appropriate for the plantation town—kind of a theme-park/Disney type with Moomin characters (European version of menehune).

HP: Did you go to school in Waikapū? If so, who were some of your classmates and/or teachers?

WP: No.

HP: What are some of your fondest memories of Waikapū?

WP: Playing with the Enos children (Wilford Brother Enos Jr; Kuʻulei Enos). Spending time at the liquor store with my father. Going to the Protestant church for services and lūʻau. Pig pens. The terraced taro patches next to the stream. In fact, when we moved to Waikapū in the 60's, I could not figure out where the taro patches had gone, only to find out that after the Enos families left Waikapū, everything was overgrown and only an old wooden house remained. When we were privileged to purchase the two acres from the Keanini Partners in the early 2000s who are family to me, we began to restore the old taro patches and found the rock walls which delineated them as well as other markings which confirmed what I remembered from my childhood.

HP: Were there any special traditions in your family that took place in Waikapū?

WP: Family gatherings.

HP: Do you still have family living in Waikapū. If so, who and where do they live?

WP: The descendants of Edmund and Winona Rogers reside in the family home and adjoining homes.

HP: Were there any cultural sites and/or resources that you were aware of in Waikapū (Example: heiau, archaeological sites, winds ʻauwai, streams, taro patches, kuleana lands, burial sites, caves, fishponds, springs, fishing grounds, etc….) If so, could you briefly describe where they were located and if they were in use at that time that you grew up in Waikapū?

WP: I remember the terraced taro patches on Waikō Road next to the Waikapū stream. The ʻauwai (open ditch) running next to Waikō road. Burial sites on the Protestant church property and family plots.

HP: Do remember any Hawaiian place names in Waikapū? (Example: Kalena, Hanaʻula, Keālia, Māʻalaea, Kapoli, Kaiwaloa, etc…..).

WP: Keālia Pond, Māʻalaea, Puʻuhele.

HP: Do you remember any natural disasters in Waikapū? (Example, floods, storms, hurricanes, tsunamiʻs).

WP: Whenever it rains hard in the mountains or storms, the stream rises, the rocks move, the banks erode. If there are landslides upstream, the stream turns brown and affects the water coming into the loʻi from the ʻauwai.

HP: What was the Waikapū Stream like when you were growing up in Waikapū? Was it flowing? Was it diverted by the sugar plantation? Did it flow only at certain times?

WP: As a child, I was not aware of diversions, etc. However, I do remember playing in the stream. It was primarily when we moved to Waikapu that we became aware of the diversions, stream flow, impacts, etc.

HP: Do remember any ʻauwai (traditional irrigation ditches – used for taro farming, etc..)?

WP: The ʻauwai ran and still exists next to West Waikō road; at certain points, it flows underground and then resurfaces, returning to the stream down the road.

HP: Did you go down to the stream or use the ʻauwai? If so, what for?

WP: Primarily to play as a child. Now, as a source of water for the loi`.

HP: Did you or your family ever gather anything from the Waikapū Stream, valley or ʻauwai for food? If so, do you remember what it was? (Example: plants for lāʻau lapaʻau, ʻoʻopu, ʻōpae, hīhīwai, etc…).

WP: Tī leaves. We would see a few ʻopae in the stream too as a child. Now we use the stream, valley and ʻauwai as resources for the loʻi or other cultural uses.

HP: Currently there is large scale development being proposed on the south side of Waikapū Stream in and around the current Maui Tropical Plantation and both sides of the current Honoapiʻilani Highway. Mauka of the Honoapiʻilani Highway 80 rural/farm lots, 253 single family homes, 100 cottage/town homes, a commercial business area and parks and open spaces are being proposed. Makai of the highway are 700 single family homes, 300 cottages/town homes, 35 country town commercial business, parks, and open spaces, and a school.

HP: After looking at the map and development plan, what can you recall of this are historically and when you were living in Waikapū? What do you remember of this area?

WP: Our family has seen the area change from sugar cane surrounding the entire plantation town to pineapple, and now concrete and houses.

HP: Do you remember kuleana lands, sugar cane, ranching, and/or taro patches, etc…in this area?

WP: Yes, I remember the taro patches on upper Waikō Road; sugar cane which surrounded our

home. When Wailuku Sugar would do a burn, we would have to close all the windows and doors or leave the area. You could see the fire visibly and very close.

We learned that our family (paternal side) still has a piece of kuleana land next to the Waikapū stream that was surrounded by Wailuku Sugar cane production. It is adjacent to the proposed project. Our concern is to gain and retain access to the kuleana piece.

If you do not currently live in Waikapū, what age were you when you moved away? Did not reside here as a child but visited often because of family. Have lived here at 1420 Kilohi Street since 1968. Edmund Rogers had told my father, Walter Garcia (related through both paternal and maternal sides), that if my husband and I moved home to Maui, he would sell us land in Waikapū. He graciously did and we built our home with a life-time friend, Gary Andrade Sr.

HP: What are your thoughts about the scale of this project? Do you feel that it will have an impact on known / or unknown cultural sites?

WP: Any kind of development impacts an area in different ways. I expect the developer to be cognizant of that and to work with the community and cultural/historical resource people to minimize negative impacts.

HP: Do you think that this development will change the character of Waikapū? If so, how?

WP: Again, any kind of development bringing changes to a location. There will be an increase in the density of what was a small plantation-style community where families lived for generations. Increases in traffic and noise will occur unless controlled by external and internal features. The developer must make a real effort to enhance rather than negatively change the character of this small town.

HP: If there are cultural sites in the area to be developed, should they be preserved?

WP: Absolutely, yes, and the people of the community should be consulted closely to determine the kinds, locations, and significance of those sites. It would be unique and respectful for the developer of this major project to recognize the value of this special community. This could be done by having a center which provides the history of Waikapū, not only for the visitors to the MTP but to its residents. Additionally, cultural sites should be clearly marked so that no damage is done to them.

HP: Are there any natural resources in the project area that may be disturbed and or impacted (Example: native forests, native animals, native plants, streams, rivers, native stream habitat, etc…).

WP: The Waikapū River, its off-shoot streams and `auwai may be impacted by the project. Water as a resource for the current and future restoration of loʻi kalo must be focused on. There needs to be on-going discussion as the landscape changes throughout the

development as well as after the place is settled.

HP: What kinds of cultural traditions and practices are occurring in and around the development project. (i.e. kalo farming, native gathering, habitat restoration, ceremonial, burials)?

WP: Kalo farming is increasing as families work to grow their own food; restoration of native forests and plants; ceremonials. I am not aware of burials although that does not mean it does not or could not occur.

HP: Do you partake in any of the above cultural practices? If so can you briefly describe them?

WP: Yes, kalo farming and growing of native plants for medicinal, cultural, restoration purposes. cultural educational and agricultural programs for the community.

HP: If you currently live in Waikapū or have land, how will this project affect you and your ʻohana, as well as your land and resources?

WP: We live across the Waikapū River from the project area so our major concerns are for the river itself and how our kalo farming may be affected.

HP: Is there anything else that would like to share about Waikapū and/or anything related to this development?

WP: We have provided testimony in many venues regarding the proposed development. As long as the developer is willing to continue the dialogue with the people of Waikapū and ensures that he will continue to engage them and to respect their input as the project moves forward, the Waikapū Country Town could be an example of a project that is mutually beneficial to both the developer and the Waikapū community.

11.8 Keahi Bustamente

Biographical Overview: Keahi Bustamente was born on Oʻahu in 1980 and lived on Molokaʻi until 1988 at which time he moved to Waikapū, Maui. Keahi lived on kuleana land originally claimed by Nauahi (LCA 3342) in the ʻili of Kuaiwa (Kuaʻiwa). Keahi grew up playing in the Waikapū Stream and north kuleana ʻauwai. He spent many of his younger years and adult life hiking throughout the Waikapū Valley and studying the unique native flora and fauna of Waikapū. He has been involved in the conservation field for over 15 years and was the former Maui Coordinator for PEPP (Plant Extinction Prevention Program of Hawaiʻi). Keahi is currently the Field Crew Supervisor for Leeward Haleakalā Watershed Partnership. His work includes collaborating with large landowners whose land is in conservation, manages field crew members and volunteers, and ensures an overall protection of rare and endangered native plant and animal species along the entire leeward slopes of Haleakalā.

HP: What is your full name?

KB: Keahi Bustamente

HP: When were you born?

KB: I was born on January 25 1980.

HP: Where were you born?

KB: I was born on Oʻahu but lived on Molokaʻi. My mother had to give birth to me on Oʻahu.

HP: What ethnic background are you?

KB: Hawaiian, Filipino, Caucasian

HP: Do you currently live in Waikapū or have you lived in Waikapū before? If so, beginning in what year to what year?

KB: I moved to Waikapū in 1988 and moved to Hawaiian Homes in Waiehu a few years after I graduated from Baldwin High School which was around the year 2000.

HP: Do you have a genealogical connection to Waikapū? If so, how and through whom?

KB: Not that I am aware of, however my ʻohana was very close with many of the lineal descendants of Waikapū.

HP: What part of Waikapū were you and/or your family raised in? (Waikō Road, Plantation camps, near Honoapiʻilani highway, Waikapū Valley, etc..).

KB: I was raised just behind the old Waikapū Protestant Church ruins which is now a million

dollar home. I believe the piece of land or ʻili that I lived on was called Kuaʻiwa and was originally claimed by a man by the name of Nauahi.

HP: Did your parents, grandparents, relatives tell you any stories about Waikapū?

KB: Not that I can recall, my understanding and knowledge of Waikapū comes from years of exploring, research and learning from my colleagues in the natural resource management field. I am aware of the story of how Waikapū received its name as well as other important stories surrounding cultural sites such as Keālia and Puʻuhele. I grew up hearing about the effects of stream diversions on taro farmers and that there once were aquatic species such as ʻoʻopu in the stream prior to dewatering the stream.

HP: What were some important landmarks that you remember in Waikapū (stores, churches, cemeteries, schools, plantation camps, sugar mills, heiau, farms, houses, etc…)

KB: I clearly remember the taro patches that were cultivated on Uncle Bolo and Aunty Katherine Riyu's kuleana property above and across Waikō Road near the Waikapū stream. I also remember the ʻauwai which ran through those historical properties and how it flowed back to the stream by Aunty Pat Federcel's house. I knew of the Protestant Church ruins which was located just above our house. I believe it was built in the 1800s. I used to play in the cane fields and pineapple fields with my friends growing up and remember seeing old plantation relics and cemeteries on the north side of the Waikapū Stream. I also spent a lot of time hiking in the Waikapū valley and seeing numerous stone walls which I believe were remnant taro patches and terraces and other archaeological sites. I clearly remember the stream diversions and how the stream was always stagnant and had a foul stench below which I believe was from the lack of flow and build up of organic material from surrounding trees.

HP: What are the names of some family members/friends that grew up around the area that you lived?

KB: I grew up around Aunty Zelie and Uncle Ted Harders property and had close friends like Dustin Vegas, Justin Locke, Gavin Taylor, Luke McLean, Kenny Yamanoue and you… Hōkūao Pellegrino. We played sports such as baseball together and rode our bikes everywhere, especially in the cane and pineapple fields. The openness of the area allowed us to greatly appreciate and respect our rural and country living surroundings. Now that I understand and value the importance of the upper reaches of the valley, I see the need to keep its pristine nature intact.

HP: When you grew up in Waikapū, what kinds of things did you do in your pastime?

KB: As mentioned before, I spent most of my time playing outside, riding bike, playing in the Waikapū Stream and North Kuleana ʻAuwai. Like I said in the last question, we explored a lot and learned to appreciate the remaining natural and cultural landscape that we were blessed to grow up around.

HP: What are some of your fondest memories of Waikapū?

KB: I loved hiking into the Waikapū Valley just as much as I do today. Because of my work in the natural resources field and my co-management of leased land owned by the developer of this Waikapū Country Town project, I have become intimately tied to this place and the natural and cultural resources that currently exist. I feel a strong kuleana to protect what is left of the natural and cultural landscape of Waikapū. I am lucky that I can do this via my full time work and work through the efforts of Hui Mālama o Waikapū.

HP: Were there any cultural sites and/or resources that you were aware of in Waikapū (Example: heiau, archaeological sites, winds ʻauwai, streams, taro patches, kuleana lands, burial sites, caves, fishponds, springs, fishing grounds, etc….) If so, could you briefly describe where they were located and if they were in use at that time that you grew up in Waikapū?

KB: Because of my extensive years of research via historical documents, maps, exploring and my work, I am aware of most sites which include cultural sites like loʻi kalo, house sites, Keālia wetlands, Māʻalaea fishing grounds. I have also hiked most ridges and mountain tops in and around Waikapū for my conservation work, therefore I have experienced Waikapū's most precious natural and cultural resource, wai…. on all levels. I have seen the sources of the stream. I completely understand the cycle of water and watersheds in this area and how they work. I have seen the impact on cultural resources not so much by development but invasive species of plants and animals which are becoming more and more common in the Waikapū Valley.

HP: Do remember any Hawaiian place names in Waikapū? (Example: Kalena, Hanaʻula, Keālia, Māʻalaea, Kapoli, Kaiwaloa, etc…..).

KB: I am familiar with most place names in Waikapū, to many to name. But I am most aware of place names found within this development due to my working in and around this area for many years. The place in which we lease from Waikapū Properties LLC is called Loaloa and was claimed by two people by the names of Charles Copp and Kupalii (Kupaliʻi). These lands were strictly used for kalo cultivation and the adjacent slopes for gathering native koaiʻa for traditional uses and likely other native plants used for lāʻau lapaʻau, Hawaiian medicine.

HP: What was the Waikapū Stream like when you were growing up in Waikapū? Was it flowing? Was it diverted by the sugar plantation? Did it flow only at certain times?

KB: I remember all of the diversions in Waikapū, they used to suck the entire stream dry. Never did I see the water flowing mauka to makai. I remember 3 specific diversions, one in the upper regions which I believe is a cement dam which diverts water into Reservoir #1. I know of the Waiheʻe Ditch which is adjacent to the development project I think and lastly the one by the bridge near the Honoapiʻilani Highway. Waikapū is a dead stream from my perspective.

HP: Do remember any ʻauwai (traditional irrigation ditches – used for taro farming, etc..)?

KB: I clearly remember the north and south kuleana ʻauwai. I remember an old ʻauwai back in the valley on the north side but I don't know if it has a name. The only reason I believe it is an ancient ʻauwai are because of extensive archaeological sites found around the ditch.

HP: Did you go down to the stream or use the ʻauwai? If so, what for?

KB: As a child I would wade in both the Waikapū Stream and ʻauwai along Waikō Road. There was never enough water to swim in the stream for my friends and I to actually swim in but we did enjoy what was there at that time. I don't seem to see much of a difference today, whereby the stream is more like a small creek versus an actual stream with a strong flow. I know that Waikapū Stream is an important cultural resource but it sad that even for recreational use such swimming, it doesn't seem that it is possible.

HP: Did you or your family ever gather anything from the Waikapū Stream, valley or ʻauwai for food? If so, do you remember what it was? (Example: plants for lāʻau lapaʻau, ʻoʻopu, ʻōpae, hīhīwai, etc…).

KB: I don't remember my family gathering anything specifically from the stream but for many years now, I have gathered native plants for lāʻau lapaʻau or Hawaiian medicine such as koʻokoʻolau and māmaki both of which are native plants that grow adjacent to the Waikapū Stream and used for making teas. I also gather seeds from this area and propagate them for outplaning in the same location. We in the conservation field have a very strict policy about seed gathering and outplanting, both of which I follow pretty religiously. The seeds have also been used for storage and propagation, especially that of the rare and endemic Hawaiian noni which supposedly cannot be found anywhere else in Hawaiʻi, but Waikapū. I have only seen a handful of these plant growing in the upper reaches of the Waikapū valley and watershed.

HP: Currently there is a large scale development being proposed on the south side of Waikapū Stream in and around the current Maui Tropical Plantation and both sides of the current Honoapiʻilani Highway. Mauka of the Honoapiʻilani Highway 80 rural/farm lots, 253 single family homes, 100 cottage/town homes, a commercial business area and parks and open spaces are being proposed. Makai of the highway are 700 single family homes, 300 cottages/town homes, 35 country town commercial business, parks, and open spaces, and a school.

HP: After looking at the map and development plan, what can you recall of this are historically and when you were living in Waikapū? What do you remember of this area?

KB: Wow! This is quite extensive. I have been fully aware of the project from day one but to be honest, I didn't know the full extent of the project. The project areas was in pineapple fields for the most part and my friends and I used to ride our bikes through them. We used to go to the Maui Tropical Plantation on occasion with my family. The upper region of the project

was where I used to gain access into the valley. This is still the case since I co-manage lands leased from the developer for native habitat restoration. I am very curious as to how we as Hui Mālama o Waikapū and the developer can proactively and collaboratively work together to ensure the protection of the valley and native plant species.

HP: Do you remember kuleana lands, sugar cane, ranching, and/or taro patches, etc…in this area?

KB: Yes, I remember the many stone wall terraces along the embankment of the Waikapū Stream which I now opened by the developers. I do also remember some ranching going on above Reservoir #1 but I can't remember the guys name who used to ranch up there. The lands that we manage under Hui Mālama o Waikapū are former kuleana lands and our plans and goals have been to restore and preserve the archaeological sites and native plants on-site.

HP: What are your thoughts about the scale of this project? Do you feel that it will have an impact on known / or unknown cultural sites?

KB: I am very concerned about the impacts of this development on the Waikapū Stream and taro farmers who rely on that water resource. I know that most of the water diverted are for the lands of the developers at this point, but have heard that they may possibly be some changes in their use of surface water. My hopes are that they stop using surface water and find other sources such as ground water as long as it doesn't have any adverse effect on the sustainable yield and surface water. I am highly nervous about the accessibility into the valley via any commercial or recreational activities such as hiking or trails. Waikapū is the home to so many endemic and indigenous native species of plants, animals, insects and land snails. I don't want to see further disruption to the natural flow of life caused by invasive species. Access into the valley could cause expanded damage to its native dryland and mesic forests, the forests that our group is working hard to protect.

HP: Do you think that this development will change the character of Waikapū? If so, how?

KB: There is no turning back after this development. In my eyes, a great deal of the character of Waikapū has to do with its natural resources which to us as Hawaiians is also a cultural resource. What we don't want is a rampant amount of people who gain access into the Waikapū valley and stream causing more negative effects on the native population of plants and animals. You can already see this happening as we speak. There needs to be some sort of clear protection or a line to delineate where those future residents and their visitors or friends can hike and/or have access to the valley or not. Many of the native species in Waikapū are sensitive and fragile, especially those in the upper watershed and native dryland forest.

HP: If there are cultural sites in the area to be developed, should they be preserved?

KB: No doubt about it. Protect all cultural sites in and around developed area along with serious

restrictions to the inner part of the valley as to further protect the archaeological sites, cultural sites and natural resources.

HP: Are there any natural resources in the project area that may be disturbed and or impacted (Example: native forests, native animals, native plants, streams, rivers, native stream habitat, etc…).

KB: My concentration and perspective in all of this would be greatly centered around the natural resources and native habitat found within the Waikapū Valley. Currently a great deal of the native dryland forest, if not all of it, has currently been overrun by non-native and invasive species. Protecting the further decimation of these species fall on the developers and land owner to ensure that no expansion of diseases and or invasive species will end up getting into the valley by increased human traffic. One helpful way of further preventing these issues is to restrict access into the valley. This is extremely important because of the conservation efforts by Hui Mālama o Waikapū as well as that of West Maui Watershed Partnership. The dominant dryland forest trees such as koaiʻa, wiliwili and alaheʻe of Waikapū have basically all but disappeared except for the area in which we are protecting as a hui. It is critical that these efforts are able to be continued and supported by the developer. Much of the Waikapū watershed is dominated by invasive species which form monotypic stands that inhibit the growth of other species. In steep areas, like the ones inhabited by *Macaranga tanarius*, this leads to erosion, runoff and potentially little groundwater recharge. *Casuarina*, which makes up a large percentage of the alien forest in Waikapū, is known for its inability to allow recharge and for the runoff it creates. Stands of *Casuarina* are also known to have low infiltration and low transpiration rates. We are losing our native forest at an alarming rate, and little of the true endangerment of our watershed is known by those outside the conservation world. In my opinion, we may see a 20-30% loss of remaining native forest in Waikapū to invasive species within my lifetime. As species like *Macaranga, Casuarina*, and others invade and become the forest, groundwater recharge will decline and runoff will increase. I would like to see land cover data and other models be improved and watershed health should be a factor in the calculation of available water for future use. The native forest go hand in hand in regards to the output of our invaluable cultural resource, wai. The name Waikapū alone along with the other three streams in Nā Wai ʻEhā are clear evidence of the abundance of water the once existed in these ahupuaʻa.

HP: What kinds of cultural traditions and practices are occurring in and around the development project. (i.e. kalo farming, native gathering, habitat restoration, ceremonial, burials)?

KB: I would have to say that wetland kalo farming in the lower reaches of the valley and adjacent to the project development is a major cultural resource and traditional practices that are currently ongoing and plant to continue into the future. As for the cultural traditions in the valley.

HP: Do you partake in any of the above cultural practices? If so can you briefly describe them?

KB: Yes, kalo farming and growing of native plants for medicinal, cultural, restoration purposes.

We as Hui Mālama o Waikapū run a volunteer restoration and education program and have partnered with many different schools on Maui and non-profit organizations which have provided man power, grant funding and tools to assist in our efforts. We share the importance of respecting cultural resources in Waikapū whether it be archaeological site stabilization, native plant habitat restoration and traditional wetland kalo farming. Gathering of native plants for medicinal purposes has been occurring with lineal descendants of families in this are such as you (Hōkūao Pellegrino), Luke McLean, and the Rogers-Harders Family. I can recall that the Rogers-Harders families have scattered the ashes of their ʻohana in the valley on multiple occasions, very close to the development project on hand.

HP: If you currently live in Waikapū or have land, how will this project affect you and your ʻohana, as well as your land and resources?

KB: Although I no longer live in Waikapū, I spend a great deal of my time here during and after work, especially in the upper reaches of the Waikapū Valley during conservation work. To me practicing my culture and working on the land through conservation efforts is one and the same. You cannot talk about ʻāina or land without talking about cultural traditions. I am concerned about the future of our efforts and the ability to protect the valley, land and stream which are all cultural resources. What reassurances are going to be put in place to ensure that our work has not been done in vain.

HP: Is there anything else that would like to share about Waikapū and/or anything related to this development?

KB: I appreciate the fact the one of the developers has given us (Hui Mālama o Waikapū) this opportunity to protect these important cultural sites and native landscapes on their property. I look forward to having more open an clear discussions with Waikapū Properties LLC during the approval process to ensure minimal or no impact will occur on the work being conducted by our Hui as well as the overall protection of the Waikapū valley and cultural resources found within or adjacent to the property.

12.0 CONCLUSION: SYNTHESIS OF ARCHIVAL, LITERARY, AND ORAL ACCOUNTS

The purpose of this project was to investigate the impact that the Waikapū Country Town development will have on the cultural practices and customs of the project area and surrounding lands through archival, literary, and oral accounts. This report provides a detailed understanding of Nā Wai ʻEhā as a moku and the overall cultural resources found within the ahupuaʻa of Waikapū pre and post-Western contact.

Waikapū has a long and rich cultural history and a strong representation of traditional cultural practices. Although many of these practices lay outside of the project site as described within the report, consideration should be taken on behalf of the developers to ensure the preservation and continuation of these practices and traditions. As conveyed throughout this extensive report, these cultural practices include cultural site preservation, natural and cultural resource management, Hawaiian agricultural resources, water resources in the Waikapū Stream and ʻauwai, land divisions and traditional place names within the project and surrounding area, and the overall spiritual essence of cultural resources found within the this ahupuaʻa. The report also discusses prior impact to the project area due mainly to commercial sugar cultivation.

Interviewees agree that those cultural sites, natural resources, and traditional and customary practices must be maintained throughout the proposed development projects while being sensitive to those found in the surrounding area. They also agree that the community should have an integral role in the ultimate planning of how these resources shall be managed, preserved and perpetuated during and after the completion of the proposed project, as to avoid over-exploitation of larger cultural and natural resources found within the ahupuaʻa of Waikapū and its surrounding environmental and cultural landscape.

There continue be identifiable cultural practices that exist within the project area and surrounding land. The possible types of cultural practices and beliefs that are subject to this assessment include Hawaiian subsistence and residential agriculture on kuleana lands. These lands utilize the Waikapū Stream which is a valuable cultural resources. Intricate irrigation systems built prior to western contact continue to purposely be maintained and utilized. There are also projects in the mauka portion of the developer's land that are being utilized for cultural site and native habitat restoration, while providing a traditional access point into the Waikapū Valley for gathering of lāʻau lapaʻau (medicinal plants) and native seed gathering.

The surrounding lands as identified through oral and archival accounts are also considered traditional cultural properties or kuleana lands. These historic lands are associated with traditional practices and beliefs that have been in use prior to the Māhele of 1848. The surrounding traditional cultural properties are associated with events that have made an important contribution to the broad pattern of the Hawaiian culture while yielding information important for research on prehistory or current historical practices. The traditional agricultural practice and cultural / natural site restoration have an important value to the native Hawaiian people, the Waikapū community, and even other ethnic groups found in these islands by enhancing cultural identity and well-being.

13.0 POTENTIAL CULTURAL IMPACTS AND RECOMMENDATIONS

The results of this study has shown that the Waikapū Country Town (TMK: (2) 3-6-05:007 por., (2) 3-6-05-007, (2) 3-6-04:006, (2) 3-6-04:003 por.) may have an indirect impact on the cultural practices and resources found within the Waikapū Community. According to the development map that was provided, it is evident that there will be no direct impact on cultural sites, practices and traditions. However, the concerns of the community and those that have been interviewed for this project are greatly concerned about how the development may impact cultural properties and resources found within the developer's properties and surrounding lands.

13.1 Mahi Kuleana Parcels

One significant impact that has been identified in this report are the two kuleana lands privately owned by the Mahi family (LCAw: 2499, R.P. 4070 AP 1 &2 to Ehunui) and (Grant 1153 to Ehunui). Although, both were born and raised on the island of O'ahu, they currently own the two kuleana parcels of land in Waikapū, Maui which are situated within the boundaries of Waikapū Properties LLC. These lands are currently TMK: (2) 3-6-05:009 (0.06 acres) and TMK: (2) 3-6-05:010 (0.5 acres). These small kuleana parcels were once directly within the confines of the development project, however have since been modified to go around these two parcels of land. The Mahi family has expressed that they would like to preserve their lands even though they may have been impacted by prior sugar plantation cultivation. In the oral interviews provided by the Mahi Family, they have voiced their concerns about the need to keep these lands in their family while working with the developer to seek a solution that will work to the benefit both parties.

Figure 30. Arrows pointing towards 2 Mahi Parcels of land situated within the lands of Waikapū Property LLC

13.2 Waikapū Stream

Another potential impact that has been shared throughout this document and within interviews both for this project and within the community, is the need to protect and restore the Waikapū Stream. Surface water from the Waikapū Stream is a valuable cultural resource which was and continues to be utilized by descendants of those original kuleana land claimants. The Waikapū Stream which has had numerous impacts mainly due to the sugar and pineapple industry has now become a heated topic throughout Maui and State wide. One of Hawai‘i’s largest water rights cases (Nā Wai ‘Ehā) which began in 2003 directly addresses the issues surrounding surface water, especially that of Waikapū Stream. In May of 2014, The State Commission on Water Resource Management requested that of the 4 mgd flowing the Waikapū Stream above the diversions, 2.9 mgd of surface water would need to be returned via the IIFS (CWRM Interim Instream Flow Process). The community along with many kuleana farmers who depend on the stream for cultivating crops continues to have discussions with the land owner and developer in order to establish a long term water use plan for both surface and groundwater. Currently, Waikapū Properties LLC uses surface water via Wailuku Water Company diversions and delivery systems for the following purposes; Maui Tropical Plantation which is a commercial agritourism business, lands leased to Hawaiian Commercial and Sugar Company for cultivating 2,000 acres of sugarcane, and lands leased to organic and conventional agribusinesses on roughly 400 acres of land that surround the Maui Tropical Plantation. One of the project developers has had open discussions with neighboring kuleana land owners as well as with members of the Waikapū Community Association about their current water uses and system and plans to minimize their reliance on surface water and shifting to ground water. Although the upper South Waikapū Intake Stream Diversion does not derive on the developers land, a major portion of the former plantation delivery system, Reservoir #1 and South Kuleana ‘Auwai is situated on their land. A portion of water situated in the reservoir via an 8” pipe that feeds into an ‘auwai or open ditch then travels 2,000 plus feet below to what are known as the “south kuleanas” or kuleana lands situated on the south side of the Waikapū Stream. Major issues surrounding sedimentation runoff and plantation material ending up into the Waikapū has derived from the developers land. This includes problems with the South Kuleana ‘Auwai or open ditch due to sporadic maintenance and management in which water spills over the ridge and causes large amount of sedimentation to enter the Waikapū Stream. Large rain events have also caused sedimentation runoff and plantation material to flow into the Waikapū Stream. And lastly, underground surface water deliver lines which have broken time to time have caused large amounts of sedimentation into the Waikapū Stream. All three examples can and have caused major disruptions in the cultivation of wetland kalo for both north and south traditional kuleana farmers. The community and especially kuleana kalo farmers on both the north and south side of the Waikapū stream have encouraged an the land owner on numerous occasions about their responsibility to managing surface water and runoff issues that affect the stream, stream habitat and many neighboring land owners who rely water as an important cultural resource.

13.3 Ground Water

The uses of Ground Water is going to play a major role in the ability for Waikapū Properties LLC to develop their lands. As stated above, Waikapū Properties LLC currently uses surface water from

the Waikapū Stream. It has been shared on numerous occasions to the Waikapū Community Association that their goal is to minimize their dependency on surface water and to utilize the 4 ground water wells that were drilled on the property beginning in 2012 for the development project and agricultural initiatives. The sustainable yield for the Waikapū aquifer is 3 mgd. With the inclusion of these 4 development and agricultural project wells along with all other documented wells in the Waikapū aquifer, the total amount that could potentially be pumped is 3.362 mgd. (Waikapū Well Aquifer List) This exceeds the sustainable yield for Waikapū and has raised many questions in the community about the potential impacts on the Waikapū Aquifer. Since the drilling of the four wells by Waikapū Properties LLC, there have been additional requests by other neighboring developers to drill wells in the Waikapū aquifer for their own projects. This too, has brought a heightened level of attention and concern by the Waikapū community as to the protection of the Waikapū aquifer and whether there is a significant threat to the sustainability of this public trust resource. Another concern voiced by members of the Waikapū Community is the impact of surface water stream flow and pumpage of ground water via the project wells and other wells in use in Waikapū.

13.4 Kuleana Agricultural Lands Adjacent to Waikapū Stream

The center or core of the Waikapū Country Town project is situated on former kuleana agricultural land, as noted throughout the study and via Māhele land claims. A vast majority of these kuleana lands were used for cultivating wetland kalo and included extensive ʻauwai or irrigation systems, both of which relied heavily on the accessibility of fresh water from the Waikapū Stream. A decent amount of the 1,400 cultivated and documented loʻi kalo at the time of the Māhele derived on what is now the current project site. The only intact remnant agricultural sites on lands owned by Waikapū Properties LLC, are those found along the Waikapū Stream. These lands are not included in the project site. The upper most kuleana agricultural site is leased by Hui Mālama o Waikapū and are in the process of being restored and farmed under wetland cultivation. What has been more discerning in regards to the impact on kuleana agricultural lands are those whose lands are adjacent to the Waikapū Properties LLC. Many lineal descendants of original Māhele claimants continue to access water from the Waikapū Stream via traditional ʻauwai or irrigation systems in order to cultivate wetland kalo on their ancestral land. The cultivation of kalo is an important traditional and customary right protected under law in Hawaiʻi. Although the current development project does not impede on their cultural rights to cultivate kalo, kalo farmers have shared their concerns about the accessibility of stream flow via their ʻauwai and the quality of water. As shared in Section 13.2, the quality of water is extremely important for kalo cultivation and minimizing any impacts to the actual Waikapū Stream and ʻauwai systems was greatly encouraged.

13.5 Native Dryland Forest and Watershed

As mentioned by Keahi Bustamente's interview, native plant and animal habitats in Waikapū, especially those found within the valley are invaluable cultural resources. He along with Hui Mālama o Waikapū would like to see these areas be protected not just for the sake of their efforts but for preservation of sensitive sites as pointed out in his interview. A major concern and cause of greater negative impact to the forest is accessibility and the potential for more invasive species to impede on the remaining native dryland and mesic forests. It was made clear that there is a

symbiotic relationship between the native forest habitats and Waikapū water resources whether they be ground or surface water. Further degradation to native plant species and habitats are a huge concern when discussing water resources in the Waikapū ahupua‘a. Although the development project will not have a direct impact on the natural and cultural resources related to native forest habitats, indirect impacts via human accessibility by future residents and others from the development could cause further damage to the forest by bringing in additional invasive species and diseases.

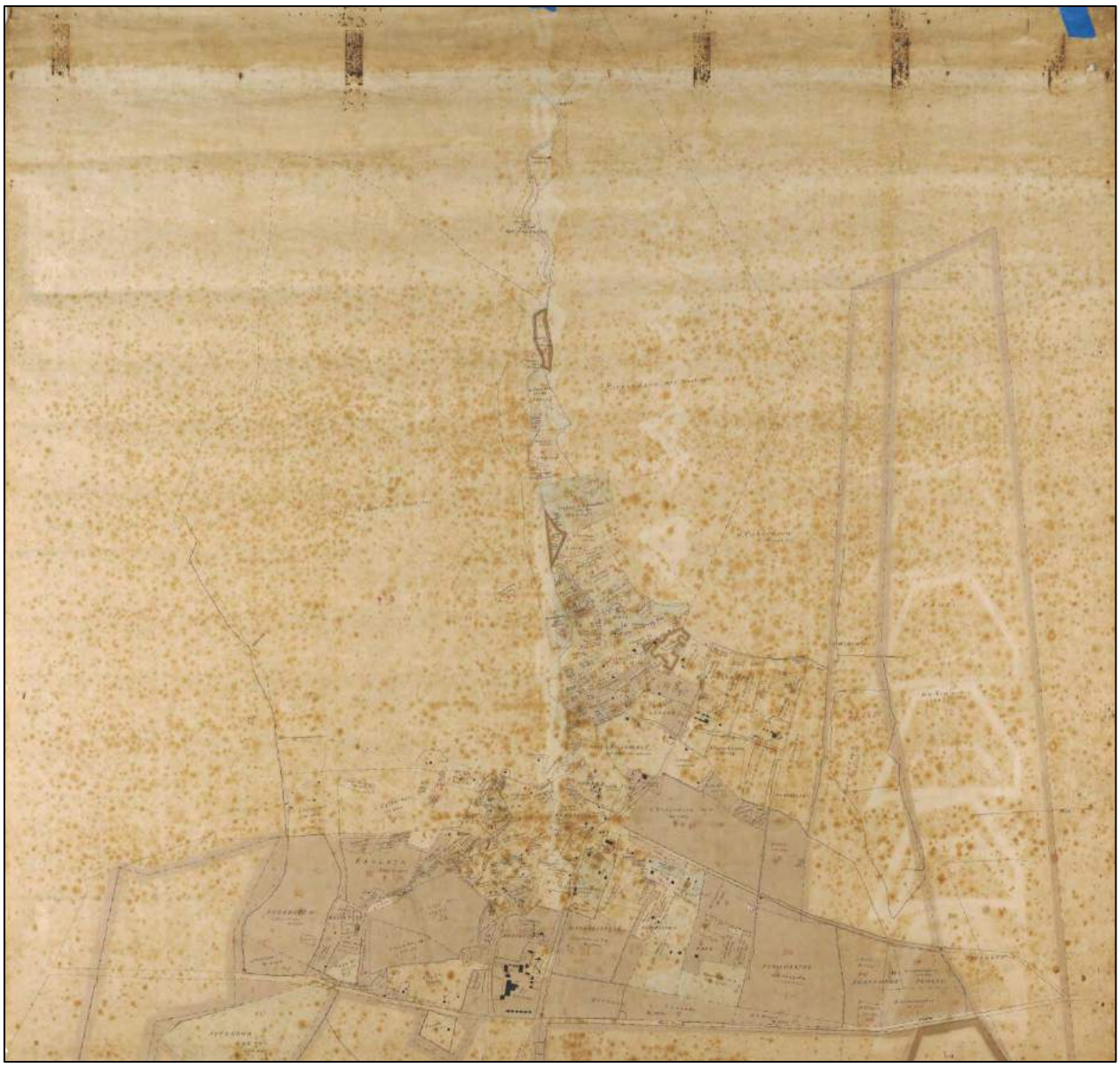
13.6 Inadvertent Finds (Artifacts & Burials)

Due to the fact that the development will take place on former cultural sites found within prior kuleana lands, there may be the potential of inadvertent finds such as artifacts and burials during the implementation phase of the project. It is highly recommended that if any cultural features (i.e. artifact, burials, etc..) arise through any portion of the project implementation phase, that the developer will comply with state laws and work in accordance with archaeologists on a site monitoring or preservation plan. It is further recommended that they stay in close communication with the Waikapū Community as many of these kuleana cultural lands once belonged to Hawaiian families, many of whom have decedents that continue to live in Waikapū

13.7 Final Recommendations

It is evident that the developer is open to communicating with the Waikapū Community at large and those land owners whose lands may be impacted adjacent to the subject property. Because of the concerns about neighboring cultural properties and resources, it is recommended that the developer continue to have genuine discussions with the Waikapū Community and provide current information and/or changes regarding the development plan. In addition, the community would also like to provide input on how to incorporate traditional cultural practices and knowledge within the development plan in order to maintain the unique traditions and practices of Waikapū and its identity. Although there have been prior impacts within the subject area made by the sugar industry, the Waikapū County Town development will be the largest development project to take place in Waikapū. Overarching sentiments provided by the community is that they would like the developer to be open to their concerns and to work directly with them on any issues that may arise in order to find positive solutions and an overall benefit to the Waikapū community at large

14.0 Indices of Māhele Awards and Māhele Documents Associated with Waikapū Country Town Development Project (Records Obtained and Compiled by Hōkūao Pellegrino)



Awardee	ʻIli (Subdivision)	Land Commission Award	Royal Patent	ʻĀpana (Parcel)	Grant	Acres	Description of Cultural & Natural Resources via Native and Foreign Testimony and Survey Notes	Surveyor
Kupalii	Keana	3546	3151	2		1.2	- Kula - Kalo paukū - Kukui & wiliwili - Borders Waikapū Stream	E. Bailey 5-5-1852
Charles Copp	Papala	236-I	498	2		1.0 (est.)	- Loʻi kalo (unspecified amount) - Borders Waikapū Stream	Ioane (John) Richardson
Napailoi	Kaloaloa / Loaloa	10481	3131	4		0.66	- Loʻi kalo (unspecified amount) - Borders Waikapū Stream	E. Bailey 4-23-1852
Opunui	Loaloa	3224	4115	6		0.27	- Loʻi kalo (unspecified amount) - Borders Waikapū Stream	E. Bailey 6-25-1852
Keaka (W)	Olohe	3549	3122	3		1.0 (est.)	- 3 loʻi kalo - Borders Waikapū Stream	Unkown
Keaka (W)	Olohe				1511	0.2 (est.)	- Loʻi kalo (unspecified amount) - Borders Waikapū Stream	Unknown
Kupalii	Mokahelahela / Makaelelu	3546	3151	3		1.0	- 1 house lot	E. Bailey 5-5-1852
Kamakaipoaa / Kamakaipuaa	Kamauhalii	6385	None	2		1.94	- Loʻi (unspecified amount) - Borders Waikapū Stream	E. Bailey 4-15-1852
Nahau	Olohe	3340	3115	2		0.8	- Moʻo kula - 1 house lot - ʻAuwai watercourse	E. Bailey 4-11-1852
Joseph Sylva	Waihalulu			3	1844	487.0	- ʻAuwai watercourse - Pens - Stone walls - Native claims retained - Gulch	E. Bailey 4-10-1855
Joseph Sylva	Waihalulu			2	1844	9.52	- Stone walls - Multiple house lot	E. Bailey 4-10-1855
Joseph Sylva	Waihalulu & Paalae			1	1844	22.36	- Native claims retained	E. Bailey 4-10-1855
Napailoi	Waihalulu	10481	3131	2&3		1.3	- 8 loʻi kalo - Kula - 1 house lot	E. Bailey 4-23-1852
Napailoi	Paalae	10481	3131	1:1		0.54	- Kalo paukū - Kula - ʻAuwai watercourse	E. Bailey 4-23-1852
Napailoi	Paalae	10481	3131	1:2		0.19	- Kalo paukū - Kula	E. Bailey 4-23-1852
Napailoi	Paalae	10481	3131	1:3		0.1	- Kalo paukū - Kula	E. Bailey 4-23-1852
Hakiki	Waihalulu	2577	4948	4		0.2	- 4 loʻi kalo - ʻAuwai watercourse	E. Bailey 8-14-1852
Kaeha	Olohe	2394	3138	1		1.36	- Kalo paukū - Pūhala - 2 house lots - ʻAuwai watercourse	E. Bailey 6-21-1852
Nalei	Olohe	10460	None	2		0.07	- 2 loʻi kalo - ʻAuwai watercourse	E. Bailey 4-16-1852
Ehunui	Olohe			1513		0.07 (est.)	- Unknown	Unknown
Ehunui	Olohe	2499	4070	1		0.8	- Kalo paukū - Poʻalima - ʻAuwai watercourse	E. Bailey 6-25-1852
Ehunui	Pikoku	2499	4070	3		1.3	- 7 loʻi kalo - ʻAuwai watercourse	E. Bailey 6-25-1852
Awardee	**ʻIli (Subdivision)**	**Land Commission**	**Royal Patent**	**ʻĀpana (Parcel)**	**Grant**	**Acres**	**Description of Cultural & Natural Resources via**	**Surveyor**

		Award					Native and Foreign Testimony and Survey Notes	
Kamaipuaa / Kamakaipoaa / Kamakaipuaa	Pikoku	6385	None	1		0.17	- Kalo paukū	E. Bailey 4-15-1852
Koa	Pikoku	3528	3155	1		3.90	- 2 house lots - Kalo paukū - Kula - ʻAuwai watercourse	E. Bailey 8-27-1852
Koa	Pikoku				1708	0.1 (est.)	- 1 loʻi kalo - ʻAuwai watercourse **- 2 burial plots (Maxwell)**	E. Bailey 9-9-1854
Hakiki	Olohe	2577	4948	2		0.25	- 7 loʻi kalo	E. Bailey 8-14-1852
Mohomoho	Kamauhalii			1	1711	0.08	- 1 loʻi kalo	E. Bailey 9-8-1854
Mohomoho	Kamauhalii			2	1711	0.04	- 1 loʻi kalo	E. Bailey 9-8-1854
Ihu	Kamauhalii			1	1712	0.09	- 1 loʻi kalo	E. Bailey 9-15-1854
Opunui	Kamauhalii				1704	1.94	- Unkown	E. Bailey 9-9-1854
Mataio	Kamauhalii	3020	3140	2		2.65	- Kalo paukū - Kula - House lot	E. Bailey 4-15-1852
Keawe (W)	Punia	3520	3135			2.54	- 2 kalo paukū - Kula	E. Bailey 4-15-1852
Makuakane	Punia	2522	3125			1.83	- Kalo paukū	Unknown
Kekua	Kamauhalii	5551	3150	1		0.42	- Kalo paukū	E. Bailey 6-25-1852
Kekua	Kaalaea	5551	3150	2		0.1	- 2 loʻi kalo	E. Bailey 6-25-1852
Kekua	Kamauhalii				1518	0.15 (est.)	- Unknown	Unknown
Kamohai	Kaalaea	3527	3156	3		0.2	- Kalo paukū - Kula moʻo	E. Bailey 8-18-1852
Naanaa	Punia	3337	3136	1,2,3		1.1	- Kalo paukū - Loʻi kalo - House lot	E. Bailey 4-14-1852
Ihu	Kaalaea			2	1712	0.07	- 1 loʻi kalo	E. Bailey 9-15-1854
Kaai	Kaalaea			2	2069	0.18	- Unknown	Unknown
Opunui	Kaalaea	3224	4115	5		0.32	- Kula	E. Bailey 6-25-13
Naanaa	Kaalaea	3337	3136	4		0.45	- Kalo paukū	E. Bailey 4-14-1852
Poepoe	Kaalaea	2609	3124	1,5		0.98	- Kalo paukū - ʻUala kula - House lot	E. Bailey 8-27-1852
Kaai	Kaalaea	5774	4014	2		2.76	- 6 loʻi kalo -ʻAuwai watercourse	E. Bailey 3-?-1852
Kaai	Kaalaea			1	2069	10.46	- Unknown	Unknown
Wahinealii	Kaalaea	11022	3142	8		0.6	- House lot	E. Bailey 4-15-1852
Mahoe	Ahuakolea	10160	3148	1		1.99	- Kalo paukū	E. Bailey 4-16-1852
Kamohai	Kaalaea	3527	3156	2		0.2	- Kalo paukū	E. Bailey 8-18-1852
Keakini	Kaalaea	5324	6374	3		0.56	- 1 loʻi kalo	E. Bailey 4-24-1852
Kaneae	Kaloapelu	8874	3130	1		0.29	- Loʻi kalo	E. Bailey 8-26-1852

Awardee	ʻIli (Subdivision)	Land Commission Award	Royal Patent	ʻĀpana (Parcel)	Grant	Acres	Description of Cultural & Natural Resources via Native and Foreign Testimony and Survey Notes	Surveyor
Haawahine	Kaloapelu	491	3139	2		0.2	- 1 loʻi kalo	Unknown
Kamohai	Kaloapelu	3527	3156	1		0.25	- Loʻi kalo - Kula moʻo	E. Bailey 8-18-1852
Mahuka	Kaloapelu	462	None	1		0.29	- 6 loʻi kalo	E. Bailey 2-11-1853
Haawahine	Kaloapelu	491	3139	1		0.2	- 4 loʻi kalo	E. Bailey 8-?-1852
Kaneae	Kaloapelu	8874	3130	2		0.87	- Loʻi kalo	E. Bailey 8-26-1852
Haawahine	Kaloapelu	491	3139	3		0.13	- 2 loʻi kalo	E. Bailey 8-?-1852
Eugene Bal	Kaloapelu			1	2747	0.72	- Unknown	E. Bailey 3-12-1861
Charles Copp	Luapuaa	236	498	1		16.5	- Unknown	E. Bailey ?
John Crowder	Koʻolau	416	41	1		7.4 (est.)	- ʻAuwai watercourse	J. Richardson 2-2-1847
John Crowder	Aikanaha	416	41	2		1.5 (est.)	- House lot	J. Richardson 2-2-1847
John Crowder	Aikanaha				2904	0.57	- House lot	E. Bailey 6-6-1861
E.W. Gleason	Aikanaha				1674	1.8	- Dry loʻi kalo	E. Bailey 7-20-1853
Haa	Aikanaha	455	324	2		1.8	- Sugar cane	J. Richardson 3-11-1850
Kaai	Kaloapelu	5774	4014	4		9.9	- Loʻi kalo - Kula	E. Bailey 3-?-1852
Kaneae	Kaloapelu	8874	3130	3		0.8	- Loʻi kalo	E. Bailey 8-26-1852
Mahuka	Kaloapelu	462	None	2		0.09	- 5 loʻi kalo	E. Bailey 2-11-1853
Keakini	Kaloapelu	5324	6374	2		1.82	- 3 loʻi kalo - Kula - House lot	E. Bailey 4-24-1852
Eugene Bal	Kaloapelu				2342	2.73	- 2 house lots	E. Bailey 2-23-1857
John Boardman	Ahuakolea				2960	23.5	- Reservoir - Stone Walls	E. Bailey
John Boardman	Ahuakolea				3043	4.5	- Reserved rights of natives	Unknown
Henry Cornwell	Unknown				3152	1,200 (est.)	- Board of Education lands - Reserved rights of natives	Unknown
Haa	Aikanaha	455	324	1		33.2	- Sugar cane	J. Richardson 3-11-1850
Eugene Bal	Aikanaha			2	2747	129.8 (port.)	- Potential house lots **- Burial sites**	
Poonui	Kaumuilio	411	None			3.53	- Loʻi kalo - House lot	Unkown

15.0 REFERENCES

Ashdown, Inez MacPhee
1971 *Ke Alaloa o Maui.* Kamaʻāina Historians, Wailuku.

Beckwith, Martha
1940 *Hawaiian Mythology.* Yale University Press.

Beaglehole, J.C.
1967 *The Journals of Captain James Cook on his Voyages of Discovery, III: The Voyage of the Resolution and Discovery, 1776-1780.* Cambridge University Press, Cambridge.

Brisbin, Joel, Alan E. Haun, and Peter M. Jensen
1991 *Data Recovery Excavations Waikapū Mauka Partners Golf Resort Project Area: Land of Waikapū, Wailuku District, Maui.* PHRI, Hilo.

Chinen, Jon J.
1958 *The Great Māhele, Hawai'i's Land Division of 1848.* University of Hawaiʻi Press, Honolulu.

Cordy, R.
2000 *Exhaulted Sits the Chief. The Ancient History of Hawai'i Island.* Mutual Publishing, Honolulu.

Corney, P.
1813-1818 *Voyages in the Northern Pacific. Narrative of Several Trading Voyages From 1813 to 1881.*

Creed, Victoria S.
1993 *Settlement Pattern For Waikapū, Wailuku, Maui.* Cultural Surveys Hawaiʻi, Honolulu.

Desha, Stephen L & Frances N. Frazier
2000 *Kamehameha and His Warrior Kekūhaupi'o.* Kamehameha Schools Press, Honolulu.

Folk, William H. and Hallett H. Hammatt.
1989 *Archaeological Survey of Mā'alaea, Waikapū, Maui.* Cultural Surveys Hawaiʻi, Honolulu.

Hammatt, Hallett H.
1993 *A Data Recovery and Preservation Plan for Waikapū Mauka, Waikapū, Maui.* Cultural Surveys Hawaiʻi, Honolulu.

Handy, E.S.C.
1940 *The Hawaiian Planter, Volume 1: His Plants, Methods, and Areas of Cultivation.* Bernice Pauahi Bishop Museum, Bulletin 161, Honolulu.

Handy, E.S.C., E.G. Handy and Mary Kawena Pukui
1972 *Native Planters in Hawai'i: Their Life, Lore, and Environment.* Bernice Pauahi Bishop Museum, Honolulu, Bulletin 233.

'Ī'Ī, John Papa
1959 *Fragments of Hawaiian History.* Bishop Museum Press, Honolulu.

(Kailianu, Kamaka Kailianu
1935 *Boundary Commission Hearing No. 230.*

Kamakau, Samuel
1992 *Ruling Chiefs of Hawai'i.* The Kamehameha Schools Press, Honolulu, Hawai'i.

Ka Nūpepa Ku'oko'a
1872 *No Waikapū.* Kaualililehua, W.K., September 21, 1872.

Kirch, Patrick V.
1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory.* University of Hawai'i Press, Honolulu.

Kuykendall, Ralph S.
1938 *The Hawaiian Kingdom, Vol. I.* University of Hawai'i Press, Honolulu.

Landgraff, Kapulani
2003 *Nā Wahi Kapu o Maui.* 'Ai Pōhaku Presss, Honolulu.

Maui News
1936 *Sugar 50 Years Ago, Waikapū Mill & Plantation.* July 8th 1936.

Maui News
1966 *Ancient Grinding Stone.* Maui News article, May 21, 1966 with photo by Bert Biehl. Wailuku, Maui.

Oki, Delwyn S., Reuben H. Wolff, Jeff A. Perreault
2010 *Effects of Surface-Water Diversions on Streamflow, Recharge, Physical Habitat and Temperature, Nā Wai 'Ehā, Maui, Hawai'i.* U.S. Geological Survey, Virginia.

Pacific Commercial Advertiser
1864 *Waikapū.* April 9th, 1864.

Pukui, Mary Kawena and Samuel H. Elbert
1986 *Hawaiian Dictionary (Revised and Enlarged Edition).* University of Hawai'i Press, Honolulu.

Pukui, Mary Kawena, Samue H. Elbert and Esther T. Mo‘okini
1974 *Place Names of Hawai‘i.* University of Hawai‘i Press, Honolulu.

Pukui, Mary Kawena
1983 *‘Ōlelo No‘eau: Hawaiian Proverbs & Poetial Sayings.* Bishop Museum Press, Honolulu.

Silva, Alvin K.
1962 *Wailuku Sugar Centenial, November 1862-1962: A Century of Progress in Sugar Cane Cultivation.* Wailuku Sugar Company, Wailuku.

Sterling, Elspeth P.
1998 *Sites of Maui.* Bishop Museum Press, Honolulu.

Stearns, Harold T. and Gordan A. Macdonald
1942 *Geology and Ground-Water Resources of the Island of Maui, Hawai‘i.* U.S. Geological Survey, Honolulu.

Tengan, Dr. Kawika & Hōkūao Pellegrino
2006 *Cultural Impact Report on Nā Wai ‘Ehā.* Office of Hawaiian Affairs, Honolulu

Thrum, Thomas G.
1909-1918 *Maui’s Heiaus and Heiau Sites Revised.* Thrum’s Hawaiian Annual, Honolulu.

Thrum, Thomas G.
1889 *Some Noted Battles of Hawaiian History – Battle of Waikapū Common.* Thrum’s Hawaiian Annual, Honolulu.

United States Fish & Wildlife Service
2011 *Keālia Pond National Wildlife Refuge: Comprehensive Conservation Plan and Environmental Assessment.* U.S. Fish and Wildlife Service, Honolulu.

Van, James
2001 *Ancient Sites of Maui, Moloka‘i, and Lāna‘i: Archaeological Places of Interest in the Hawaiian Islands.* Mutual Publishing, Honolulu.

Walker, Winslow
1931 *Archaeology of Maui.* Manuscript at Bishop Museum, Honolulu.

Yale Law Journal
1898 *A Sketch of the Evolution of Allodial Titles in Hawai‘i.*

Maps

1879 M.D. Monsarrat, Coastline of Kahului and Māʻalaea Bays, Scale 1:24,000 Reg. Map 779.

1887 M.D. Monsarrat, Waikapū Kuleana Lands, Maui.

1883 George Ed Gresley Jackson, Māʻalaea Bay, Maui, Hawaiian Government Survey, W.D. Alexander Surveyor General ,Scale 200 ft. = 1 inch.

1935 Robert Bruce, Title Map of Wailuku Sugar Company, E.D. Baldwin and A.G. Alexander Surveyor.

1997 USGS 7.5 Minutes Series Wailuku Quadrangles

APPENDIX F, A
Ka Pa‘akai Cultural Analysis

Waikapū Country Town Development
Ka Paʻakai Cultural Analysis

December 2016

Hōkūao Pellegrino
(Consultant)

The proposed Waikapū Country Town intends to develop a new residential mixed-use community on lands within and around the Maui Tropical Plantation (MTP), which is adjacent to the existing small, historic town and ahupuaʻa of Waikapū, Maui. According to the proposed development plans, the project will encompass approximately 503 acres of land to be used for urban and rural development. Approximately 1,073 acres will remain in agricultural use and about 800 acres of this agricultural land will be placed into an agricultural conservation easement. Waikapū Country Town must obtain approval from the State Land Use Commission (LUC) and County of Maui Planning Commission, and Maui County Council in order to proceed with their development plan.

Article XII, section 7 of Hawaiʻi Constitution obligates the State of Hawaiʻi and its agencies, such as the LUC, "to protect the reasonable exercise of customarily and traditionally exercised rights of Native Hawaiians to the extent feasible when granting permission for reclassification of district boundaries." (*Ka Paʻakai o Ka ʻĀina v Land Use Commission*, 94 Hawaiʻi 31, 7 P.3d 1068 [2000]. Under Article XII, section 7, the State shall protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by ahupuaʻa tenants who are descendants of Native Hawaiians who inhabited the Hawaiian Islands prior to 1778, subject to the right of the State to regulate such rights. In the context of land use permitting, these issues are commonly addressed when the LUC is asked to approve a petition for the reclassification of district boundaries, as such an action most often initiates activities that precede initial intensive development.

In the September 11, 2000 Hawaiʻi Supreme Court landmark decision ((*Ka Paʻakai o Ka ʻĀina v Land Use Commission*), an analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities was created, The court decision established a three-part process relative to evaluating such potential impacts: first, to identify whether any valued cultural, historical, or natural resources are present; and identify the extent to which any traditional and customary Native Hawaiian rights are exercised; second, to identify the extent to which those resources and rights will be affected or impaired by the proposed action; and third, to specify the feasible action, if any, to be taken by the regulatory body to reasonably protect Native Hawaiian rights if they are found to exist.

In an effort to identify whether any valued cultural, historical, or natural resources are present within the proposed project area, and identify the extent to which any traditional and customary Native Hawaiian rights are, or have been, exercised (the first part of the analytical process); historical archival information was investigated, and prior and current cultural studies that included consultation and oral-historical interviews were reviewed. A summary of the analysis is presented below.

Waikapū is the first of four ahupuaʻa (land divisions) in the moku (district) of Wailuku, poetically known as Nā Wai ʻEhā (Waikapū, Wailuku, Waiehu, Waiheʻe). This land division is located within the southern portion of the West Maui Mountains named Mauna Kahālāwai (Ashdown 1971) and extends into the central isthmus named Ke Kula o Kamaʻaomaʻo (Pukui1983). The traditional palena ʻāina (boundaries) originate from the Hanaʻula Mountain Range (4,456 ft.). The boundary navigates northward through the Waikapū Valley and Stream onto Kapilau Ridge and eastward down Kalapaokaʻīlio Ridge located above a portion of the current Wailuku Heights subdivision. Continuing eastwards, appears a boundary known as Pōhākoʻi which was a large adze grinding stone near the current intersection of Kuʻikahi Road and Honoapiʻilani Highway. It subsequently moves east to a boundary point named Kaʻōpala located near the Central Maui Baseyard. From there, the boundary moves southerly to Kīheipūkoʻa near the once historical moʻo paʻakai (salt grounds) and current Keālia wetlands / fishpond. Moving westwards through Keālia and to Māʻalaea Bay is a boundary point known as Kapoli, a famous spring adjacent to the current Māʻalaea Boat Harbor. The palena ʻāina then veers north to a once famous cinder cone and now commercial dump called Puʻuhele. The traditional boundary concludes when returning westward by means of four additional cinder cones named Puʻuhona, Puʻulūʻau, Puʻumoe, and Puʻuanu, located on the Hanaʻula Mountain Range. (See Figure 1 for description)

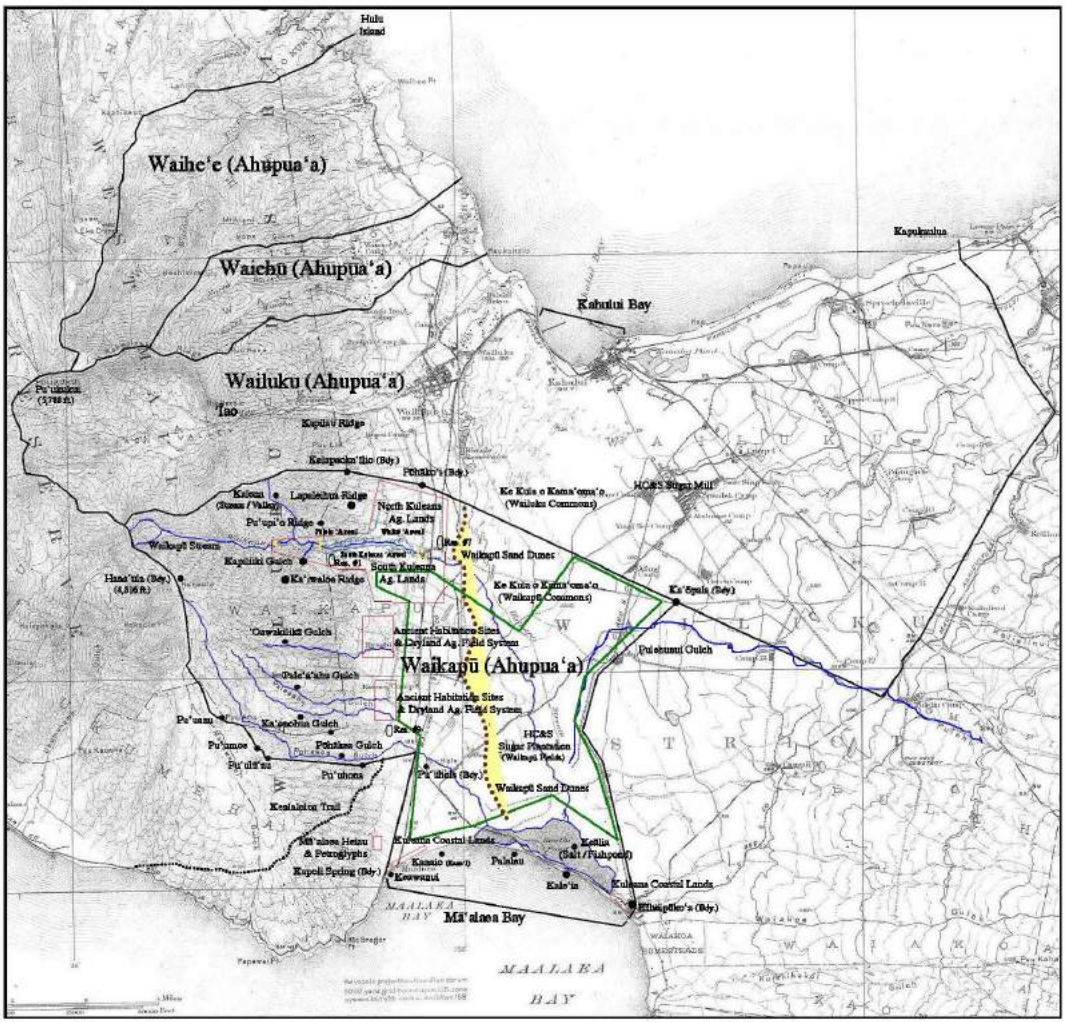


Figure 1. Copy of 2013 Palapala Hiʻonaina ʻŌiwi o Waikpū - Cultural Landscape Map of Waikapū by Hōkūao Pellegrino.

One legendary account of Waikapū, as translated from the Hawaiian Language newspaper (Ka Nūpepa Kūʻokoʻa) by Elspeth Sterling and revised by Hōkūao Pellegrino, states that Waikapū received its name from a great conch which its sound used to be heard throughout the valley.

> …The Waikapū now being discussed, is a legendary place named by some of the ancients, and has remained until this time. This place, Waikapū, has a cave away up the stream, the distance perhaps a mile or more from the village. On the southern side of the river, is a cave, and inside this cave is a pū, or conch…From this pū, the whole of the place was named Waikapū, Waters of the Conch… (Sterling 1998)

The land tenure during the time of the Māhele of 1848 indicated that Waikapū was a thriving ahupuaʻa in which Hawaiians dominated the cultural landscape by cultivating an extensive system of loʻi kalo (wetland taro patches) in and around Waikapū Valley and Stream. The coastal region of Waikapū was utilized for fishing grounds and salt production from Keālia wetlands/fishpond to Māʻalaea Bay. Maps from the late 1800s, demonstrate some 120+ Māhele land claims, both Land Commission Awards (LCAs) and Government Grants. The land mass of ʻili (subdivisions) where loʻi kalo were cultivated is estimated to be around 900 acres. Over 1,300 loʻi kalo were recorded in Land Commission Award claims and dispersed throughout the 900 acres. In addition to loʻi kalo claims, were requests for kula (dryland cultivation), moʻo paʻakai (salt pans/grounds), wauke (paper mulberry used for making kapa), hala (pandanus used for making mats), potatoes, and hale (house lots for living).

The interior portion of the Waikapū watershed existed an abundance of fresh water for the perennial waterway known as Waikapū Stream. Both stream and rich alluvial soils ensured high agricultural productivity and output by Native Hawaiians. Maps and records demonstrate that traditionally, Waikapū Stream was utilized to create 4 extensive ʻauwai (irrigation systems), 3 on the north side and 1 on the south side of Waikapū Stream. These ʻauwai were associated with irrigating the more than 1,300 loʻi kalo (wetland taro patches) documented in the Land Commission Awards and Government Grants. Waikapū Stream not only supported kalo which was the Hawaiians main dietary staple, but also maiʻa (bananas), ʻuala (sweet potatoes), kī (tī), and trees such as ʻulu (breadfruit) niu (coconuts), wauke (paper mulberry) and pūhala (pandanus). In addition, Waikapū Stream was the main freshwater source for Keālia, a fishpond, wetlands and estuary adjacent to Māʻalaea Bay. Habitation and religious structures, along with agricultural sites were likely distributed near loʻi kalo and down by the coast for marine exploitation, fish pond maintenance and the collection of salt produced in the moʻo paʻakai at Māʻalaea and Keālia. Water sources were equally important for those Hawaiians who established hale or habitation structures.

> …Spreading north and South from the base of Waikapū to a considerable distance below the valley are the vestiges of extensive wet-taro plantings, now almost obliterated by sugar-cane cultivation; a few here and there are preserved in plantation camps and under house and garden sites along the roads. Among these gardens there were, in 1934, a few patches of dry Japanese taro. Far on the north side, just above the main road and at least half a mile below the entrance to the canyon, an extensive truck garden on old terrace ground showed the large area and the distance below and away from the valley that was anciently developed in terraced taro culture. On the south side there are likewise several sizable kuleanas

> where, in 1934, old terraces were used for truck gardening. In the largest of these a few old patches were flooded and planted with Hawaiian taro, and there was some dry Japanese taro. Several terraces were used as ponds planted with lotus for their edible seed. There were probably once a few small terraces on the narrow level strip of the valley bottom in the lower canyon… (Handy and Handy 1972).

The proposed development project named Waikapū Country Town is located within the Waikapū ahupua‘a near the opening of the valley, stream and historic town of Waikapū. The developer’s land holdings comprise of 52 Land Commission Awards (LCAs) and Government Grants totaling 74 ‘āpana (parcels) that were claimed during period of the Māhele of 1848. The proposed project is situated on more than half of these claims. Of the 52 claims, 36 were compromised during the introduction of sugar cultivation and grazing by Waikapū and Wailuku Sugar Company. The remaining cultural properties are within the interior part of the Waikapū Valley and likely remain as they once were at the time of the Māhele. Some of these properties and cultural sites are still in use. Waikapū Country Town Development will be situated on the 36 Māhele land claims that were impacted by sugar cultivation and along intact kuleana lands currently being cultivated for lo‘i kalo.

Previous archaeological studies along with the history of land use at the time of the Māhele of 1848 and in-depth ethno-historic accounts, can be used to develop a general predictive model for traditional Hawaiian settlement and subsistence patterns for the Waikapū Country Town planned development. The region in and around the proposed project area appears to have been part of an extensive system of lo‘i kalo (wetland taro) production and pre-western habitation.

A hypothetical model for traditional Hawaiian settlement was developed by Kirch (1985) and Cordy (1978). According to this postulation, the project area would have been an ideal setting for early Hawaiian permanent habitation and agriculture. Utilizing dates from other Hawaiian Islands, Cordy postulated that initial pre-Contact settlement in lower valleys and coastal regions occurred from 300 to 600 A.D. and by 1000 A.D. fishponds, protected bays, and religious structures.

There have been numerous archaeological surveys and studies in Waikapū beginning in 1909 by Thomas Thrum, followed by J.F.G. Stokes and Kenneth P. Emory in 1920. More recently, there have been studies of pre-western contact settlement, agriculture, and other cultural sites by Folk and Hammatt, Kennedy, and Brisbin. None of these studies until recently however, were conducted on the land that is being proposed for the development of Waikapū Country Town.

An archaeological inventory survey (AIS) was conducted for the proposed Waikapū Country Town development by Archaeological Services Hawai‘i LLC. Of the 1,576 acres of land in which the developer consists of, the planned development will have a footprint of 503 acres of the total land base of 1,576 acres. The project area extends all the way to the southern edge of the Waikapū Stream, however the development will remain at least 100 ft. from the stream, such that the former cane access road which parallels the stream, as well as the steep to moderate slopes down to the stream’s edge will not be encroached upon by development. This 100 ft. buffer zone was mandated in 1992 by the State Land Use District Boundary Review for Maui, Molokai, Lanai, Honolulu where a 100-ft corridor on both sides of Waikapū Stream was placed into a Conservation District (Office of State Planning: 31). Developing a cultural reserve or corridor is one such mitigation

measure that has been proposed in the latter part of this study as a way to ensure protection of these cultural sites in perpetuity.

The AIS scope of work consisted of dividing the project area into five zones based primarily on the current TMK's (ASH 2013). From mauka to makai the zones are as follows: Parcel 3 Mauka, constitutes the mauka section of TMK 3-6-004:003; Parcel 3 Waena is the middle and remaining section of TMK 3-6- 004:003: Parcel 6 is TMK 3-6-004:006; Parcel 7 is the current Maui Tropical Plantation landholdings 3-6- 004:007 and Parcel 3 Makai is within TMK 3-6-002:003. The investigation was conducted to determine presence/absence, extent, and significance of historic properties within the proposed development area and to formulate future mitigation measures for these remains and the project area.

Due to the extensive grading and tilling activities associated with Waikapū and Wailuku Sugarcane Company cultivation and the construction of the Maui Tropical Plantation commercial buildings and agro-tourism facilities, no surface structural remains associated with the pre-Contact and post Contact periods were evident; however features associated with sugarcane cultivation was frequently found. Remnant subsurface historic properties such as rock alignments, buried cultural deposits, pits and human burials were not found in the over 150 trenches that were dug. The likelihood of encountering subsurface features throughout the actual development, was dependent upon the depth of the sugarcane till zone. Majority of the project area has undergone compounded surficial disturbances from commercial and small scale agricultural and animal husbandry pursuits providing little evidence of surface historic properties. This area was however intensively settled from the pre-contact period through the historic era as evidenced by the numerous kuleana land records via Land Commission Awards (LCAs), several large Government Grant lots, coupled with archival research and prior archaeological studies around the project area. Due to these alterations across the project area, the AIS procedures consisted of a pedestrian survey and subsurface investigations through mechanical excavations.

There were numerous features and historic properties found, most of which were associated with the plantation era, such as the Waiheʻe Ditch (circa 1907) and a plantation ditch deriving from Reservoir #1. In addition was a traditional ʻauwai which continues to flow and feed kuleana lands and loʻi kalo adjacent to the planned development. Lastly, there was an L-shaped retaining wall adjacent to the ʻauwai that was likely part of a loʻi kalo complex.

Because of the numerous amount of former LCA's and Grants, as well as historic properties found within the proposed project area, the AIS recommended there be archaeological monitoring of Parcel 3 Mauka and Waena. Furthermore, the conducting of spot monitoring inspections of other localities not expressed in above analysis was recommended. Parcels 6 and 7 contain numerous LCA's and Grants; thus monitoring should initially be full time until the nature of the subsurface conditions in relationship to the proposed ground-altering activities is determined. Similarly for Parcel 3 Makai, monitoring should initially be full-time with the primary focus along the eastern and western perimeters, which are close to Waiʻale and East Waikō Roads, areas known and documented in Government Grant 2747 to Eugene Bal which contain sand dune burials. Prior to the commencement of construction, an Archaeological Monitoring Plan (AMP) detailing the localities to undergo monitoring procedures will be prepared and submitted to SHPD for review and approval.

A comprehensive Cultural Impact Assessment was developed for the proposed development and clearly outlined specific traditional Hawaiian practices and access rights found within the project area. The CIA formalized a collective review of prior cultural, archaeological and ethno-historical studies related to the Waikapū ahupuaʻa, along with a wide range of interviews with living kamaʻāina and lineal descendants of Waikapū. It seems that both historical and current traditional Hawaiian practices have not differed over time. What has changed however, is the extent for which these Hawaiian cultural practices are occurring. What once was a vast cultural landscape within the Waikapū, has diminished drastically due to the alterations of the land and natural resources caused by plantation era activities. Despite a fragmented cultural landscape, evidence of cultural Hawaiian practices occurring within and directly adjacent to the project area continues to exist.

The following valued cultural, historical and natural resources are currently being utilized for cultural Hawaiian practices; Access and utilization of Waikapū Stream, access to water via ʻauwai systems for traditional loʻi kalo cultivation on kuleana lands, access to the interior part of the Waikapū Valley and watershed for gathering endemic and native medicinal plants as well as other Hawaiian food crops, native forest and habitat restoration, archaeological stabilization and cultural resource management of kuleana lands, and access to privately owned kuleana lands. The following paragraphs will address specific details regarding the above cultural Hawaiian practices by 1) Extent to which those resources including traditional and customary native Hawaiian rights will be affected or impaired by the proposed development. 2) Feasible action, if any, to be taken by the LUC to reasonably protect native Hawaiian right if they are found to exist.

The Waikapū Stream has and continues to be a very important cultural resource for Native Hawaiian cultural practitioners and practices such as loʻi kalo cultivation. The proposed project area includes a plantation era irrigation and traditional ʻauwai system that provides water for South Waikapū kuleana loʻi kalo farmers. An ancient ʻauwai historically provided water for South Waikapū kuleana loʻi kalo farmers which commenced on Government Grant 1844 to Joseph Sylva, now currently part of the proposed project area. The use of the poʻowai or intake portion of this ʻauwai was discontinued when Wailuku Sugar Co. built the south Waikapū dam intake within the Waikapū Valley around the turn of the 20th century. Currently, the south Waikapū dam and intake is owned by Wailuku Water Co. whom divert Waikapū Stream water about 2 miles into the Waikapū Valley, delivers water through their ditch system and into Reservoir #1 which is on the developer's proposed projects land. From Reservoir #1, a portion of water is released via a pvc pipe into a smaller open ditch and connects with the remaining portion of the ancient ʻauwai that delivers water to the south kuleana loʻi kalo farmers. As of December 2016, 6 south kuleana land owners have been identified as utilizing this ditch commonly called south Waikapū kuleana ʻauwai for kalo cultivation: (TMK 3-6-005:019, TMK 3-6-006:027, TMK 3-6-006:025, TMK 3-6-006:029, TMK 3-6-006:003, TMK 3-6-006:013). There are numerous other south kuleana lands that are privately owned and consist of former loʻi kalo terraces, however are not in use. Lineal descendants of these lands through the State Water Use Permit process have expressed interest in utilizing or returning to their ancestral lands to restore and farm loʻi kalo. These lands are identified as (TMK 3-6-005:014, TMK 3-6-005:067, TMK 3-6-005:001, TMK 3-6-006:017, TMK 3-6-006:032, TMK 3-6-006:033, TMK 3-6-006:001, TMK 3-6-005068, TMK 3-6-007:010).

To ensure that current and future Native Hawaiian practices associated with access to kuleana water for loʻi kalo cultivation are protected, the following information has been provided by existing south kuleana loʻi kalo farmers. They expressed that the irrigation system which provides water to their lands via the plantation ditch found within the proposed project area, is inefficient and causes limitations. The limitations include lack of and consistent water for loʻi kalo cultivation as well as warm water that comes from Reservoir #1 rather than straight from the stream as it historically did. They have shared that the water entering the ditch comes from a reservoir which causes some warming of the water rather than fresh stream water directly from the Waikapū Stream. Although the amount of water released via a pvc pipe may be sufficient, the estimated 1 mile long open ditch has numerous leaks and along with absorption into the ground along the ironwood trees. When the water finally enters the ancient ʻauwai system near the kuleana lands, it has been said that the amount is minimal and does not provide sufficient amount of water for the current and growing needs of existing kuleana loʻi kalo farmers.

The proposed project area has identified the plantation era irrigation and ʻauwai system be located within a greenway. Although the development will not adversely Hawaiian cultural practices related to loʻi kalo cultivation on neighboring properties that access water via the developer's land, a proposed improvement of the infrastructure and overall system should be implemented to mitigate their concerns. Kuleana loʻi kalo farmers who are Native Hawaiian would like the developer to allow a direct in-flow from the diversion ditch prior to entering Reservoir #1. In addition, the plantation era open ditch along the ironwood tree line, should be enclosed with a large pipe to minimize water loss prior to entering the traditional ʻauwai. This they believe will which ensure the protection of existing and future access rights to this important cultural and natural resource. Prior to any work, it would be advised that the developer of the proposed project consult with neighboring south kuleana loʻi kalo farmers to ensure that infrastructure improvements has minimal to no adverse effects to their traditional and customary rights and practices.

Traditional and customary rights in relationship to Waikapū water and loʻi kalo cultivation are also occurring extensively on the north side of Waikapū Stream on kuleana lands directly across from the proposed project area. (TMK An intact traditional ʻauwai known as the north kuleana ʻauwai accesses Waikapū Stream water directly from the Waikapū Stream. (TMK 3-5-012:031, TMK 3-5-012:028, TMK 3-5-012:041, TMK 3-5-012:027, TMK 3-5-012:026, TMK 3-5-012:049, TMK 3-5-012:048, TMK 3-5-012:047, TMK 3-5-012:023, TMK 3-5-012:021, TMK 3-5-012:020, TMK 3-5-004:028, TMK 3-5-004:32, TMK 3-5-012:016, TMK 3-5-012:016, TMK 3-5-012:015, TMK 3-5-012:10, TMK 3-5-012:012, TMK 3-5-012:013, TMK 3-5-012:009, TMK 3-5-012:008, TMK 3-5-012:007, TMK 3-5-012:006, TMK 3-5-012:005, TMK 3-5-012:003, TMK 3-5-012:001) The State Commission on Water Resource Management set the Interim Instream Flow Standards (IIFS) for Waikapū Stream as 2.9 mgd in 2014 through a settlement agreement between the following parties; Hui o Nā Wai ʻEhā, Wailuku Water Company, Hawaiian Commercial Sugar Company, Maui Tomorrow, County of Maui, and Office of Hawaiian Affairs. The amount of water that has been released into Waikapū Stream does not account for traditional and customary rights for kuleana loʻi kalo farmers which is a protected right under State Law. Currently, Waikapū Properties who owns the land for the proposed project has a delivery purchase agreement from Wailuku Water Company for diverted Waikapū Stream water to be used for commercial agricultural and agro-tourism activities. The amount of water being utilized has directly impacted traditional and customary rights and practices for kuleana loʻi kalo farmers on the north side of the

Waikapū Stream. The amount of water in the stream remaining in the Waikapū Stream in insufficient and does not satisfy the current and future use of kuleana loʻi kalo farmers on the north side of the Waikapū Stream. Waikapū Properties however, has consulted with north kuleana users and has provided a clear mitigation plan stating that they will end all surface water use from Waikapū Stream except for cattle water troughs (250 gad/acre). Waikapū Properties commercial ag activities will be transitioning throughout 2017 to relocate to lands that will be irrigated via Waiheʻe Ditch and agricultural wells developed on the proposed project area. There is currently an ongoing contested case through the State Water Commission for issuance of Water Use Permits as well as revising the Interim Instream Flow Standards for Waikapū Stream.

The interior valley of Waikapū watershed includes a diverse native forest with an array of endemic plants, insects, snails and mammals. Traditional access and trails into the Waikapū Valley are along the Waikapū Stream which is partially owned by the developer of the proposed project. In addition to the river, are two plantation era access points adjacent to Reservoir #1. There are a number of Hawaiian cultural practices identified in relationship to accessing the Waikapū Valley for gathering and stewarding highly sensitive cultural and natural resources.

There are endemic medicinal plants such as koʻokoʻolau (bidens sp.) and māmaki (pipturus albidus) that have been identified by lineal descendants of Waikapū for gathering and use in lāʻau lapaʻau (Hawaiian herbal medicine). These native plants and others grow in very specific regions within the valley and ridges. A Hawaiian family shared about a specific koʻokoʻolau plant that they would gather fresh leaves from which was located along a ridge and dry gulch in the valley named Kapiliiki. The leaves were used to treat a family member who has high blood pressure. The proposed project does not adversely impact the area in which traditional cultural practice of gathering herbs exist. The proposed project will continue to allow access to the Waikapū Valley for traditional and customary practices through a greenway or potential cultural reserve adjacent to the Waikapū Stream and near the opening of the valley on a trail below Reservoir #1.

Lineal descendants of Waikapū have also been identified as having scattered the ashes of their ancestors within the valley. The cultural practices conducted by lineal descendants are reliant on access through the proposed development in order to honor their kūpuna. The proposed project will continue to allow access to the Waikapū Valley for traditional and customary practices through a greenway or potential cultural reserve adjacent to the Waikapū Stream and near the opening of the valley on a trail below Reservoir #1.

Hui Mālama o Waikapū, a non-profit organization affiliated with Tri-Isl RC&D was stablished in 2009 and currently has a 15 year lease with the developer for a 5 acre parcel of land adjacent to the proposed project. The mission of the organization is “E mālama a hoʻokāʻoi i ka moʻomeheu, kaiameaola kūlohelohe a me ka wai o kō Waikapu ahupuaʻa” or “To preserve and enhance the cultural, biological, and water resources of the Waikapū ahupuaʻa”. Hui Mālama o Waikapū is comprised of four Waikapū residents who have genealogical ties to the ahupuaʻa and have committed themselves to protecting the culturally and environmentally rich landscape through cultural practices. The members of Hui Mālama o Waikapū (HMOK) who are also lineal descendants conduct cultural practices on the leased parcel of land in addition to lands in and around the project area. These practices include gathering of seeds and cuttings of endemic plant cultivars for propagation and restoration of the leased native dryland forest owned by the

developer. They also gather native plants and material for traditional implements used during activities on the leased land such as loʻi kalo, Hawaiian food crop cultivation and lāʻau lapaʻau. In addition, the group has sought and received funding to initiate a natural and cultural resource management and education program in the leased area. Access and protection to this highly sensitive cultural sight is critical for both cultural practices and educational program implementation. Hui Mālama has brought over 1,000 students since their inception and continue to grow their educational programs to include formal partnerships with educational institutions on Maui. Currently the land owner provides access via an old plantation road leading up to the reservoir and access point to HMOW leased lands. The proposed project will continue to allow access to their lease lands for traditional and customary Hawaiian practices through a greenway or potential cultural reserve adjacent to the Waikapū Stream and near the opening of the valley on a trail below Reservoir #1. The founders and members of Hui Mālama o Waikapū and who are from the Waikapū ahupuaʻa, have extensive knowledge of the cultural sites and practices within and adjacent to the proposed development project. HMOK has recommended that a cultural preserve be established to ensure that all cultural sites, existing and future cultural practices within the developers land base be protected in perpetuity. These sites include kuleana lands with loʻi kalo terraces, ʻauwai systems, house sites, other cultural and archaeological features, and native plant species. Hui Mālama o Waikapū proposes to work alongside developer to ensure that there is a plan to mitigate any potential adverse impacts on these highly sensitive cultural lands.

Through the development of the CIA, two privately owned kuleana parcels of land were identified. They are called the "Mahi parcels". Both parcels are located directly in the middle of where the proposed urban lots were to be developed in the mauka section. These parcels are currently vacant and in the middle of a pasture used by the developer and neighboring land owner for grazing cattle. Lineal descendants of the Mahi family who now live on Oʻahu, were contacted through this process and expressed a deep interest in returning to their ancestral land someday along with a permanent access easement to their property. The developer for the project has been made aware of this and has since moved the urban lots and road away from the Mahi kuleana parcels. In addition to the Mahi family, are also the Kauihou family who have genealogical ties to Waikapū. Their kuleana lands are adjacent to the Waikapū Stream and along a flat joined by the proposed project. Access to both the Kauihou and Mahi parcels are through the proposed project area. Mitigation measures to ensure access by the developer has been taken to minimize any potential impacts. A permanent easement for these families is recommended to ensure that both Native Hawaiian families are able to exercise any traditional practices in the future.

Given the cultural-historical, archaeological and Hawaiian land tenure background presented above, combined with cultural/oral historical studies conducted during the CIA, it is the finding of the current analysis that there are specific valued cultural, historical and natural resources present and traditional and customary Native Hawaiian rights being exercised within the proposed Waikapū Country Town development. The Ka Paʻakai Cultural Analysis addresses specific mitigation measures to ensure that there are minimal to no adverse effects on any of the cultural practices identified within the CIA. It is further recommended that the Hawaiʻi Land Use Commission follow up with the applicant to ensure that Native Hawaiian rights and practices are preserved and that mitigation measures are formalized prior to securing their entitlements.

Reference Cited

Ashdown, Inez MacPhee
1971 *Ke Alaloa o Maui.* Kamaʻāina Historians, Wailuku.

Board of Commissioners
1929 *Indices of Awards Made by the Board of Commissioners to Quiet Land Titles in the Hawaiian Islands.* Commission of Public lands, Territory of Hawaii. Honolulu.

Brisbin, Joel, Alan E. Haun, and Peter M. Jensen
1991 *Data Recovery Excavations Waikapū Mauka Partners Golf Resort Project Area: Land of Waikapū, Wailuku District, Maui.* PHRI, Hilo.

Cordy, R.
2000 *Exhaulted Sits the Chief. The Ancient History of Hawai'i Island.* Mutual Publishing, Honolulu.

Creed, Victoria S.
1993 *Settlement Pattern For Waikapū, Wailuku, Maui.* Cultural Surveys Hawaiʻi, Honolulu.

Folk, William H. and Hallett H. Hammatt.
1989 *Archaeological Surveys of Māʻalaea, Waikapū, Maui.* Cultural Surveys Hawaiʻi, Honolulu.

Google Earth
2013 Data USGS, Geoeye, Image 2013 Digital Globe, Data S/O, NOAA, U.S. Navy, NGA, GEBCO.

Guerriero, Diane, Andre`e Conley-Kapoi, Lisa J. Rotunno-Hazuka and Jeffrey Pantaleo
2013 *Draft Archaeological Inventory Survey Report For Several Parcels of Land Situated Within Waikapū Ahupuaʻa; Wailuku District, Pūʻali Komohana Moku*. Archaeological Services Hawaiʻi LLC.

Handy, E.S.C.
1940 *The Hawaiian Planter, Volume I: His Plants, Methods, and Areas of Cultivation.* Bernice Pauahi Bishop Museum, Bulletin 161, Honolulu.

Handy, E.S.C., E.G. Handy and Mary Kawena Pukui
1972 *Native Planters in Hawai'i: Their Life, Lore, and Environment.* Bernice Pauahi Bishop Museum, Honolulu, Bulletin 233.

Kaualililehua, W.K.
1872 *No Waikapū.* Ka Nūpepa Kūʻokoʻa. September 21, 1872.

Kirch, Patrick
1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory.* Honolulu University of Hawaiʻi Press.

Oki, Delwyn S., Reuben H. Wolff, Jeff A. Perreault
2010 *Effects of Surface-Water Diversions on Streamflow, Recharge, Physical Habitat and Temperature, Nā Wai ʻEhā, Maui, Hawaiʻi.* U.S. Geological Survey, Virginia.

Pukui, Mary Kawena and Samuel H. Elbert
1986 *Hawaiian Dictionary (Revised and Enlarged Edition).* University of Hawaiʻi Press, Honolulu.

Pukui, Mary Kawena, Samuel H. Elbert and Esther T. Moʻokini
1974 *Place Names of Hawaiʻi.* University of Hawaiʻi Press, Honolulu.

Pukui, Mary Kawena
1983 *ʻŌlelo Noʻeau: Hawaiian Proverbs & Poetical Sayings.* Bishop Museum Press, Honolulu.

Silva, Alvin K.
1962 *Wailuku Sugar Centennial, November 1862-1962: A Century of Progress in Sugar Cane Cultivation.* Wailuku Sugar Company, Wailuku.

Sterling, Elspeth P.
1998 *Sites of Maui.* Bishop Museum Press, Honolulu.

Tengan, Dr. Kawika & Hōkūao Pellegrino
2005 *Cultural Impact Report on Nā Wai ʻEhā.* Office of Hawaiian Affairs, Honolulu.

Thrum, Thomas G.
1909-1918 *Maui's Heiaus and Heiau Sites Revised.* Thrum's Hawaiian Annual, Honolulu.

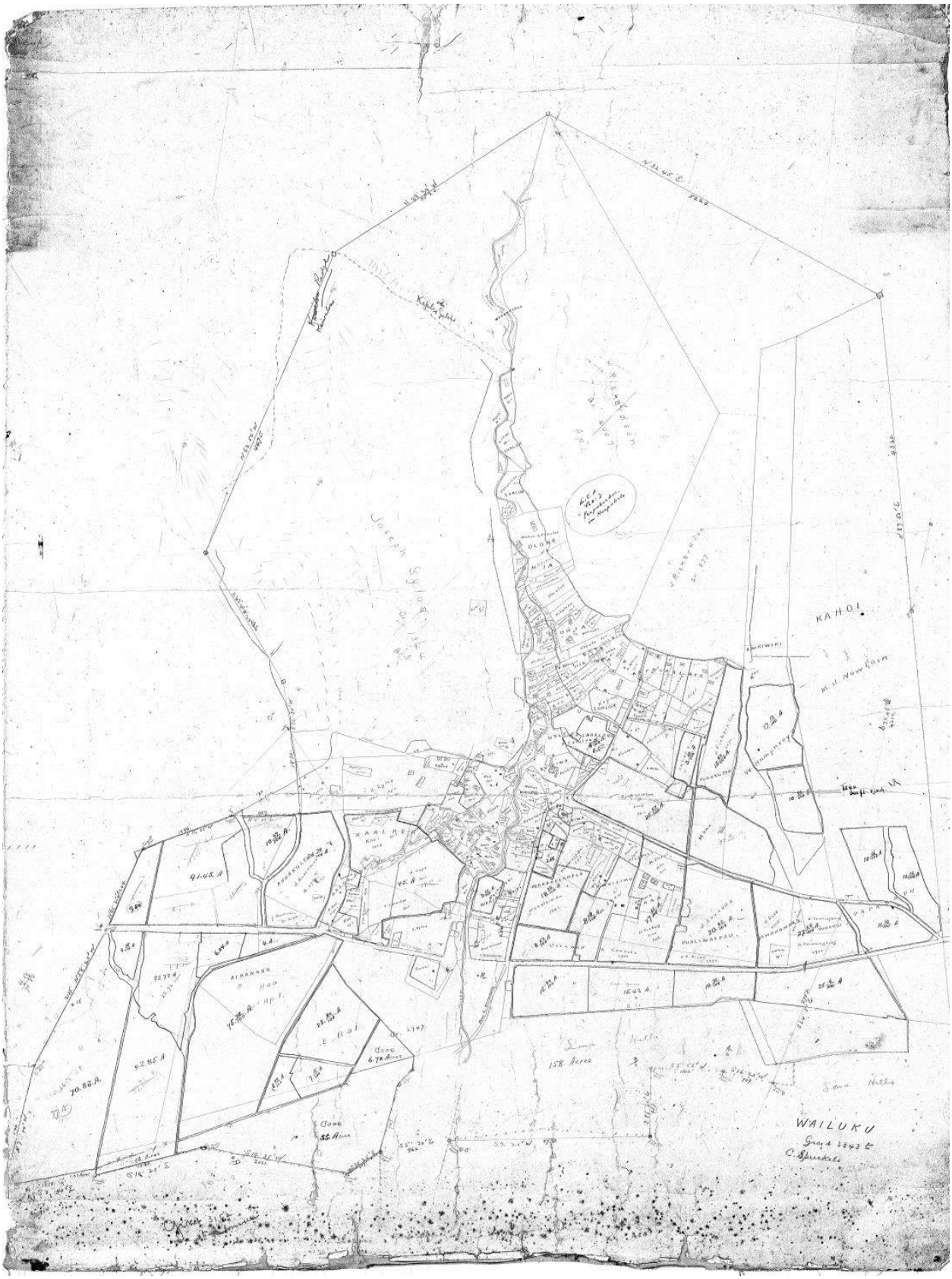


Figure 2. Copy of 1884 Map of Waikapū by M.D. Monsarrat, depicting extensive kuleana lands associated with LCAs and Government Grants.

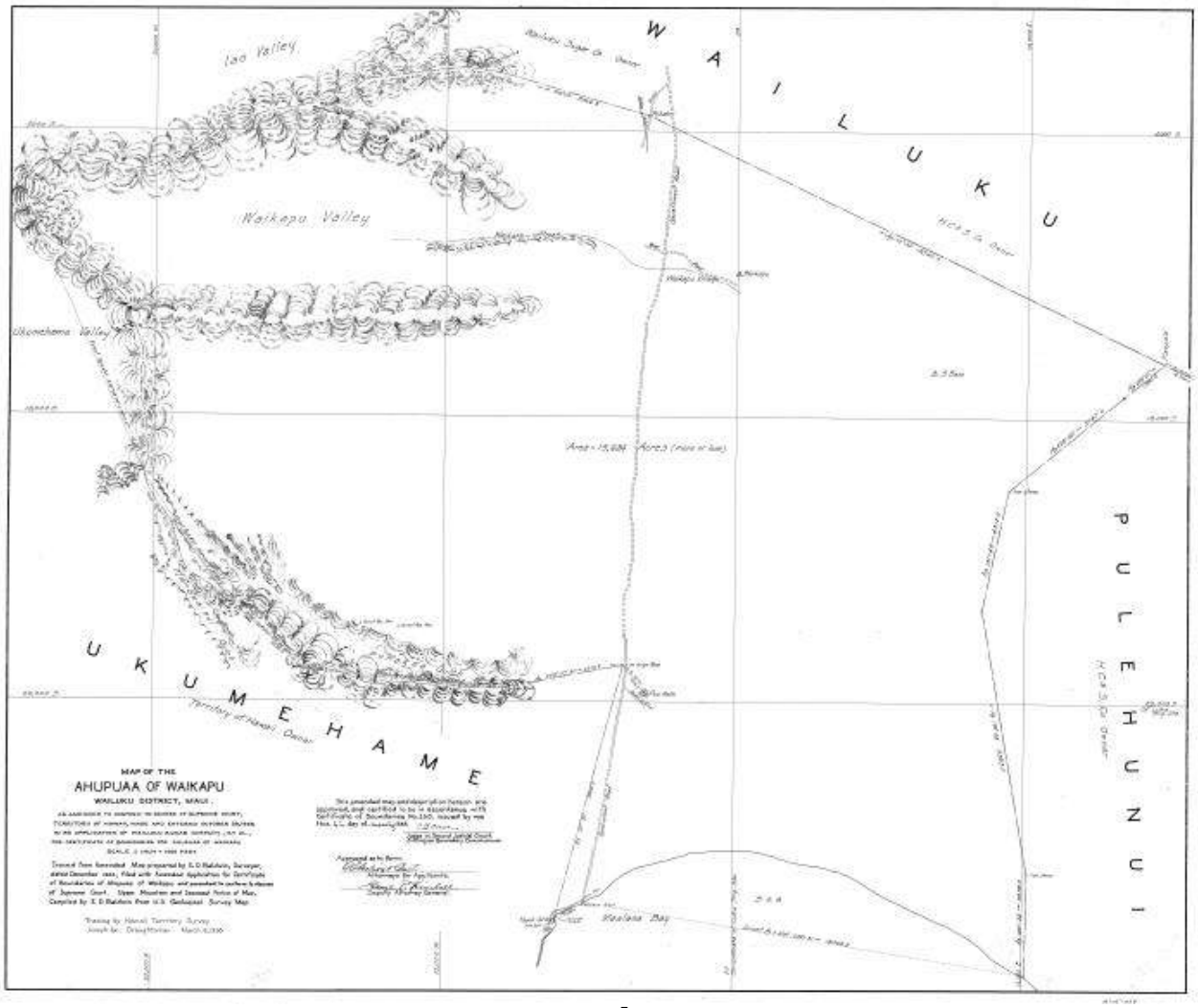


Figure 3. Copy of 1930 Map of Waikapū Ahupuaʻa Boundaries by Joseph ʻĪao.

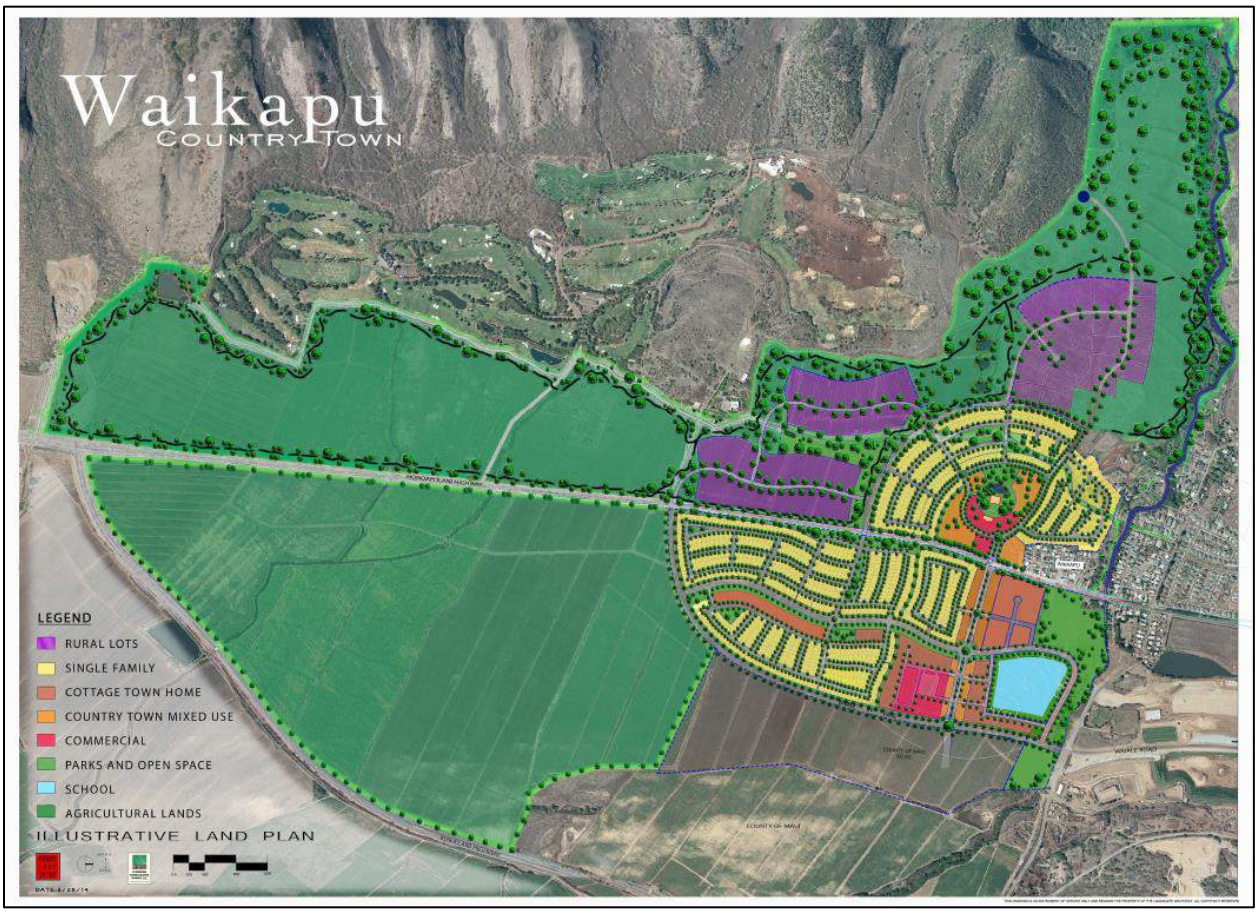


Figure 4. Waikapū Country Town Development Map and Key.

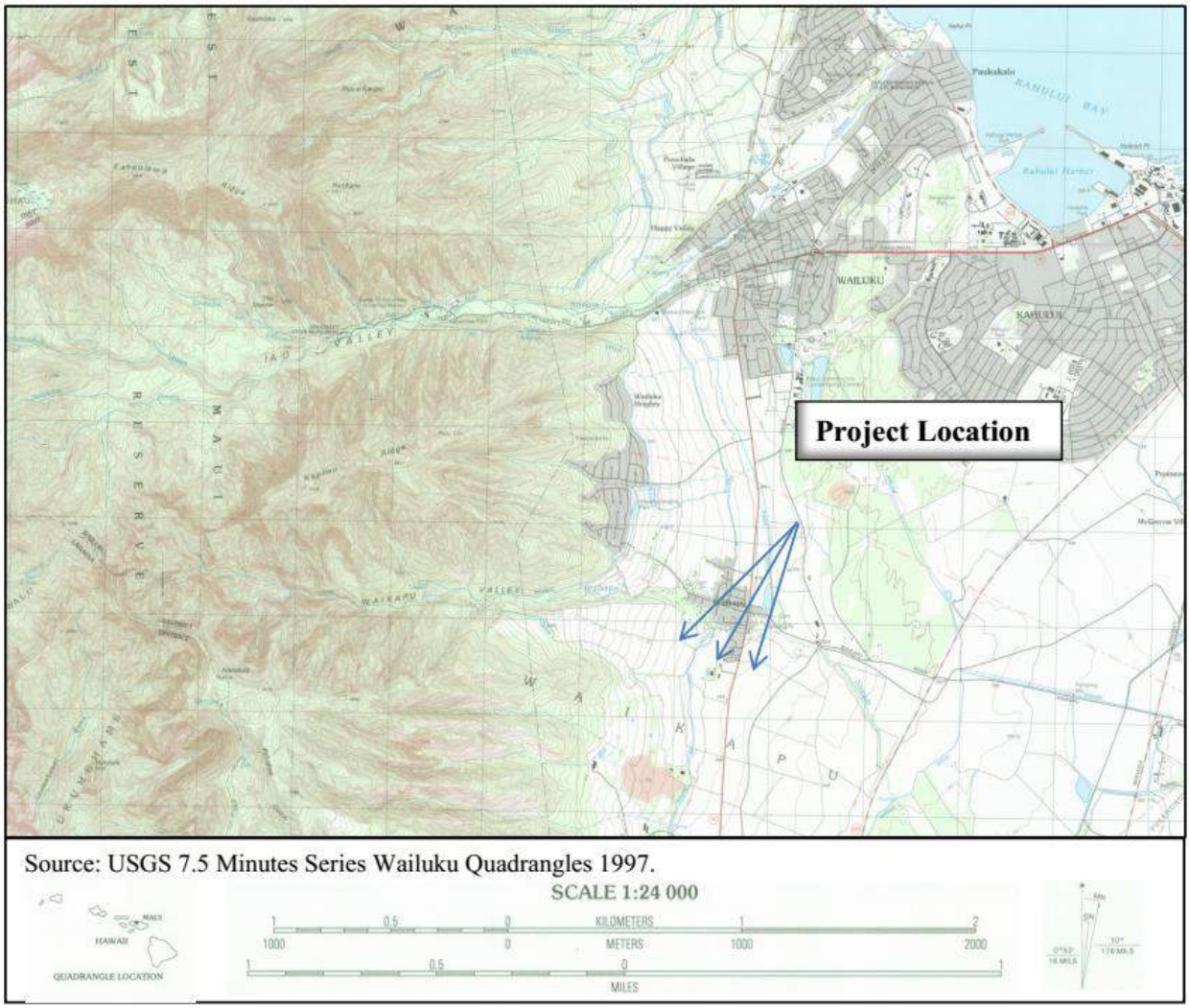


Figure 5. Project Location Map.

Awardee	ʻIli (Subdivision)	Land Commission Award	Royal Patent	ʻĀpana (Parcel)	Grant	Acres	Description of Cultural & Natural Resources via Native and Foreign Testimony and Survey Notes	Surveyor
Kupalii	Keana	3546	3151	2		1.2	- Kula - Kalo paukū - Kukui & wiliwili - Borders Waikapū Stream	E. Bailey 5-5-1852
Charles Copp	Papala	236-I	498	2		1.0 (est.)	- Loʻi kalo (unspecified amount) - Borders Waikapū Stream	Ioane (John) Richardson
Napailoi	Kaloaloa / Loaloa	10481	3131	4		0.66	- Loʻi kalo (unspecified amount) - Borders Waikapū Stream	E. Bailey 4-23-1852
Opunui	Loaloa	3224	4115	6		0.27	- Loʻi kalo (unspecified amount) - Borders Waikapū Stream	E. Bailey 6-25-1852
Keaka (W)	Olohe	3549	3122	3		1.0 (est.)	- 3 loʻi kalo - Borders Waikapū Stream	Unkown
Keaka (W)	Olohe				1511	0.2 (est.)	- Loʻi kalo (unspecified amount) - Borders Waikapū Stream	Unknown
Kupalii	Mokahelahela / Makaelelu	3546	3151	3		1.0	- 1 house lot	E. Bailey 5-5-1852
Kamakaipoaa / Kamakaipuaa	Kamauhalii	6385	None	2		1.94	- Loʻi (unspecified amount) - Borders Waikapū Stream	E. Bailey 4-15-1852
Nahau	Olohe	3340	3115	2		0.8	- Moʻo kula - 1 house lot - ʻAuwai watercourse	E. Bailey 4-11-1852
Joseph Sylva	Waihalulu			3	1844	487.0	- ʻAuwai watercourse - Pens - Stone walls - Native claims retained - Gulch	E. Bailey 4-10-1855
Joseph Sylva	Waihalulu			2	1844	9.52	- Stone walls - Multiple house lot	E. Bailey 4-10-1855
Joseph Sylva	Waihalulu & Paalae			1	1844	22.36	- Native claims retained	E. Bailey 4-10-1855
Napailoi	Waihalulu	10481	3131	2&3		1.3	- 8 loʻi kalo - Kula - 1 house lot	E. Bailey 4-23-1852
Napailoi	Paalae	10481	3131	1:1		0.54	- Kalo paukū - Kula - ʻAuwai watercourse	E. Bailey 4-23-1852
Napailoi	Paalae	10481	3131	1:2		0.19	- Kalo paukū - Kula	E. Bailey 4-23-1852
Napailoi	Paalae	10481	3131	1:3		0.1	- Kalo paukū - Kula	E. Bailey 4-23-1852
Hakiki	Waihalulu	2577	4948	4		0.2	- 4 loʻi kalo - ʻAuwai watercourse	E. Bailey 8-14-1852
Kaeha	Olohe	2394	3138	1		1.36	- Kalo paukū - Pūhala - 2 house lots - ʻAuwai watercourse	E. Bailey 6-21-1852
Nalei	Olohe	10460	None	2		0.07	- 2 loʻi kalo - ʻAuwai watercourse	E. Bailey 4-16-1852
Ehunui	Olohe			1513		0.07 (est.)	- Unknown	Unknown
Ehunui	Olohe	2499	4070	1		0.8	- Kalo paukū - Poʻalima - ʻAuwai watercourse	E. Bailey 6-25-1852
Ehunui	Pikoku	2499	4070	3		1.3	- 7 loʻi kalo - ʻAuwai watercourse	E. Bailey 6-25-1852

Awardee	ʻIli (Subdivision)	Land Commission Award	Royal Patent	ʻĀpana (Parcel)	Grant	Acres	Description of Cultural & Natural Resources via Native and Foreign Testimony and Survey Notes	Surveyor
Kamaipuaa / Kamakaipoaa / Kamakaipuaa	Pikoku	6385	None	1		0.17	- Kalo paukū	E. Bailey 4-15-1852
Koa	Pikoku	3528	3155	1		3.90	- 2 house lots - Kalo paukū - Kula - ʻAuwai watercourse	E. Bailey 8-27-1852
Koa	Pikoku				1708	0.1 (est.)	- 1 loʻi kalo - ʻAuwai watercourse **- 2 burial plots (Maxwell)**	E. Bailey 9-9-1854
Hakiki	Olohe	2577	4948	2		0.25	- 7 loʻi kalo	E. Bailey 8-14-1852
Mohomoho	Kamauhalii			1	1711	0.08	- 1 loʻi kalo	E. Bailey 9-8-1854
Mohomoho	Kamauhalii			2	1711	0.04	- 1 loʻi kalo	E. Bailey 9-8-1854
Ihu	Kamauhalii			1	1712	0.09	- 1 loʻi kalo	E. Bailey 9-15-1854
Opunui	Kamauhalii				1704	1.94	- Unkown	E. Bailey 9-9-1854
Mataio	Kamauhalii	3020	3140	2		2.65	- Kalo paukū - Kula - House lot	E. Bailey 4-15-1852
Keawe (W)	Punia	3520	3135			2.54	- 2 kalo paukū - Kula	E. Bailey 4-15-1852
Makuakane	Punia	2522	3125			1.83	- Kalo paukū	Unknown
Kekua	Kamauhalii	5551	3150	1		0.42	- Kalo paukū	E. Bailey 6-25-1852
Kekua	Kaalaea	5551	3150	2		0.1	- 2 loʻi kalo	E. Bailey 6-25-1852
Kekua	Kamauhalii				1518	0.15 (est.)	- Unknown	Unknown
Kamohai	Kaalaea	3527	3156	3		0.2	- Kalo paukū - Kula moʻo	E. Bailey 8-18-1852
Naanaa	Punia	3337	3136	1,2,3		1.1	- Kalo paukū - Loʻi kalo - House lot	E. Bailey 4-14-1852
Ihu	Kaalaea			2	1712	0.07	- 1 loʻi kalo	E. Bailey 9-15-1854
Kaai	Kaalaea			2	2069	0.18	- Unknown	Unknown
Opunui	Kaalaea	3224	4115	5		0.32	- Kula	E. Bailey 6-25-13
Naanaa	Kaalaea	3337	3136	4		0.45	- Kalo paukū	E. Bailey 4-14-1852
Poepoe	Kaalaea	2609	3124	1,5		0.98	- Kalo paukū - ʻUala kula - House lot	E. Bailey 8-27-1852
Kaai	Kaalaea	5774	4014	2		2.76	- 6 loʻi kalo -ʻAuwai watercourse	E. Bailey 3-?-1852
Kaai	Kaalaea			1	2069	10.46	- Unknown	Unknown
Wahinealii	Kaalaea	11022	3142	8		0.6	- House lot	E. Bailey 4-15-1852
Mahoe	Ahuakolea	10160	3148	1		1.99	- Kalo paukū	E. Bailey 4-16-1852
Kamohai	Kaalaea	3527	3156	2		0.2	- Kalo paukū	E. Bailey 8-18-1852
Keakini	Kaalaea	5324	6374	3		0.56	- 1 loʻi kalo	E. Bailey 4-24-1852
Kaneae	Kaloapelu	8874	3130	1		0.29	- Loʻi kalo	E. Bailey 8-26-1852

Awardee	ʻIli (Subdivision)	Land Commission Award	Royal Patent	ʻĀpana (Parcel)	Grant	Acres	Description of Cultural & Natural Resources via Native and Foreign Testimony and Survey Notes	Surveyor
Haawahine	Kaloapelu	491	3139	2		0.2	- 1 loʻi kalo	Unknown
Kamohai	Kaloapelu	3527	3156	1		0.25	- Loʻi kalo - Kula moʻo	E. Bailey 8-18-1852
Mahuka	Kaloapelu	462	None	1		0.29	- 6 loʻi kalo	E. Bailey 2-11-1853
Haawahine	Kaloapelu	491	3139	1		0.2	- 4 loʻi kalo	E. Bailey 8-?-1852
Kaneae	Kaloapelu	8874	3130	2		0.87	- Loʻi kalo	E. Bailey 8-26-1852
Haawahine	Kaloapelu	491	3139	3		0.13	- 2 loʻi kalo	E. Bailey 8-?-1852
Eugene Bal	Kaloapelu			1	2747	0.72	- Unknown	E. Bailey 3-12-1861
Charles Copp	Luapuaa	236	498	1		16.5	- Unknown	E. Bailey ?
John Crowder	Koʻolau	416	41	1		7.4 (est.)	- ʻAuwai watercourse	J. Richardson 2-2-1847
John Crowder	Aikanaha	416	41	2		1.5 (est.)	- House lot	J. Richardson 2-2-1847
John Crowder	Aikanaha				2904	0.57	- House lot	E. Bailey 6-6-1861
E.W. Gleason	Aikanaha				1674	1.8	- Dry loʻi kalo	E. Bailey 7-20-1853
Haa	Aikanaha	455	324	2		1.8	- Sugar cane	J. Richardson 3-11-1850
Kaai	Kaloapelu	5774	4014	4		9.9	- Loʻi kalo - Kula	E. Bailey 3-?-1852
Kaneae	Kaloapelu	8874	3130	3		0.8	- Loʻi kalo	E. Bailey 8-26-1852
Mahuka	Kaloapelu	462	None	2		0.09	- 5 loʻi kalo	E. Bailey 2-11-1853
Keakini	Kaloapelu	5324	6374	2		1.82	- 3 loʻi kalo - Kula - House lot	E. Bailey 4-24-1852
Eugene Bal	Kaloapelu				2342	2.73	- 2 house lots	E. Bailey 2-23-1857
John Boardman	Ahuakolea				2960	23.5	- Reservoir - Stone Walls	E. Bailey
John Boardman	Ahuakolea				3043	4.5	- Reserved rights of natives	Unknown
Henry Cornwell	Unknown				3152	1,200 (est.)	- Board of Education lands - Reserved rights of natives	Unknown
Haa	Aikanaha	455	324	1		33.2	- Sugar cane	J. Richardson 3-11-1850
Eugene Bal	Aikanaha			2	2747	129.8 (port.)	- Potential house lots **- Burial sites**	
Poonui	Kaumuilio	411	None			3.53	- Loʻi kalo - House lot	Unkown

Figure 6. Indices of Māhele Awards and Descriptions Associated with Waikapū Country Town Development by Hōkūao Pellegrino

APPENDIX G

Agricultural Impact Assessment

Waikapu Country Town

Agricultural Impact Assessment

Prepared for:
Mr. Michael Atherton
Waikapu Properties, LLC
P.O. Box 1870
Manteca, CA 95336

Prepared by:
Planning Consultants Hawaii, LLC.
Urban and Regional Planning
2331 W. Main Street
Wailuku, Hawaii 96793
Phone: (808) 244-6231
email: msummers@planningconsultantshawaii.com

PLANNING
CONSULTANTS
HAWAII, LLC

July, 2013

Table of Contents

I. EXECUTIVE SUMMARY 1

A. WAIKAPU COUNTRY TOWN MASTER PLAN 1
B. PURPOSE AND SCOPE OF THE AGRICULTURAL IMPACT ASSESSMENT 1
C. STATUS OF HAWAII'S AGRICULTURAL INDUSTRY 2
D. STATE AND COUNTY AGRICULTURAL LANDS 3
E. IMPACT OF DEVELOPING THE PROJECT 3
F. CONSISTENCY WITH STATE AND COUNTY AGRICULTURAL POLICIES 5

II. INTRODUCTION 7

A. BACKGROUND 7
B. THE WAIKAPU COUNTRY TOWN MASTER PLAN 11
C. PURPOSE AND SCOPE OF THE AGRICULTURAL IMPACT ASSESSMENT 20

III. HAWAII'S AGRICULTURAL INDUSTRY 23

A. ECONOMIC SIGNIFICANCE TO THE ECONOMY 23
B. MARKET COMPOSITION 24
C. MARKET SHARE 28
D. INDUSTRY CHALLENGES AND OPPORTUNITIES 32
E. CONCLUSIONS 43

IV. STATE AND COUNTY AGRICULTURAL LANDS 46

A. STATE OF HAWAII 46
B. CURRENT AVAILABILITY OF STATE AGRICULTURAL LANDS 47
C. COUNTY OF MAUI 48
D. AVAILABILITY OF AGRICULTURAL LANDS ON MAUI 50
E. CONCLUSIONS 54

V. AGRICULTURAL IMPACT OF THE PROPOSED PROJECT 56

A. WAIKAPU COUNTRY TOWN'S EXISTING AGRICULTURAL RESOURCES 56
B. PRIOR AGRICULTURAL USE 64
C. CURRENT AGRICULTURAL USE 65
D. IMPACT OF THE PROJECT ON AGRICULTURE 67
E. CONCLUSIONS 71

VI. CONSISTENCY WITH STATE AND COUNTY AGRICULTURAL POLICIES 73

A. STATE AGRICULTURAL LAND USE POLICY 73
B. COUNTY AGRICULTURAL LAND USE POLICY 76

REFERENCES 84

LIST OF FIGURES

Figure 1a: Maui Island Plan Directed Growth Map 9
Figure 1b: Maui Island Plan Wailuku / Kahului Planned Growth Areas 10
Figure 2: Regional Location Map 13

Figure 3: Aerial Location Map 14

Figure 4 a-d: TMK Maps 15

Figure 5: State Land Use Designation 19

Figure 6: Conceptual Land Plan 21

Figure 7: Value of Hawaii's Agricultural Production between 1964 and 2003 25

Figure 8: Relative Value of Hawaii's Major Agricultural Crops from 1960 to 2003 25

Figure 9: Value of 2010 Crop Sales (in thousands) 26

Figure 10: Value of Hawaii's Major Crops between 1985 and 2010 (in thousands) 27

Figure 11: Value of Hawaii's Crop Sales between 1995 and 2010 (in thousands) 27

Table 1: 2005 Market Share for Hawaii Agricultural Products 28

Figure 12: Hawaii Market Share in U.S. Mainland Market for Select Products (in thousands 30

Table 2: Japanese Market Sales between 1995 and 2008 of Select Hawaii Products 31

Figure 13: Cost per Acre of Agricultural Land in Hawaii and the U.S. Mainland 34

Figure 14: Cost per Acre to Rent Agricultural Land in Hawaii and the U.S. Mainland 35

Figure 14: 35

Table 3: Value of Consumption and Production of Select Agricultural Products in Hawaii (in thousands) 36

Figure 15: Hawaii Crop Sales between 1995 and 2010 (in thousands) 37

Figure 16: Value of Hawaii's Seed Crop Sales between 2000 and 2010 (in thousands) 39

Table 4: HCEI Renewable Fuel Goals for 2015 41

Table 6: Hawaii's Important Agricultural Lands by Rating System 47

Table 8: Hawaii's Important Agricultural Lands by Rating System 49

Table 9: Maui Island's LSB Designated Agricultural Lands 49

Table 10: Acreage in Crop in Maui County between 1987 and 2010 51

Figure 17a: Waikapu Country Town LSB Ratings 56

Figure 17b: Waikapu Country Town LSB Map 57

Figure 18a: Waikapu Country Town ALISH Ratings 58

Figure 18b: Waikapu Country Town ALISH Map 59

Figure No.19: Soils Map 61

LIST OF TABLES

Table 1: 2005 Market Share for Hawaii Agricultural Products **28**

Table 2: Japanese Market Sales between 1995 and 2008 of Select Hawaii Products **31**

Table 3: Value of Consumption and Production of Select Agricultural Products in Hawaii (in thousands) **36**

Table 4: HCEI Renewable Fuel Goals for 2015 **41**

Table 5: HCEI Renewable Fuels Goal for 2020 **42**

Table 6: Hawaii's Important Agricultural Lands by Rating System **47**

Table 7: Acreage in Crop in Hawaii between 1960 and 2010 **48**

Table 8: Hawaii's Important Agricultural Lands by Rating System **49**

Table 9: Maui Island's LSB Designated Agricultural Lands **49**

Table 10: Acreage in Crop in Maui County between 1987 and 2010 **51**

Table 11: Waikapu Country Town Soil Types **60**

I. EXECUTIVE SUMMARY

A. WAIKAPU COUNTRY TOWN MASTER PLAN

The proposed Waikapu Country Town (WCT) is situated in Central Maui, just south of the small plantation community of Waikapu, at the Maui Tropical Plantation (MTP).

The project area encompasses approximately 59 acres of State Urban District lands and 1,517 acres of State Agricultural District lands (**See**: Figure No. 5, "State Land Use Designation"). The existing MTP retail shops, restaurant, convention hall, tropical gardens and lagoon are on the urban designated lands. Approximately 443 acres are proposed to be re-designated from the State Agricultural District to the State Urban and Rural Districts.

WCT will be a "complete community," encompassing a mixture of rural, single- and multi-family residential units, commercial, and civic uses. In accordance with the Maui Island Plan (MIP), WCT includes 1,433 residential units together with neighborhood retail, commercial, a school, parks and open space. The town will be bound by agricultural lands that will be preserved in perpetuity through a conservation easement. WCT will be built both mauka and makai of Honoapiilani Highway. Access to the project will be from Honoapiilani Highway and the proposed Waiale Bypass road.

B. PURPOSE AND SCOPE OF THE AGRICULTURAL IMPACT ASSESSMENT

The Agricultural Impact Assessment (AIA) will assess the long-term impact of the project on the State and County's Agricultural industry.

The scope of the study includes the following tasks:

- Assessment of the current status of Hawaii's agricultural industry;
- Assessment of the current availability of agricultural lands;
- Analysis of existing agronomic conditions within the project site;
- Description of the recent agricultural history of the property;
- Assessment of the impact of the project on current agricultural operations; and
- Analysis of the project's consistency with State and County agricultural policies.

C. STATUS OF HAWAII'S AGRICULTURAL INDUSTRY

While agriculture, predominantly sugar and pineapple, dominated Hawaii's economy from the late 1800s through the 1950s, its overall significance has declined dramatically since the advent of mass market tourism. In 1927, sugar alone created 56,600 jobs, whereas in 2011 the entire agricultural industry employed just 6,900 workers.[i] In 2011, agriculture employed 1,600 Maui County workers, which was 2.4% of the 67,200 wage and salary jobs in the County .[ii]

Hawaii farmers face stiff competition in local, national, and international markets. In the local market, off-shore suppliers dominate the market for most fresh fruits, vegetables, dairy, meat, and poultry products. It has been estimated that 85% of all food consumed in Hawaii statewide is imported.

In the U.S. Mainland market, Hawaii growers have sustained the value of their sales in recent years, but have lost significant export value in sales to Japan. Significant impediments to agricultural development in Hawaii include high labor costs, high transportation costs, high energy costs and high land costs.

Despite major challenges, Hawaii's growers are competitive in many niche products and opportunities are available. Because 85% of food consumed in Hawaii is imported, a significant

market exists for farmers who can find creative ways to displace imports. Moreover, Hawaii's seed crop industry has demonstrated that Hawaii agriculture can have significant comparative advantage in some sectors. Substituting locally grown biofuels for imported petroleum may also provide opportunities for Hawaii farmers over the coming decades.

D. STATE AND COUNTY AGRICULTURAL LANDS

Since 1960, there has been a release of approximately 316,590 acres from crop farming, primarily sugar and pineapple.[iii] While some of these lands have been absorbed by urban development and other agricultural uses, much is fallow and available on Oahu, Maui, Molokai, Lanai and Kauai.

The County of Maui has approximately 402,354 acres within the State Agricultural District. Of these lands, approximately 244,088 acres, or 61%, is located on Maui.[iv] Using the LSB rating system, Maui alone has approximately 82,592 acres that are classified "A", "B", or "C".[v] Since 1960, there has been a release of approximately 64,150 acres from crop farming, primarily sugar and pineapple, within the County.[vi] While some of these lands have been absorbed by urban development and other agricultural uses, much is fallow and available on the islands of Maui, Molokai, and Lanai.

Although there is an abundant supply of productive agricultural land, access to affordable agricultural lots offering long-term tenure remains an impediment to agricultural development in Hawaii. The current shortage of available State and County agricultural park lots is symptomatic of this issue.

E. IMPACT OF DEVELOPING THE PROJECT

The Waikapu Country Town, including its adjoining agricultural lands, comprises approximately 1,675 acres, 50 acres of which are within the State Urban District. Approximately 92% of WCT agricultural lands, or 1,495 acres, are rated "A" or "B" by the Land Study Bureau (LSB).

According to the Agricultural Lands of Importance to the State of Hawaii (ALISH) rating system, 97%, or 1,576 acres, is "Prime" agricultural land.

The project will result in the urbanization of approximately 450 acres of prime agricultural land. This represents a very small percentage of agricultural lands statewide and on Maui. There are approximately 2 million acres in the State Agricultural District. The subject development represents just .022% of this area. On Maui, there are approximately 82,582 acres of agricultural lands rated by the LSB as A, B, or C. The subject development represents just 0.54% of these lands. Within Maui County, approximately 64,150 acres has been released from crop production since 1987. The subject development represents just 0.7% of these lands. The MTP's agricultural component includes nearly 1,100 acres of land that will remain in agricultural use. Of these lands, approximately 800 acres will be permanently dedicated to agricultural use with no residential structures to be permitted. Several hundred acres of MTP's agricultural lands may be developed as a private agricultural park to help facilitate Maui's agricultural development.

There are currently three commercial farms farming MTP lands. These include Kumu Farms, Hawaii Taro LLC, and HC&S. The proposed urbanization will require both Kumu Farms and Hawaii Taro LLC to relocate their agricultural operations to the land owners' proposed agricultural park, which will be located on lands to be preserved in perpetuity by the land owner for agricultural use. The project will also impact a portion of the current lands being leased by HC&S. It is anticipated that these lands will gradually begin to be impacted in about five to ten years. Over the long-term, HC&S may lose approximately 330 acres to urbanization and up to an additional 75 acres to a private agricultural park. According to HC&S General Manager, Mr. Rick Volner, HC&S would desire to continue farming its MTP lands to maximize its current economy of scale in production. However, Mr. Volner acknowledged that HC&S has additional lands available that are currently fallow and that urbanization of a portion of its MTP leased lands will not significantly impact the Plantation's long-term economic viability.

A significant impediment to agricultural development on Maui, and throughout the state, is the scarcity of agricultural land that is both readily available and affordable for long-term lease to diversified farmers. The establishment of a centrally located agricultural park, with productive lands and affordable irrigation water, should help Maui farmers compete in local, mainland and international markets.

F. CONSISTENCY WITH STATE AND COUNTY AGRICULTURAL POLICIES

The Hawaii State Plan and State Functional Plans establish policy to protect the viability of the sugar and pineapple industries, protect agriculturally suitable lands for future agricultural needs, and promote the growth of diversified agriculture.

The Maui County General Plan (County-wide Policy Plan, Maui Island Plan, and Wailuku-Kahului Community Plan) seek to preserve productive agricultural lands and facilitate agricultural self-sufficiency in food production. The plans also recognize the need to provide sufficient land areas to accommodate future population growth. Goal 7.1.1.f of the Maui Island Plan (MIP) states, "*Strongly discourage the conversion of productive and important agricultural lands (such as sugar, pineapple, and other produce lands) to rural or urban use, unless justified during the General Plan update, or when other overriding factors are present*."

The subject land was placed into an Urban Growth Boundary during the General Plan update, when other overriding factors were present. These factors included the land's development suitability, as well as its proximity to existing employment, infrastructure, public facility systems and existing urban development. Moreover, as documented in this report, the urbanization of the subject lands will not significantly impact the future viability of the sugar or pineapple industries or the growth of diversified agriculture.

The proposed action has been carefully analyzed for its short- and long-term impacts upon the agricultural industry. While the proposed action will result in the loss of prime agricultural lands, it will not significantly impact the short- or long-term viability of agriculture in Hawaii since an abundance of currently fallow land remains available. The project will, however, help to address the current shortage of agricultural park lots by establishing a new park within Central Maui.

The project represents a carefully considered approach to land development that balances the need for urbanization with the desire to protect agricultural lands and other important natural and environmental resources. This approach is consistent with the spirit of existing State and County policies to protect agricultural lands.

II. INTRODUCTION

A. BACKGROUND

In December, 2012, the County of Maui adopted the Maui Island Plan (MIP). The MIP establishes goals, objectives, policies and actions to direct growth and development on Maui through the year 2030. The MIP was based upon a comprehensive analysis of population growth, economic conditions, development capacity of existing entitled lands, and extensive community outreach.

To guide development of future urban lands, the MIP sets forth policies requiring higher urban densities, a greater balance between single- and multi-family housing types, mixed-use development, vehicular and pedestrian connectivity between land uses, and the incorporation of parks, schools, open space and affordable housing into future developments.

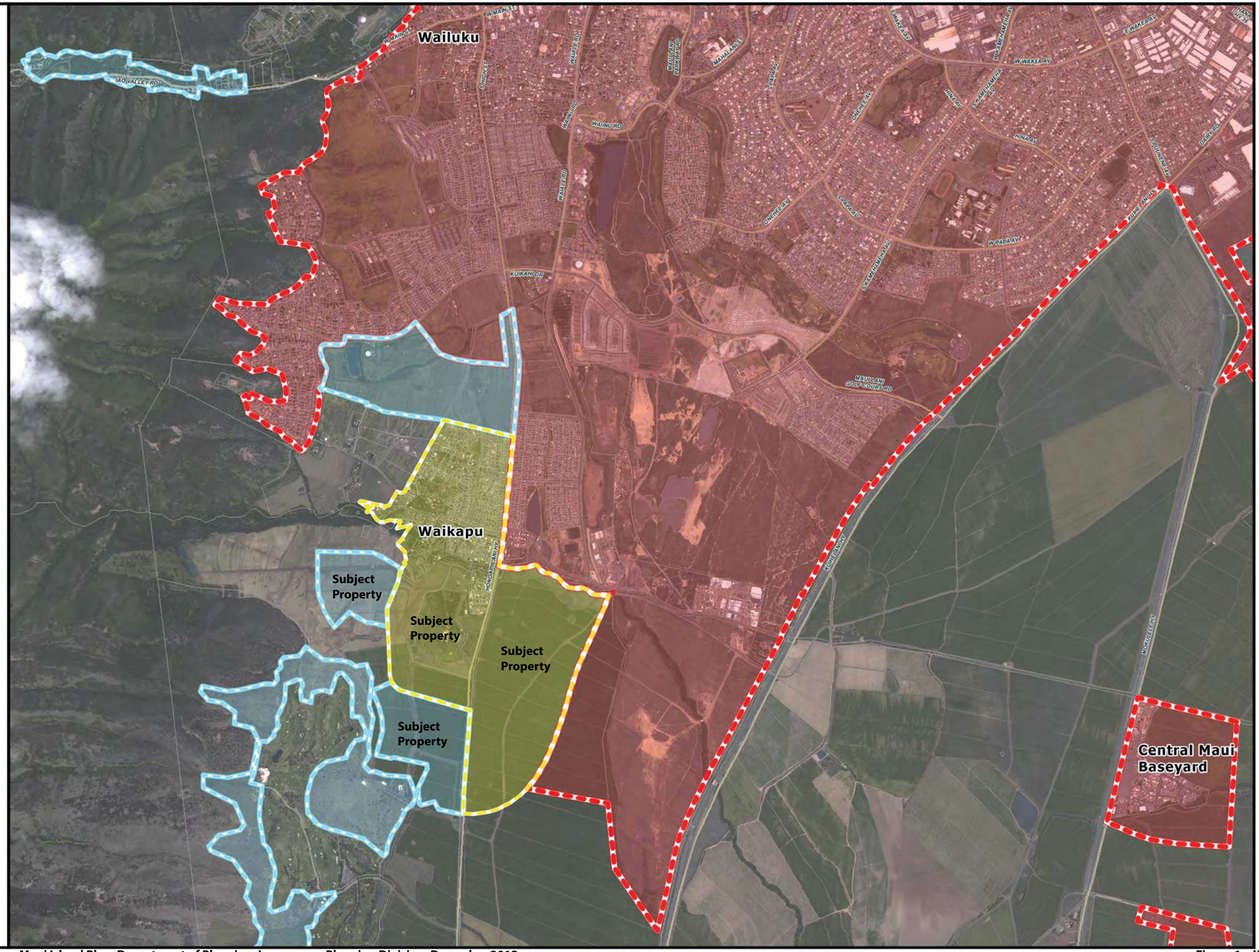
The MIP's Directed Growth Plan places approximately 502 acres of Waikapu Country Town's (WCT's) 1,576 acres into urban and rural growth boundaries. The remaining 1,074 acres are to remain within the State's Agricultural District. Of these lands, approximately 800 acres will be preserved in perpetuity for agricultural use through a conservation easement, and the remaining 274 acres will be kept in large agricultural lots (**See**: Figure No. 1a-b, "Maui Island Plan Map Directed Growth Map" and "Maui Island Plan Wailuku/Kahului Planned Growth Areas").

The MIP describes the purpose and intent of the Waikapu Country Town "Planned Growth Area" as follows:

> *The Waikapu Tropical Plantation Town planned growth area is situated in the vicinity of the Maui Tropical Plantation, and includes lands on both the mauka and makai sides of Honoapi'ilani Highway. Providing the urban character of a traditional small town, this area will have a mix of single-family and*

multifamily rural residences, park land, open space, commercial uses, and an elementary or intermediate school developed in coordination with the Wai'ale

Maui Island - Directed Growth Map C3



Maui Island Plan Directed Growth Map

Waikapu / Kahului

C3

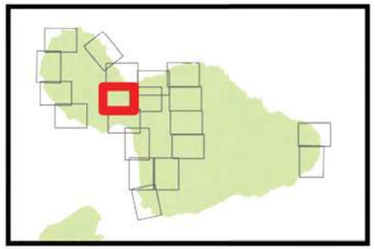
Legend

Growth Boundaries

- Urban
- Small Town
- Rural

Reference

- 2011 Parcels
- Primary Roads



Feet

0 500 1,000 2,000 3,000 4,000

Product Code: M-CET_20121210-D2

Copyright © December 10, 2012

Background Image: Worldview 2 - 2010

This is not a zoning map. Please contact the Planning Department for Zoning confirmation.

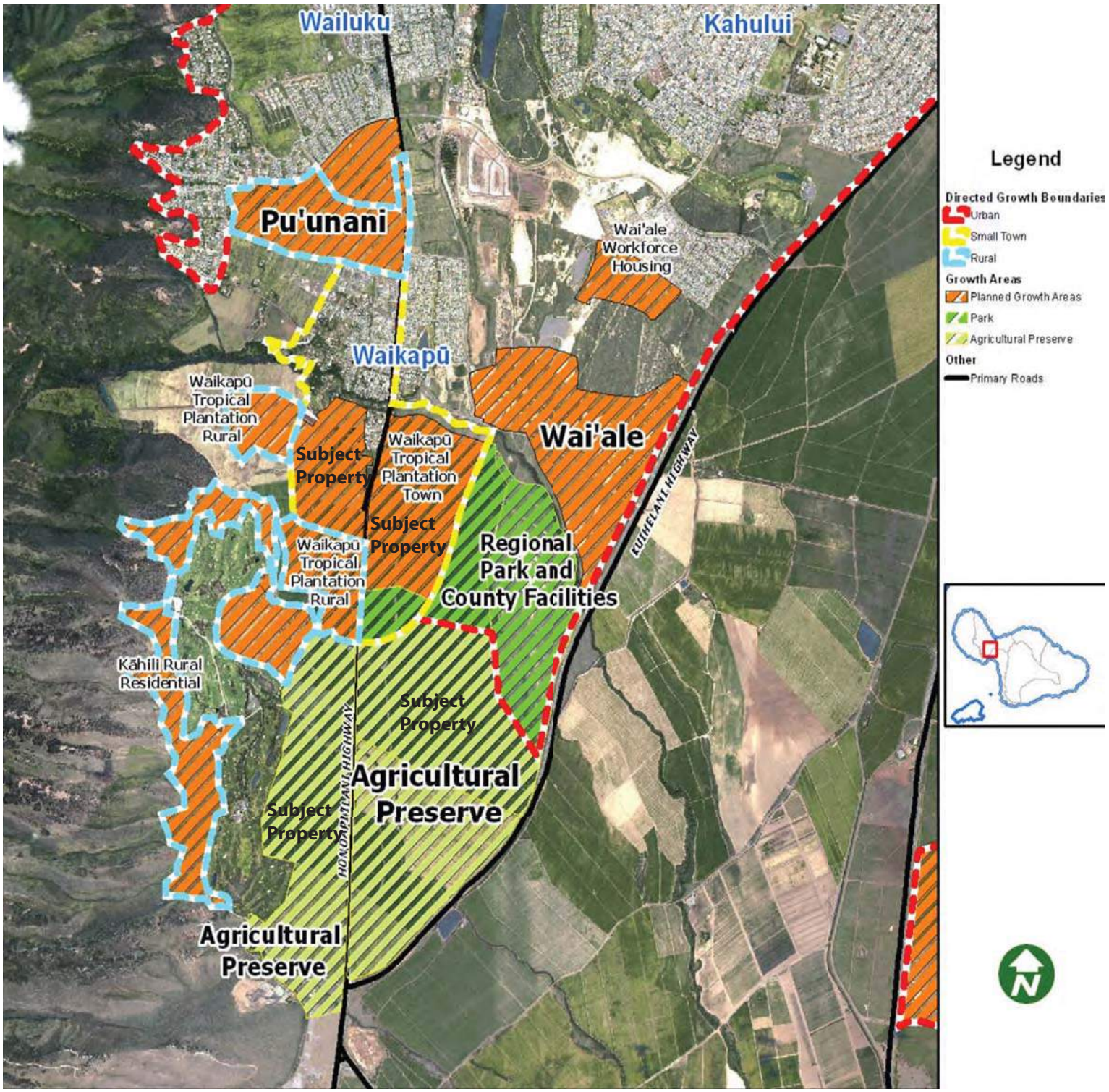
PREPARED BY:

Long Range Planning Division
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793

County of Maui

Source: Maui Island Plan, Department of Planning, Long-range Planning Division, December 2012

Figure 1a, Waikapu / Kahului Directed Growth Map



Source: Maui Island Plan, Department of Planning, Long-range Planning Division, December 2012

Figure 1b

Maui Island Plan
Wailuku-Kahului Planning Growth Areas

Not to Scale

WAIKAPU COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

project. The area is located south of Waikapu along Honoapi'ilani Highway, and it will incorporate the integrated agricultural and commercial uses of the existing tropical plantation complex. This area is proximate to the Wai'ale planned growth area, providing additional housing in central Maui within the Wailuku-Kahului Community plan region. As part of this project, parcels to the south of the project (identified as Agricultural Preserve on Figure 8-1) shall be protected in perpetuity for agricultural use through a conservation easement. A portion of this area may be dedicated to the County as an agricultural park administered pursuant to County regulations. Alternatively, this area can be developed as a private agricultural park available to Maui farmers, and executed through a unilateral agreement between the landowner and Maui County. The rural lots mauka of Honoapi'ilani Highway are intended to be developed using a CSD plan. The CSD plan shall provide access to uninterrupted walking and bicycling trails and will preserve mauka and makai views while protecting environmentally sensitive lands both along Waikapu stream and mauka of the subdivision.

Planned Growth Area Rationale:

Keeping the Waikapu Tropical Plantation as its town core, this area will become a self-sufficient small town with a mix of single-family and multifamily housing units in a walkable community that includes affordable housing in close proximity to Wailuku's employment centers. Schools, parks, police and fire facilities, transit infrastructure, wastewater, water supply resources, and other infrastructure should be developed efficiently, in coordination with neighboring developments including Maui Lani, Kehalani, Pu'unani and Wai'ale. The Waikapu Tropical Plantation Town planned growth area is located on Directed Growth Map #C3 . [vii]

B. THE WAIKAPU COUNTRY TOWN MASTER PLAN

The proposed Waikapu Country Town (WCT) is situated in Central Maui, just south of the small plantation community of Waikapu, at the Maui Tropical Plantation (MTP). The property is identified as TMK Nos. (2) 3-6-5:007; 3-6-002:001 and 003; 3-6-004:003 and 006; and 3-6-

006:036 (**See**: Figure Nos. 2, 3, and 4a-d, ("Regional Location Map", "Aerial Location Map", and "TMK Maps"). The project area encompasses approximately 59 acres of State Urban District lands and 1,517 acres of State Agricultural District lands (**See**: Figure No. 5, "State Land Use Designation"). The existing MTP retail shops, restaurant, convention hall, tropical gardens and lagoon are on the urban designated lands (TMK No. (2) 3-6-005:007). Approximately 443 acres are proposed to be re-designated from the State Agricultural District to the State Urban and Rural Districts.

WCT will be a "complete community," encompassing a mixture of single- and multi-family residential units, commercial, and civic uses. In accordance with the MIP, WCT includes 1,433 residential units together with neighborhood retail, commercial, a school, parks and open space. The town will be bound by agricultural lands that will be preserved in perpetuity through a conservation easement. The utilization of conservation subdivision design (CSD) practices will preserve additional rural lands for farming, open space, and open land recreation.

WCT will be built both mauka and makai of Honoapiilani Highway. Development mauka of the highway will focus inward onto a "village center," incorporating the existing buildings and grounds of the MTP. The Master Plan calls for a diverse mixture of affordable and market priced housing, along with commercial, entertainment, and civic uses within and around the village center.

Development makai of the highway will focus onto a pedestrian-oriented "main street," a nearby elementary school, and parks. The makai development is bound to the east by the planned extension of the Waiale Road, which will intersect with Honoapiilani Highway. A primary objective of the project is to develop a community where walking and biking are the preferred modes of transportation and recreation for short commutes. Therefore, in addition to proposing mixed-use and more compact development patterns, approximately eight miles of

Figure 2
Regional Location

Not to Scale

WAIKAPU COUNTRY TOWN

PLANNING
CONSULTANTS
HAWAII, LLC

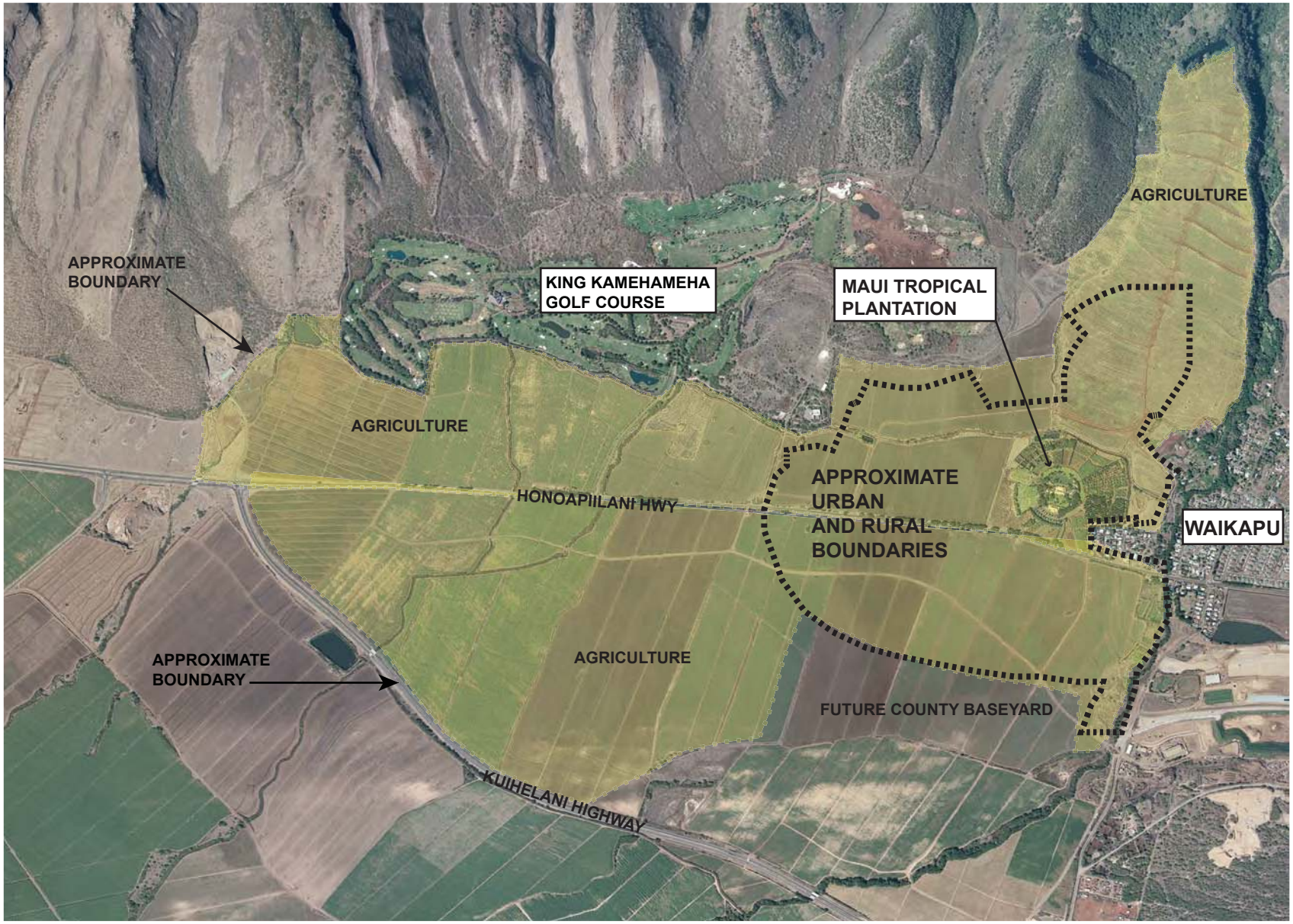


FIGURE 3

AERIAL LOCATION

Not to Scale

WAIKAPU COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

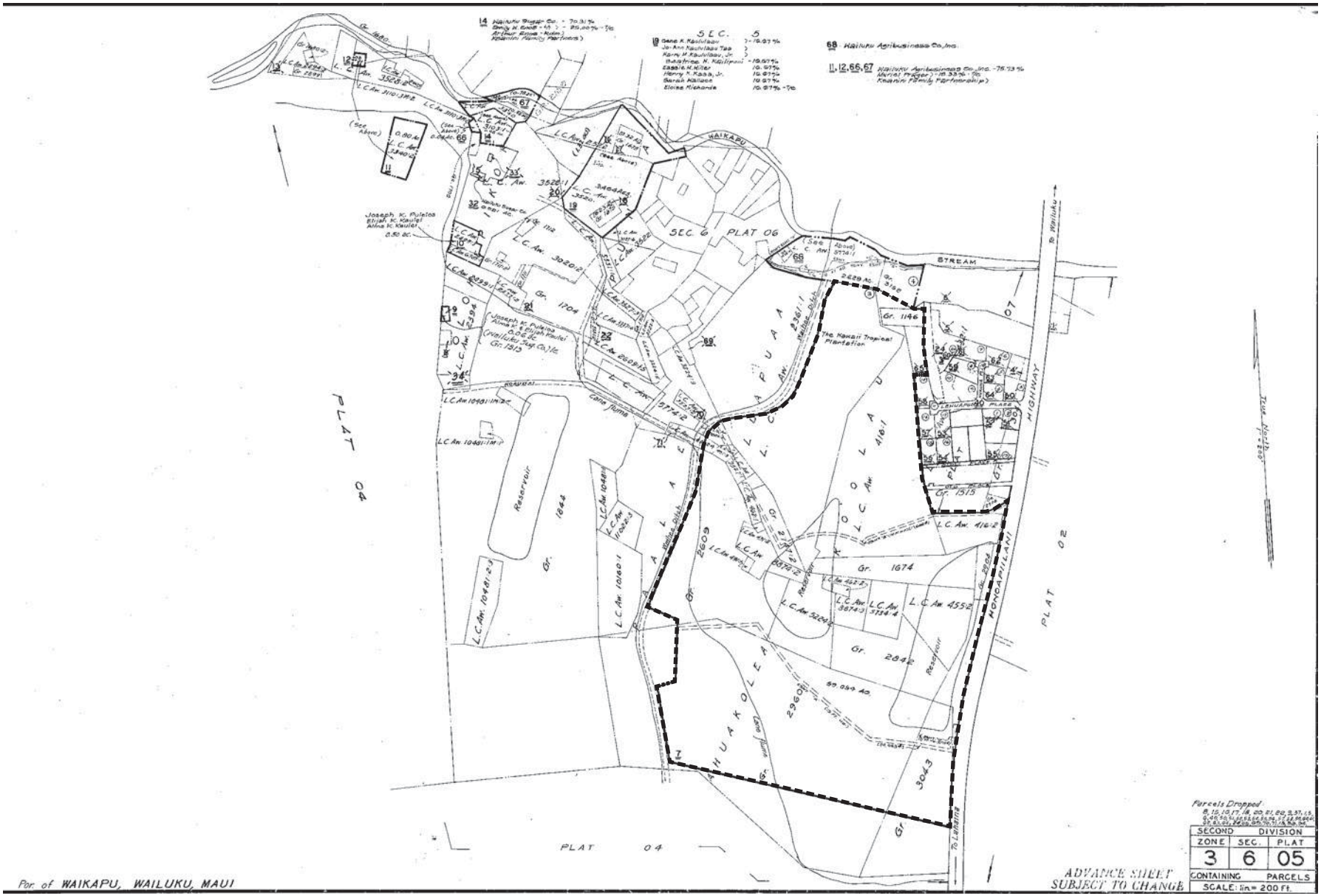


Figure 4a

TMK MAP

TMK No. (2) 3-6-005:007

Not to Scale

WAIKAPU COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

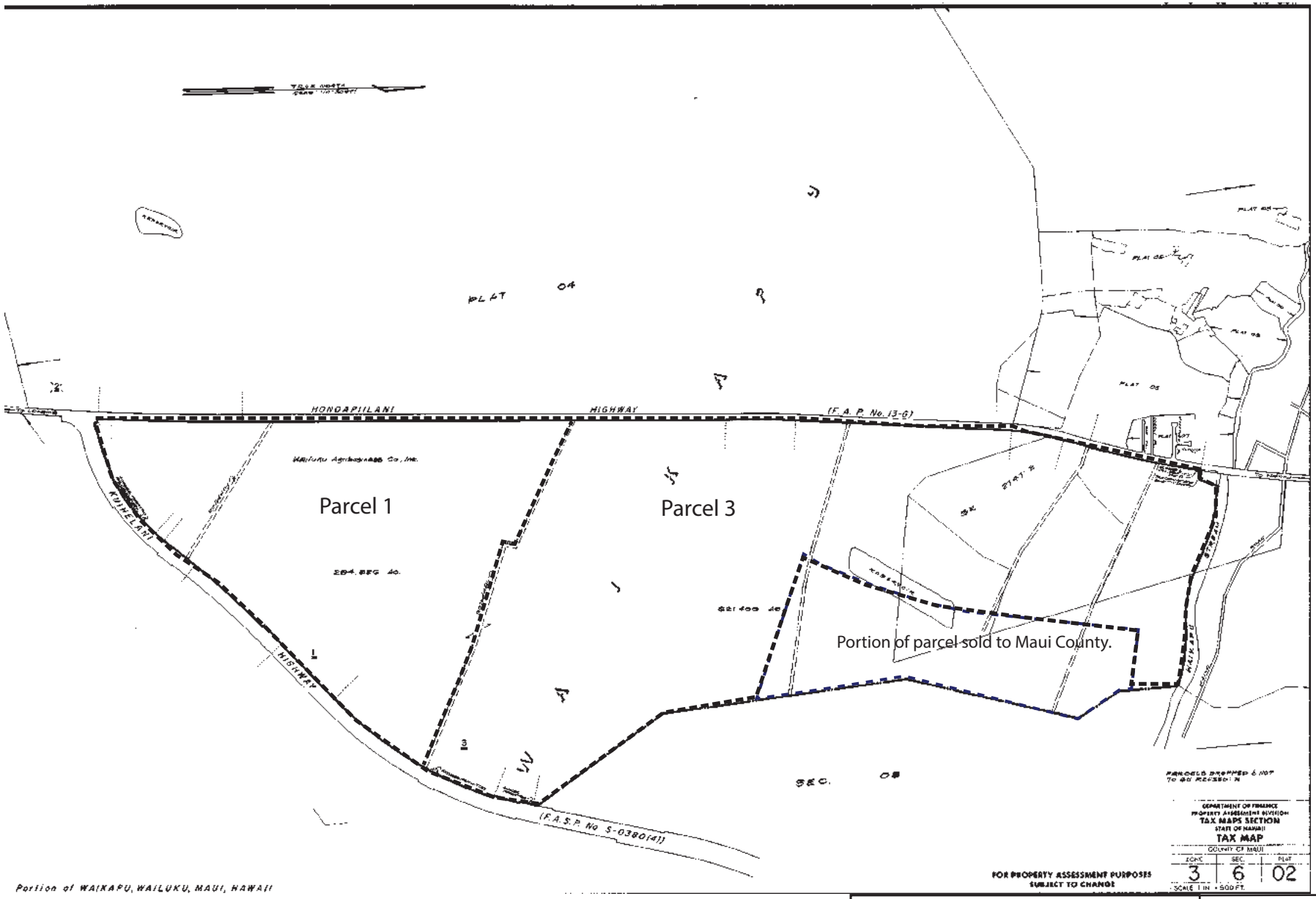


Figure 4b
TMK MAP
Not to Scale
TMK Nos. (2) 3-6-002: 001 and 003

WAIKAPU COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

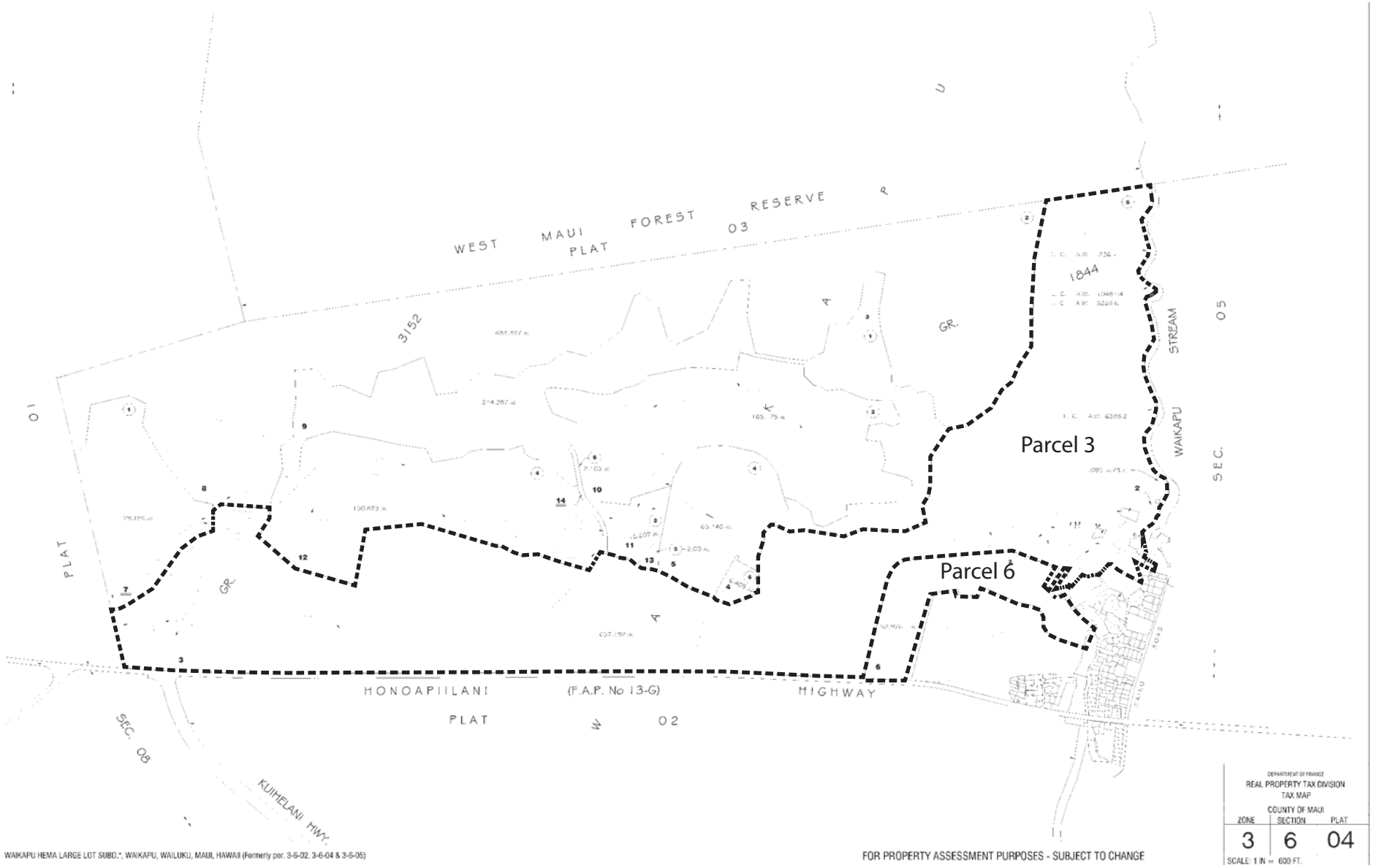


Figure 4c

TMK MAP

Not to Scale

TMK Nos. (2) 3-6-004: 003 and 006

WAIKAPU COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

Figure 4d

TMK MAP

TMK No. (2) 3-6-006:036

Not to Scale

WAIKAPU COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

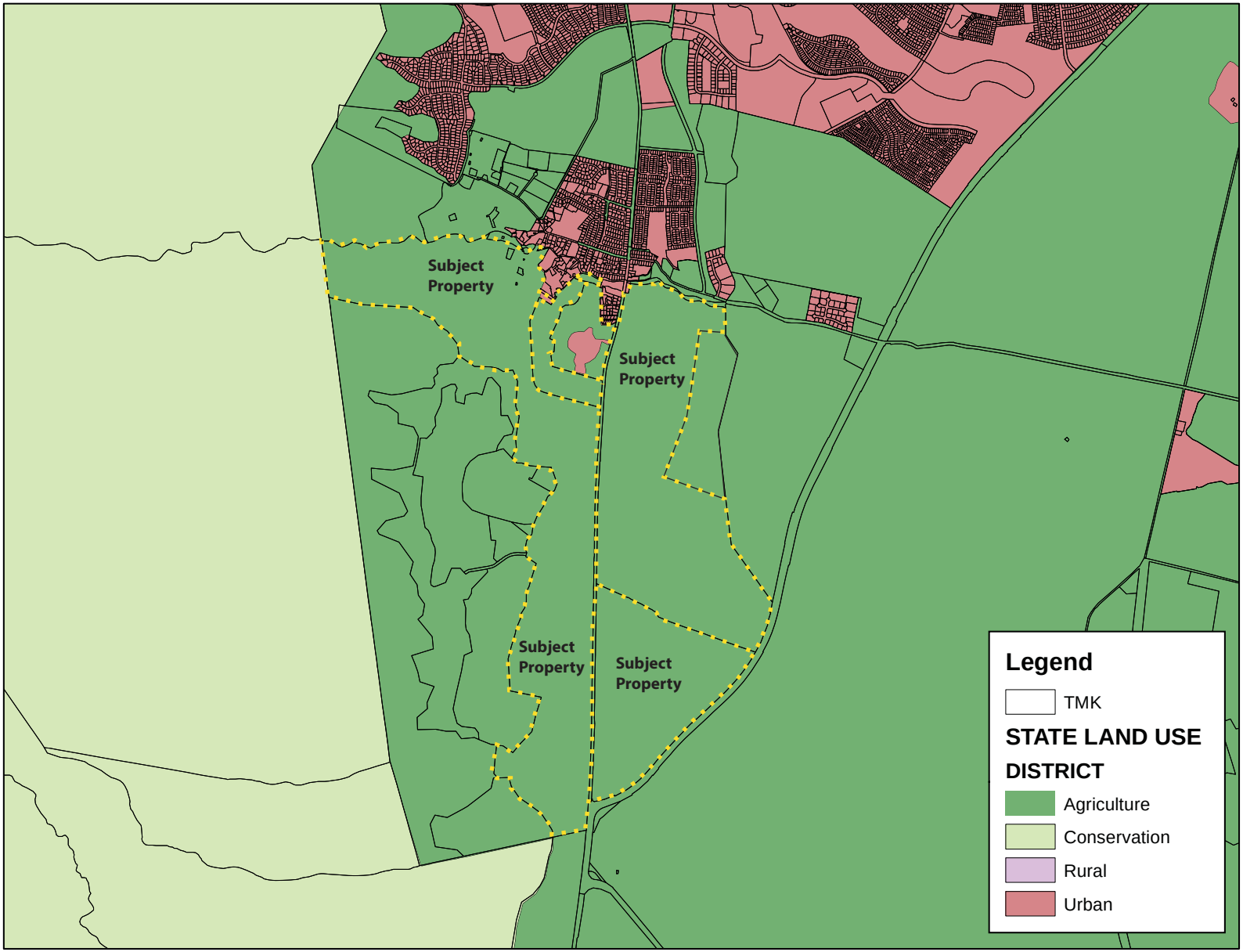


FIGURE 5
STATE LAND USE
DISTRICT BOUNDARIES

Not to Scale

WAIKAPU COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

hiking, biking and walking trails will be incorporated into the project. Public transit will also be accommodated in strategic locations to facilitate the use of transit to jobs-rich areas in Wailuku/Kahului and South and West Maui (**See**: Figure 6: "Conceptual Land Plan").

C. PURPOSE AND SCOPE OF THE AGRICULTURAL IMPACT ASSESSMENT

The property owner, Waikapu Properties, LLC, has contracted with a professional consultant team to prepare a consolidated Hawaii Revised Statutes (HRS) Chapter 343 Environmental Impact Statement (EIS), State Land Use Commission District Boundary Amendment, Community Plan Amendment and Change in Zoning Application.

The Agricultural Impact Assessment (AIA) will assess the long-term impact of the project on the state's agricultural industry.

The scope of the study includes the following tasks:

- Assessment of the current status of Hawaii agriculture. This will include an overview of the agricultural industry's significance to Hawaii's economy, its current economic standing, its market penetration, and challenges and opportunities.
- Assessment of the current availability of agricultural resources. This will include an assessment of the availability of agricultural lands state-wide and on Maui, current agricultural land use within Maui County, availability of State and County Agricultural Park lots, and agricultural lands proposed for development on Maui.
- Analysis of existing agronomic conditions within the project site. This will include documentation of the following factors: 1) soil types, 2) soil ratings, 3) slopes, 4) solar radiation, 5) rainfall, 6) and existing irrigation systems.
- Description of the recent agricultural history of the property. This will include a description of the past and current operators, including HC&S, Kumu Farms, Maui Tropical Plantation (MTP), Hawaii Taro LLC, and ranching.
- Assessment of the impact of the project on current agricultural operations. This will include an assessment of the project's impact on the ongoing operations of HC&S, Kumu

Waikapu
Country Town

AGRICULTURE PRESERVE

AGRICULTURAL PARK

AGRICULTURE

AGRICULTURE PRESERVE

WAIKAPU

WAIALE BY-PASS

COUNTY OF MAUI
100 AC.

Legend

- Rural Lots
- Single Family
- Cottage Town Home
- Country Town Mixed Use
- Commercial
- Parks and Open Space
- School

LAND USE PLAN

HAWAII LAND DESIGN

DATE: JULY 18, 2013

Farms, Hawaii Taro LLC and other enterprises actively engaged in farming on the property.

- Analysis of the Project's consistency with State and County Agricultural Policies. This section will identify and discuss the project's consistency with State and County agricultural land use policy.

III. HAWAII'S AGRICULTURAL INDUSTRY

A. ECONOMIC SIGNIFICANCE TO THE ECONOMY

Agriculture has played a major role in Hawaii's socio-economic development for over 150 years. Hawaii's modern culture, ethnic composition, land use patterns, urban design, and landscapes are all shaped by Hawaii's agricultural history.

However, while agriculture, predominantly sugar and pineapple, dominated Hawaii's economy from the late 1800s through the 1950s, its overall significance has declined dramatically since the advent of mass market tourism. At its peak in 1927, the sugar industry employed 56,600 workers. Shortly thereafter, in 1932, land utilized for sugar peaked at 254,600 acres. By 1957, however, the sugar industry employed just 16,800 workers, a decline of 70% since 1927. Despite its dramatic decline, sugar was still a major contributor to Hawaii's economy in 1957. In that year the leading income generators in Hawaii included these sources:

- Military expenditures at $308 million;
- Sugar at $146 million;
- Pineapple at $110 million; and
- Tourism at $80 million. [viii]

By 2011, the fortunes of Hawaii agriculture, relative to the total economy, had fallen precipitously. In 2011, the entire agricultural sector in Hawaii employed 6,900 workers, providing 1.15% of wage and salary jobs. Moreover, its share of the gross domestic product (GDP) for all private industries was 0.89%, and, if Federal, State and County government is included, agriculture represented 0.68% of the State's GDP in 2011.[ix]

Likewise, in Maui County, the economic significance of agriculture has fallen. In 2011, agriculture employed 1,600 Maui County workers, which represents 2.4% of the 67,200 wage and salary jobs in the County. In terms of County earnings, in 2008, agriculture generated $98.55 million as compared to total non-farm earnings of approximately $3.6 billion.[x]

While agriculture is no longer a dominant industry in Hawaii, it is still important because it creates jobs and facilitates economic diversification. In addition to the 6,900 people that are directly employed by agriculture, the industry creates indirect and induced employment in other sectors of the economy. Using the State of Hawaii's input-output model, it can be estimated that in addition to direct employment, approximately 1,636 indirect jobs were created by agriculture and another 1,695 induced jobs were created by the industry in 2011.[xi]

According to the Maui Agricultural Development Plan (July, 2009), the agricultural industry is important for the following reasons:[xii]

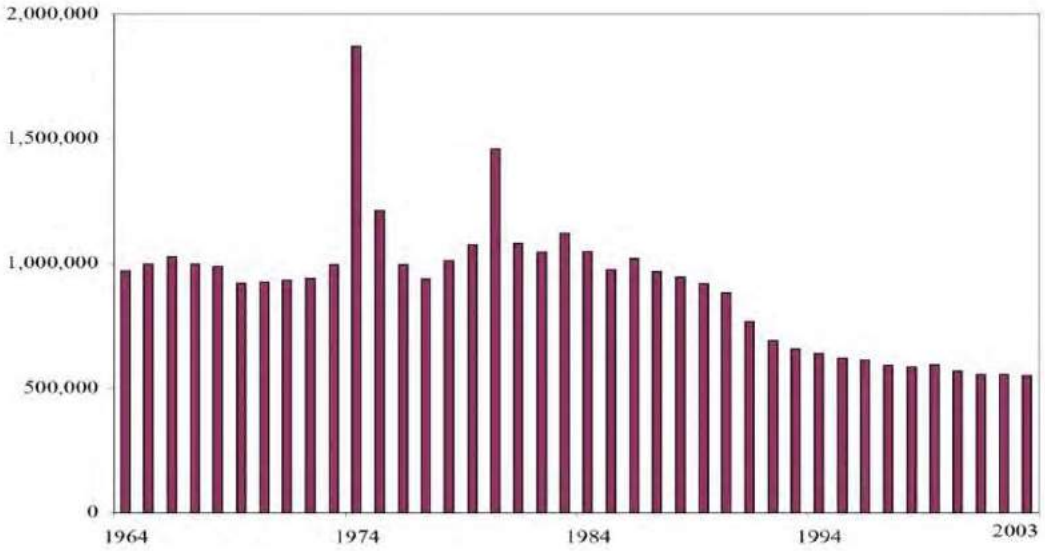
- Agriculture creates jobs;
- Locally grown foods are fresher and of higher quality;
- Locally grown food increases food security;
- Local agriculture provides for Maui's biosecurity;
- Agriculture preserves open space and working agricultural viewscapes; and
- Agriculture contributes to groundwater recharge.

It is because of these reasons that, despite the declining role of agriculture in Hawaii's economy, the State and County maintain strong policies to protect the State's agricultural resources.

B. MARKET COMPOSITION

As noted, agriculture is a far smaller component of Hawaii's economy than it was historically. As Figure 7 shows, the value of agricultural production decreased significantly between 1964 and 2003. The decrease is largely attributed to the closure of sugar plantations throughout the State.

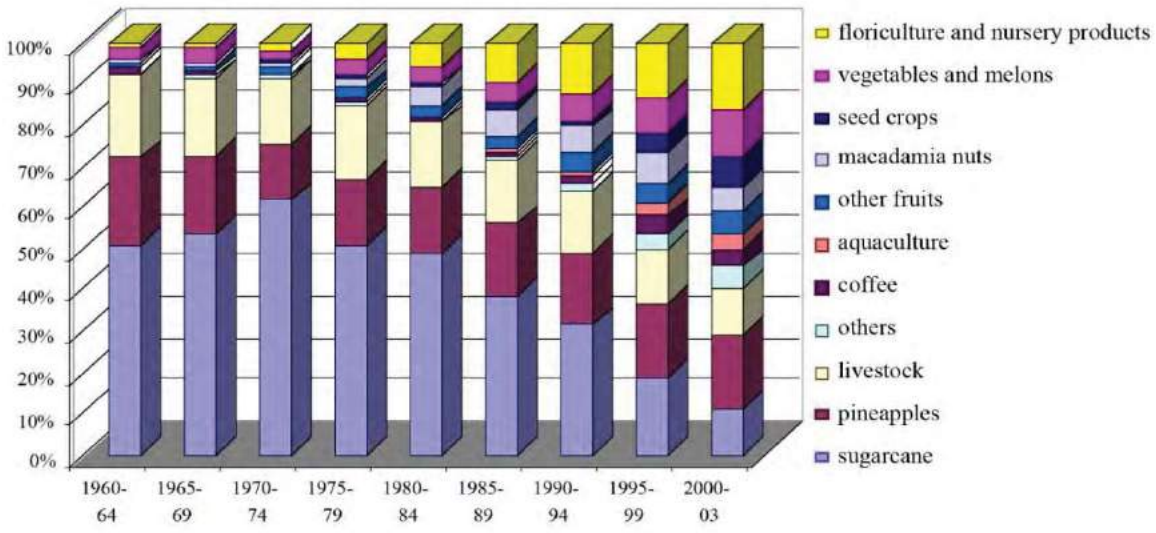
Figure 7: Value of Hawaii's Agricultural Production between 1964 and 2003



Since the mid 1980s, the economic benefits of agricultural production have been in steady decline. [xiii]

However, since 2003 the market value of crop and livestock sales has increased by 27%, from $520.47 million in 2003 to $659.66 million in 2010. [xiv] The increase is largely attributed to the dramatic growth in seed crop sales.

Figure 8: Relative Value of Hawaii's Major Agricultural Crops from 1960 to 2003

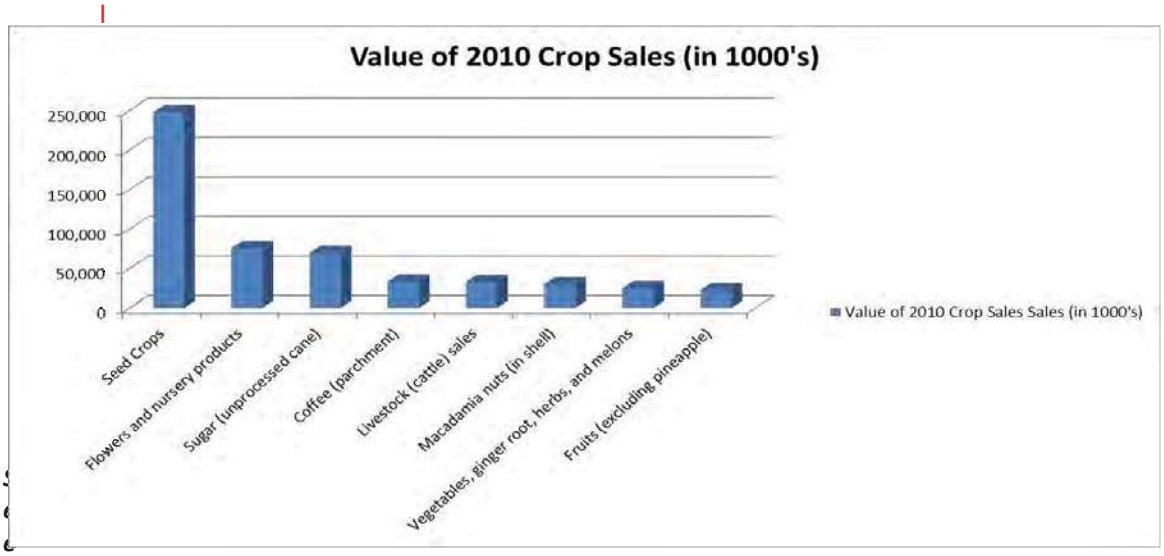


Agricultural Crop diversification was significant in the years between 1960 and 2003. [xv]

Figure 8 shows the diversification of Hawaii's agricultural industry from one dominated by sugar, pineapple and livestock sales during the 1960s to a significantly more balanced and diversified portfolio in 2003. However, as Figure 9[xvi] shows, the explosive growth of the seed crop industry has led to an industry whose value, as measured by sales, is once again dominated by a single crop.

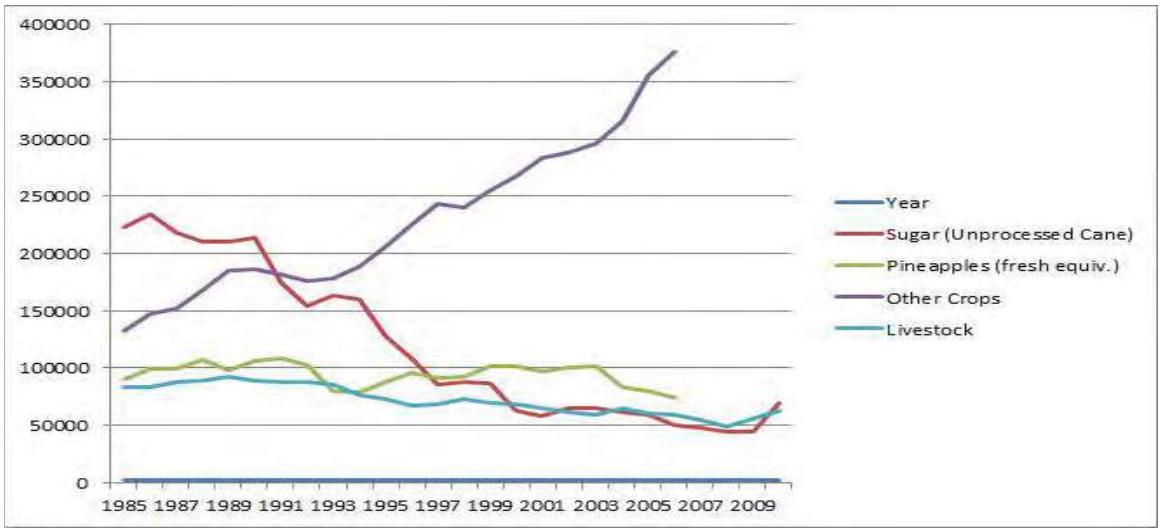
Figures 10 and 11 show the tremendous growth of Hawaii's seed crop industry and equally dramatic contraction of the sugar industry between 1985 and 2010. During this period, sales of Hawaii coffee, vegetables and melons, macadamia nuts and taro have been relatively flat.[xvii]

Figure 9: Value of 2010 Crop Sales (in thousands)



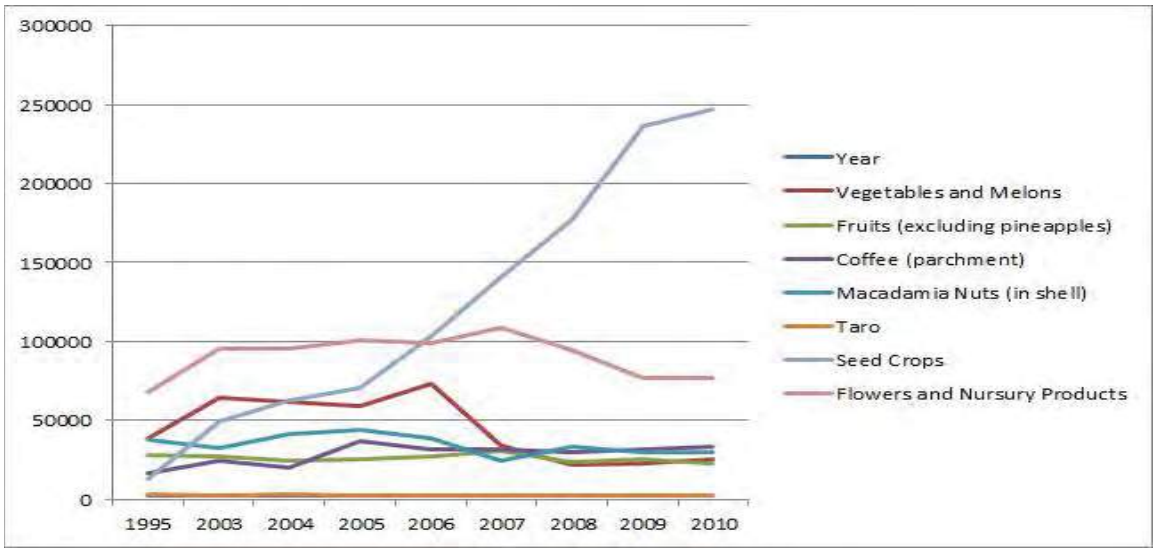
Seed crop sales far out performed other commodities in 2010.

Figure 10: Value of Hawaii's Major Crops between 1985 and 2010 (in thousands)



While seed crop sales increased dramatically between 1985 and 2010, sugar sales steadily declined.

Figure 11: Value of Hawaii's Crop Sales between 1995 and 2010 (in thousands)[1]



Hawaii enjoyed varied crop sales in several different commodities, with seed crops the clear high performer.

[1] Beginning in 2007 non-published vegetable commodities were not included to avoid disclosure of individual operations. This change produces the sharp decline is vegetable and melon sales as shown in the graph.

C. MARKET SHARE

1. Hawaii Market

It has been well documented that Hawaii farmers face intense competition from U.S. Mainland and International food suppliers for Hawaii market sales. In a 2008 study by the University of Hawaii, College of Tropical Agriculture and Human Resources (UH-CTAHR),[xviii] it was documented that Hawaii food consumption expenditures grew from $2.6 billion in 1995 to $3.7 billion in 2005, increasing at a rate of 3.4% annually. Of the food consumed in Hawaii, it further notes that approximately 85% is imported.

For local market sales, one would expect that Hawaii farmers would have a comparative advantage because of lower shipping costs and the ability to deliver fresher product. However, as documented by UH-CTAHR's study, in 2005 off-shore suppliers dominated the local market for fresh fruits and vegetables, beef, pork, chicken, eggs and milk, as is shown in Table 1:

Table 1: 2005 Market Share for Hawaii Agricultural Products

Agricultural Product	% of Hawaii market held by off-shore suppliers	% of Hawaii market held by Hawaii suppliers
Beef	95.50	4.50
Pork	96.10	3.90
Eggs	80.00	20.00
Fresh Milk	90.00	10.00
Fresh Fruits	65.22	34.78
Fresh Vegetables	66.50	33.50

Off-shore suppliers greatly exceeded Hawaiian suppliers for all products in 2005

According to the study, Hawaii farmers only increased market share in the fresh vegetable market. The UH-CTAHR study notes that the rate of growth in the production of fresh vegetables in Hawaii outpaced consumption at an annual rate of 5.8% to 4.3%,

which means Hawaii is becoming more self-sufficient in vegetables. In beef, Hawaii production and consumption remained stable at an annual growth rate of 4.4%. In fresh fruits, fresh milk, eggs and pork, annual production has decreased and Hawaii has become less self-sufficient.

2. Mainland Market

In 2005, UH-CTAHR conducted an analysis of Hawaii's comparative advantage in the US Mainland market for the following eleven export crops:

1. Fresh papaya;
2. Fresh pineapples;
3. Processed pineapples;
4. Coffee;
5. Seed corn;
6. Dendrobium (spray)
7. Cut and potted foliage;
8. Raw sugar (cane);
9. Macadamia nuts;
10. Fresh cut anthuriums; and
11. Potted orchids.

In this study, UH-CTAHR found that Hawaii increased its competiveness (as measured by market share) in seed corn, coffee and dendrobiums. In five crops – fresh pineapple, processed pine, raw sugar, potted orchids, and foliage – Hawaii became relatively less competitive. In three crops – fresh papayas, macadamia nuts, and anthuriums – Hawaii maintained its comparative advantage.[xix]

Figure 12: Hawaii Market Share in U.S. Mainland Market for Select Products (in thousands

Hawaii growers maintained a steady Mainland market share in the 10 years between 1995 and 2005.

Figure 12 above shows the U.S. Mainland market share controlled by Hawaii growers between 1995 and 2005 for the eleven agricultural products. During the period, Hawaii retained a relatively stable share of the aggregate market value of these products.

3. Japanese Market

In 2010, UH-CTAHR conducted an analysis of Hawaii's competiveness in the Japanese market for twenty agricultural products.[xx] CTAHR found that between 1995 and 2008 the aggregate average annual value of Hawaii's agricultural exports increased from $31.46 million (1995-1999) to $52.82 million (2005-2008). However, the large increase was primarily the result of the tremendous growth in deep sea water sales to Japan. Of the twenty products analyzed, eight are "traditional" crops (i.e., where the fresh product and/or the input into the processed product may be grown by farmers in Hawaii). When analyzing only these eight products, just three, unroasted coffee, roasted coffee and fresh or dried pineapple, increased market share in Japan between 1995 and 2008. The remaining five products, cut flowers/buds, fruits and nuts,

macadamia nuts (fresh or dried), papayas, macadamia nuts (processed), and pineapple (processed) had declining market shares. Table 2 shows the average value of Hawaii exports to Japan in these eight products between 1995 and 2008.

Table 2: Japanese Market Sales between 1995 and 2008 of Select Hawaii Products

Product	**Average Value (US$M)**		
	1995-1999	**2000-2004**	**2005-2008**
Coffee, unroasted	2.22	2.04	3.13
Cut Flowers/Buds	2.63	1.60	0.67
Fruits and Nuts	0.18	0.22	0.15
Macadamia Nuts, Fresh or Dried	0.27	0.03	0.02
Papayas	12.14	6.47	3.50
Pineapples, Fresh or Dried	0.00	0.68	0.45
Coffee Roasted	0.51	1.08	2.04
Macadamia Nuts, Processed	1.80	1.80	1.01
Pineapples, Processed	1.98	0.92	0.53
TOTAL	**21.73**	**14.84**	**11.5**

As seen, the average annual value of exports to Japan in these eight products decreased from $21.73 million (1995-1999) to $11.5 million (2005-2008).

In conclusion, Hawaii farmers face stiff competition in local, national, and international markets for agricultural products. In the local market, off-shore suppliers dominate the market for fresh fruits and vegetables, beef, pork, chicken, eggs and milk. While Hawaii growers have slightly increased their market share of fresh vegetables and maintained their very small share of the beef market, they have lost market share in pork, chicken, eggs and milk.

In the U.S. Mainland market, Hawaii growers have had varying degrees of success but overall have sustained the aggregate value of export sales between 1995 and 2005. In

the Japanese market, exports of "traditional" agricultural crops, such as pineapple, papaya and cut flowers, have experienced a significant decrease in the value of sales between 1995 and 2008.

D. INDUSTRY CHALLENGES AND OPPORTUNITIES

1. Industry Challenges

Some of the more significant impediments to agricultural development in Hawaii are the following economic factors:

- High labor costs;
- High transportation costs;
- High energy costs; and
- High land costs.

In 2012 UH-CTAHR conducted an analysis of the economic performance and cost structure of Hawaii and U.S. Mainland farms for the year 2007.[xxi] Among the study's significant findings are the following impacts:

- In 2007, average farm sales for Hawaii farms were less than the average cost of inputs. Each dollar spent on Hawaii farms in 2007 generated only $0.96 of production, whereas each dollar spent on Mainland farms generated $1.14.
- The average Hawaii farm had a net loss of $20 per acre. The average mainland farm had a net profit of $40 per acre.
- Small- to average-sized farms ($10,000 to $1,000,000) in Hawaii performed nearly as well as similarly sized mainland farms. Hawaii farms of that size had an output-input ratio of 1.21 while Mainland farms were 1.22.
- Hawaii's vegetable and melon sector and nursery/floriculture/greenhouse sector achieved net profits, while all other sectors suffered net losses.

The following are among UH-CTAHR's findings related to cost structure:

- ***Labor.*** Hawaii labor expenditures were 43% higher than U.S. Mainland farms. For Hawaii farms that hired labor, labor costs equaled about 38% of total sales, while in the U.S. Mainland labor costs were just 9% of sales. Relative to Hawaii's U.S. Mainland market competitors (foreign suppliers), Hawaii has the highest monthly average wage. Compared to its Japanese market competitors, Hawaii has the 3rd highest average monthly wage.

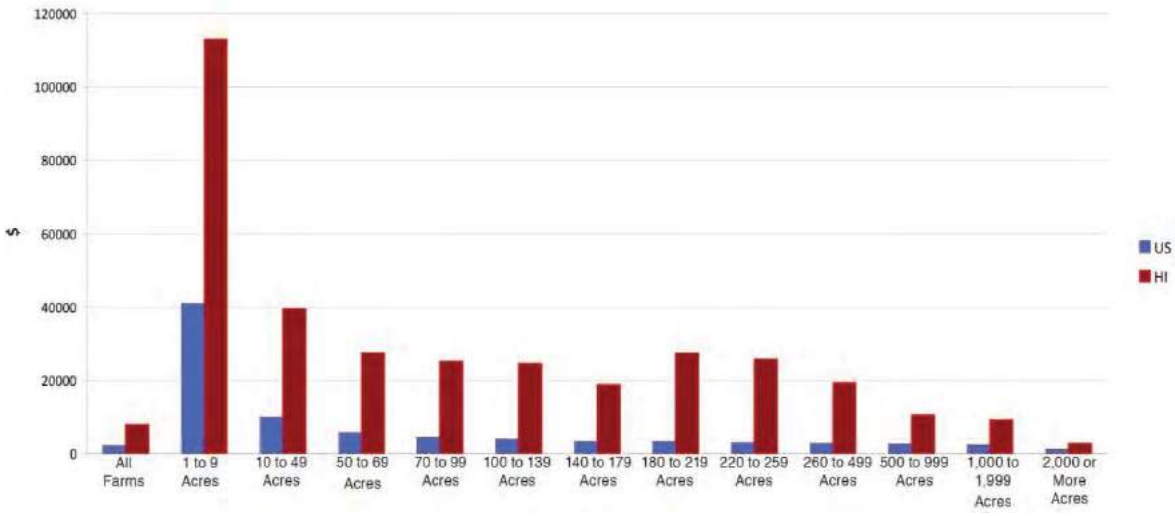
- ***Transportation costs.*** Relative to its U.S. Mainland foreign market competitors, Hawaii has the highest per mile transportation cost to the U.S. Mainland market. Relative to its major Japanese market competitors, Hawaii farmers have the highest transportation cost.

  When shipping to the Honolulu market, however, Hawaii farmers have a significant cost advantage. For Oahu farmers, this cost advantage is considerable as no air or ocean shipping is required. For neighbor island farmers, ocean shipping is relatively affordable, while airfreight is expensive. This fact was documented in a 2010 UH-CTAHR study comparing the cost of shipping between Hilo and Honolulu and Los Angeles and Honolulu. The study found the cost for ocean freight was six times less expensive between Hilo and Honolulu than between Los Angeles and Honolulu. However, the study also found that in 2010 air freight between Hilo and Honolulu was nearly twice as expensive as air freight between Los Angeles and Honolulu. At the time of the study, if the same commodity were to be shipped, it was about 114% more expensive to ship by air between Los Angeles and Honolulu than by ocean freight between Hilo and Honolulu.[xxii]

- ***Energy Costs.*** Compared to U.S. Mainland farms, electric/gasoline costs are equivalent to 10% of input costs for Hawaii farmers, whereas they are only 6% for U.S. Mainland farmers. In a comparison of input prices between Hawaii and its major export competitors, it was found that of 52 countries with available data, Hawaii (if assumed to be a separate country) had the 5th highest electricity costs. By comparison, the U.S. Mainland was 39th.[xxiii]

- ***Land.*** As shown in Figure 13[xxiv], the value of an acre of agricultural land in Hawaii is considerably higher than the value of an equivalent acre in the U.S. Mainland. As such, it is not surprising, as shown in Figure 14, that for farms that are less than 500 acres the cost per acre to rent is considerably more expensive in Hawaii than on the U.S. Mainland.

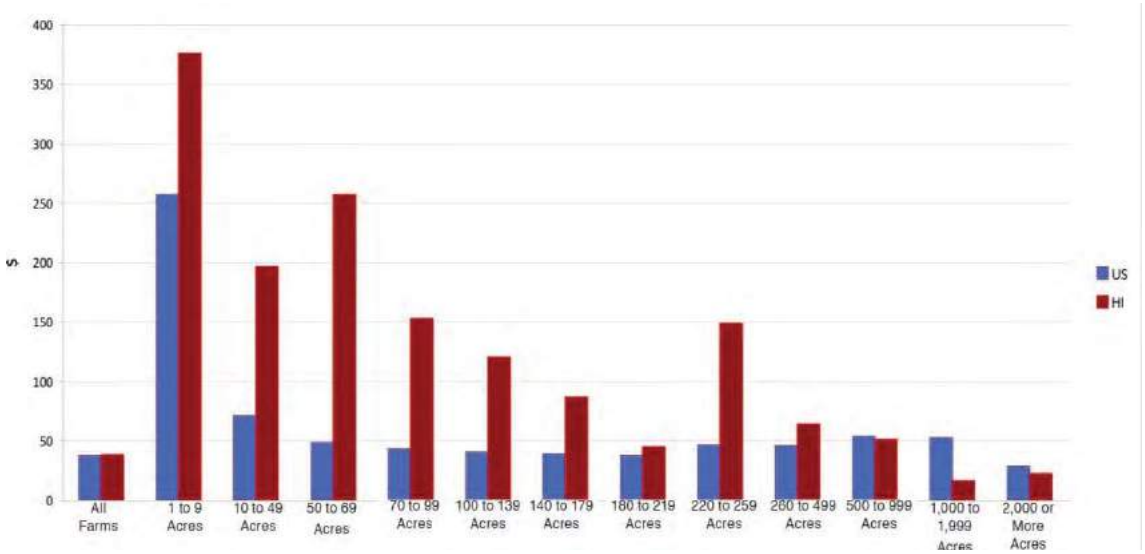
Figure 13: Cost per Acre of Agricultural Land in Hawaii and the U.S. Mainland



The cost per acre of agricultural land in Hawaii greatly increases costs for Hawaii growers.

Figure 14: Cost per Acre to Rent Agricultural Land in Hawaii and the U.S. Mainland

F



Rent costs reflect the high cost of agricultural land in Hawaii.[xxv]

2. Industry Opportunities

Although Hawaii farmers face higher input costs than their U.S. Mainland and foreign competition, Hawaii is still a significant supplier of agricultural products. In 2010, the value of all crop and livestock sales in Hawaii was approximately $660 million,[xxvi] and despite having relatively high input costs, the seed corn industry has demonstrated that Hawaii agriculture can develop comparative advantage in the right niches.

The following discusses the opportunity for Hawaii agriculture in the following three sectors:

a. Import Replacement;
b. Seed Crops; and
c. Biofuel Crops.

a. Import Replacement

As noted, approximately 85% of food consumed in Hawaii is imported. Table 3 shows Hawaii's consumption and estimated production in 2005 of the following agricultural products: beef, pork, eggs, fresh milk/cream, fresh fruits, and fresh vegetables.[xxvii]

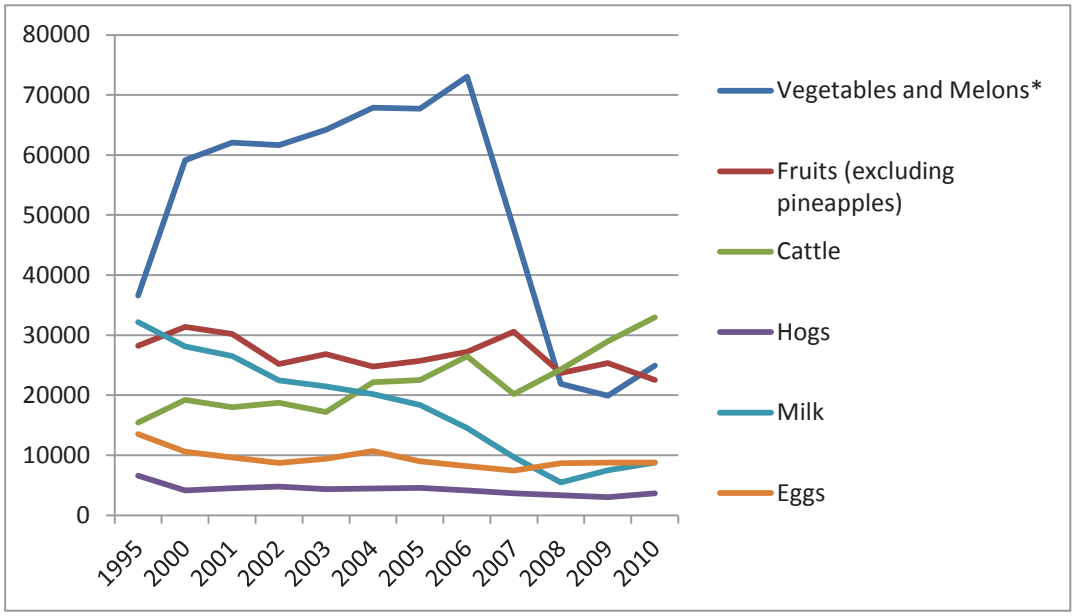
Table 3: Value of Consumption and Production of Select Agricultural Products in Hawaii (in thousands)

Agricultural Product	Total Estimated Consumption	Estimated Hawaii Production	Estimated Hawaii Market Share
Beef	112.80	5.08	4.5
Pork	116.74	4.55	3.9
Eggs	44.90	8.98	20.00
Fresh Milk and Cream	183.87	18.39	10.00
Fresh Fruits	61.54	21.40	34.78
Fresh Vegetables	180.87	60.92	33.50

There is a significant gap between foods consumed in Hawaii and those produced in Hawaii.

As shown, Hawaii has very low market share in the local beef, pork, eggs and fresh milk markets. However, Hawaii's market share in the fruit and vegetable markets is over 30%. Figure 15 shows sales of the above-referenced products between 1995 and 2010. [xxviii] Despite having the advantage of proximity to the local market and lower shipping costs, Hawaii farmers have been unable to significantly increase the value of their production.

Figure 15: Hawaii Crop Sales between 1995 and 2010 (in thousands)[2]



Hawaii crop sales remained steady between 1995 and 2010. Vegetable and melon sales were not reported between 2007 and 2010.

In an October 2011 study, UH-CTAHR[xxix] made six recommendations to help address the higher agricultural input costs faced by Hawaii farmers. These recommendations include the following items:

1. ***Labor.*** Substitute capital, i.e. machinery and equipment, for labor.
2. ***Energy/Electricity.*** Develop alternative off-grid sources of electricity, such as solar, wind and hydro, to mitigate high electricity costs.
3. ***Fertilizer.*** Utilize alternative sources of recyclable waste materials in lieu of imported fertilizers.

[2] Beginning in 2007 non-published vegetable commodities were not included to avoid disclosure of individual operations. This change produces the sharp decline in vegetable and melon sales as shown in the graph.

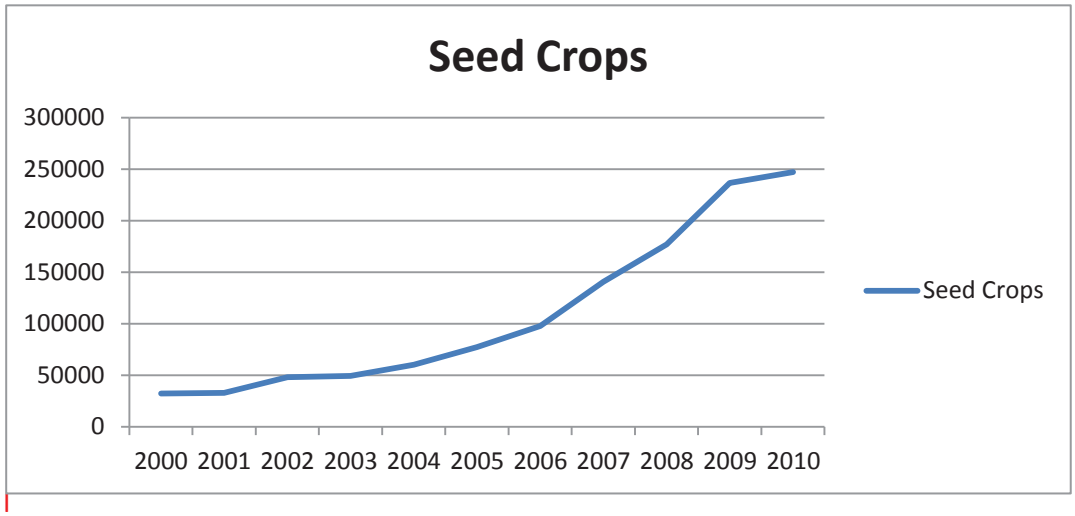
4. ***Agricultural Land.*** Seek the designation of Important Agricultural Lands (IAL). Place additional acreage in State and County agricultural parks to improve access to affordable farmland and long-term leases.
5. ***Transportation Costs.*** Encourage the production of crops that can be sold in local markets.

UH-CTAHR also recommends that Hawaii farmers consider shifting production to lower value fruits and vegetables, where a significant percentage of the input costs for these products is transportation costs. They also suggest production of highly perishable and niche products, since quality over price is often a consideration of consumers.

b. Seed Crops

The rapid growth of Hawaii's Seed Crop industry demonstrates that agriculture in Hawaii can be profitable. Hawaii's Seed Crop industry is dominated by 10 farms that cultivate seed corn, soybean, wheat, sunflower, and other seed crops. However, seed corn is the dominant crop and in 2011 represented approximately 95.6% of all seed crop sales.[xxx] Figure 16 shows the dramatic growth of the industry from 2000 to 2010.

Figure 16: Value of Hawaii's Seed Crop Sales between 2000 and 2010 (in thousands)



The value of seed crop sales increased 700% from 2000 to 2010.

As shown in Figure 16, seed crop sales grew by 700%, from $35.3 million in 2000 to $247.22 million in 2010. In 2010, seed crop sales represented 37% of all crop and livestock sales in the state. The next largest contributor was flower and nursery products at 11%, then sugar sales at 10.6%. According to most current accounting, the seed crop industry created 1,397 jobs, which is equivalent to 20.2% of statewide agricultural jobs.[xxxi]

According to the February, 2013 report prepared for the Hawaii Farm Bureau Federation and the Hawaii Crop Improvement Association entitled "Hawaii's Seed Crop Industry: Current and Potential Economic and Fiscal Contributions", the industry is successful in Hawaii for the following reasons:

- Year-round growing conditions allowing up to four crop cycles per year;
- Availability of a highly skilled agricultural workforce;
- Availability of land and water; and
- A stable political and economic environment.

During the 2005-2006 growing season, there were 4,200 acres harvested that produced 8 million pounds of seed. During the 2010-2011 growing season, there were 7,100 acres harvested that produced 9.77 million pounds of seed. [xxxii] It is expected that the industry will continue to experience growth, but as it matures it is estimated that growth may be at a slower rate than over the past ten years.[xxxiii]

c. Bio-Fuel Crops.

The State of Hawaii is one of the most oil dependent states in the Country. In 2008, approximately 85% of its energy came from imported petroleum. In comparison, the national average was 35.7%.[xxxiv] In 2010, the State imported 46.3 million gallons of petroleum at a cost of approximately $5.09 billion.[xxxv]

In response to the State's dependency upon imported fossil fuels, it adopted Renewable Portfolio Standards in 2001 and established the Hawaii Clean Energy Initiative (HCEI) goals in 2008. The Renewable Portfolio Standards (RPS) established numeric targets for renewable energy use by Hawaii's electric companies. At present, the RPS standards for renewable energy (wind, solar, biomass, bio-fuels, etc.) have the following target dates:[xxxvi]

- 10 percent of net electricity sales by December 31, 2010;
- 15 percent of net electricity sales by December 31, 2015;
- 25 percent of net electricity sales by December 31, 2020; and
- 40 percent of net electricity sales by December 31, 2030).

The HCEI, an agreement between the State and HECO, has a goal of increasing renewables total share of energy generation to 40 percent, while reducing overall demand by 30 percent through conservation by 2030.

HCEI envisions that locally produced bio-fuels will be a significant contributor to Hawaii's renewable energy portfolio. HCEI's fuels strategy includes these objectives:[xxxvii]

- Evaluating local agricultural potential and supporting its development;
- Investing in key logistical infrastructure;
- Evaluating and developing renewable fuel processing infrastructure; and
- Matching potential fuel supply to sources of demand.

In its 2011 strategic plan[xxxviii], HCEI noted that large scale production of biofuels was approximately five (5) years away from being commercially viable. There are currently several pilot projects underway in the State. These projects are assessing the viability of various crops and bio-refinery technologies. HCEI has established goals for locally produced renewable fuels for the years 2015, 2020, 2025 and 2030. Its 2015 goals are shown in Table 4 below.

Table 4: HCEI Renewable Fuel Goals for 2015

Source of Demand	Estimated Total Green Replacement Fuel (2015)
The HECO Companies	45 MGY renewable fuel
KIUC	100,000 gal/year
The Department of Defense	TBD MGY renewable JP8 TBD MGY renewable J5 TBD MGY renewable F76 TBD MGY renewable Diesel Fuel/biodiesel
The Ground Transport Sector	Maintain current E10 standard and biodiesel usage

Goals for 2015 reflect efforts across the economic sectors.

Table 5 shows HCEI's renewable fuel goals for 2020. The 2020 goals are predicated on locally produced biofuels being commercially viable and HECO and the Department of Defense implementing plans to accelerate biofuel usage.

Table 5: HCEI Renewable Fuels Goal for 2020

Source of Demand	Estimated Total Green Replacement Fuel (2020)
The HECO Companies	80 MGY renewable generation fuel (based off estimated RPS demand)
KIUC	TBD
The Department of Defense	32 MGY renewable fuels
The Ground Transport Sector	50 MGY of renewable fuels

2020 Renewable Fuels goals show a significant increase over 2015.

In its strategic plan, HCEI states that the "future price of oil will be the deciding factor, as it will materially impact the bottom line for each of the alternative outcomes under consideration".

HCEI's goal is to meet in-state demand for fuel with locally produced bio-fuels (approximately 500 MGY) by 2030. If locally produced bio-fuel is not commercially competitive, HCEI's preferred alternative is to source such fuel from domestic U.S. suppliers and then from foreign suppliers.

Bio-Fuel Viability in Hawaii

The most comprehensive assessment of the viability of bio-fuel production in Hawaii was conducted by Black & Veatch and the University of Hawaii for the State of Hawaii's Department of Business, Economic Development, and Tourism Strategic Industries Division (DBETD). [xxxix]The study was completed in January 2010.

The purpose of the study was to access the potential feedstocks, technologies, and economics of biofuel production in Hawaii to meet the State of Hawaii's alternative fuel standards, which mandate 10% of transportation fuels from renewable sources by 2010, 15% by 2015, and 20% by 2020. The study addressed several topics, including the following factors:

- Biomass conversion technology options and issues;
- Biomass residue availability;
- Energy crop potential;
- Evaluation of energy crop economics in Hawaii; and
- Emerging and innovative options for biofuel production.

For the purpose of its analysis, the study identified approximately 300,000 acres of prime irrigated land and 800,000 acres of non-prime rainfed land that would be suitable for energy crops. The study concludes that displacing 20% of the gasoline and diesel fuel consumed in Hawaii in 2007 with bio-fuel from locally grown feedstocks would require about 10%, or 110,000 acres, of the lands studied. Therefore, displacing 100% of all gasoline and diesel fuel consumed in Hawaii would require approximately 550,000 acres.

The study estimates that based on projected future prices of retail gasoline and diesel fuels, together with potential cost improvements in alternative fuel production costs, locally produced biofuels would likely not be competitive until at least 2015 when average U.S. gasoline prices reach $3.50/gallon or more. It should be noted that the average price of a gallon of regular gasoline in the U.S. as of July 11, 2013 was $3.518/gallon, while the average price in Hawaii was $4.307.

E. CONCLUSIONS

Hawaii farmers face stiff competition in local, national, and international markets for agricultural products. In the local market, off-shore suppliers dominate the market for fresh fruits and vegetables, beef, pork, chicken, eggs and milk. While Hawaii growers have slightly increased their market share of fresh vegetables and maintained their very small share of the beef market, they have lost market share in pork, chicken, eggs and milk.

In the U.S. Mainland market, Hawaii growers have had varying degrees of success but overall have sustained the aggregate value of export sales between 1995 and 2005. In the Japanese market, exports of "traditional" agricultural crops, such as pineapple, papaya and cut flowers, have experienced a significant decrease in the value of sales between 1995 and 2008.

Significant impediments to agricultural development in Hawaii include high labor costs, high transportation costs, high energy costs and high land costs. Hawaii farms face labor costs that have been documented to be 43% higher that U.S. Mainland farms. Hawaii farmers also have the highest per mile transportation cost to the U.S. Mainland market. However, when shipping to the Honolulu market, Hawaii farmers enjoy a significant cost advantage. The cost of purchasing agricultural land in Hawaii is significantly more expensive that it is in the U.S. Mainland. The cost of renting is also more expensive when the lands being rented are less than 500 acres.

Despite the major challenges that Hawaii farmers face, they are still competitive in many sectors and numerous opportunities are still available. The fact that 85% of food consumed in Hawaii is imported creates opportunities for Hawaii farmers to displace imports, thereby creating jobs and increasing tax revenues in Hawaii. UH-CTAHR recommends that Hawaii farmers consider shifting production to lower value fruits and vegetables, where a significant percentage of the input costs are transportation costs. They also suggest production of highly perishable and niche products, since quality over price is often a consideration of consumers.

Hawaii's seed crop industry has demonstrated that Hawaii agriculture can have significant comparative advantage in the right sectors. Since 2000, seed crop sales have grown by 700%, from $35.3 million in 2000 to $247.22 million, in 2010. According to the industry, Hawaii is successful in this market for the following reasons:

- Year-round growing conditions allowing up to four crop cycles per year;
- Availability of a highly skilled agricultural workforce;
- Availability of land and water; and
- A stable political and economic environment.

Substituting locally grown biofuels for imported petroleum may also provide opportunities for Hawaii farmers over the next several decades. In 2008, approximately 85% of Hawaii's fuel came from imported petroleum. There are many crops, including sugarcane, which can be grown in Hawaii and converted into fuel. The Hawaii Clean Energy Initiative (HCEI) has established aggressive goals for the use of renewable fuels through 2030. One of its primary strategies is to evaluate local agricultural potential for developing bio-fuels. A 2010 study done by Black & Veatch and the University of Hawaii for the State of Hawaii found that displacing 20% of the gasoline and diesel fuel consumed for ground transportation in Hawaii in 2007 with bio-fuel from locally grown feed-stocks would require about 10% of Hawaii's agricultural lands.

IV. STATE AND COUNTY AGRICULTURAL LANDS

A. STATE OF HAWAII

The total land area in the State of Hawaii is 4,112,388 acres, approximately 47% of which, or 1,928,318 acres, is in the State Agricultural District.[xl] Depending upon the agricultural land rating system used, it is estimated that from 21% to 46% of these lands are very productive for agriculture. Within the State of Hawaii there are four agricultural land rating systems:

1. The Land Capability Classification (LCC) system developed by the United States Department of Agriculture in 1972;
2. The Land Study Bureau's (LSB) Detailed Land Classification system developed between 1965 and 1972 by the University of Hawaii;
3. The Agricultural Lands of Importance to the State of Hawaii (ALISH) rating system developed by the State Department of Agriculture, United States Department of Agriculture, and the University of Hawaii College of Tropical Agriculture and Human Resources between 1977 and 1978;
4. The Land Evaluation and Site Assessment (LESA) system developed between 1983 and 1986 by the LESA Commission.

Hawaii Revised Statutes (HRS) Chapter 205 uses the LSB system to regulate certain uses within the State Agricultural District. Maui County Code, Title 19.30A uses the ALISH rating system as criteria to determine lands that should be given the highest priority for preservation.

The LSB system ranks lands on a scale from "A," which is very good, to "E," which is not suitable. The LSB system also provides crop productivity ratings for pineapple, sugar, vegetables, forage, grazing, orchard crops, and timber. The ALISH system groups land into three classifications: Prime, Unique, and Other. Prime lands are considered to have the best soils with physical, chemical and climatic conditions to favor mechanized field crops. Unique agricultural lands are also considered to be productive for high value crops, such as coffee, taro, and vegetables. Other agricultural lands are not as productive as Prime and Unique lands and may need greater

irrigation and field management to be productive. The following table identifies the approximate acreage of productive agricultural lands in Hawaii using the LSB and ALISH rating systems.[xli]

Table 6: Hawaii's Important Agricultural Lands by Rating System

Hawaii's Important Agricultural Lands by Rating System	***Acres***	***Percentage of State Ag District***
University of Hawaii Land Study Bureau (LSB) Lands Lands Rated "A", "B", "C"	447,250	24
Agricultural Lands of Importance to the State of Hawaii (ALISH) Prime, Unique, Other	846,363	46

46% of Hawaii agricultural lands are considered Prime, Unique or Other by ALISH.

B. CURRENT AVAILABILITY OF STATE AGRICULTURAL LANDS

As discussed, there are 1.93 million acres within the State Agricultural District. Of these lands, between 21% and 46% are considered very productive. Using the LSB rating system, there are approximately 447,250 acres that are classified "A", "B", or "C". These lands should be considered very suitable for agriculture. Using the ALISH rating system, there are 846,363 acres of "Prime", "Unique" or "Other" agricultural lands that are suitable for agriculture.[xlii]

As Table 7 shows, there has been a release of approximately 316,590 acres from crop farming, primarily sugar and pineapple, since 1960. While some of these lands have been absorbed by urban development and other agricultural uses – such as seed crops, forestry crops, macadamia nuts, and floriculture – much of the lands are fallow and are available on Oahu, Maui, Molokai, Lanai and Kauai.[xliii]

Table 7: Acreage in Crop in Hawaii between 1960 and 2010

Crop	1960	1989	1999	2010	Difference 1960-2010
Sugarcane	287,400	170,800	67,000	34,500	-252,900
Pineapple	96,500	32,700	21,000	1,350[xliv]	-96,500
Vegetables and Melons	3,445	5,000	8,200	2,700	-745
Fruits (Excluding Pineapples	2,142	7,400	8,100	4,100	1,958
Coffee	6,188	3,000	7,700	8,000	+1,812
Macadamia Nuts	3,515	22,300	19,900	17,000	+13,485
All other crops	NA	4,800	16,200	21,100	+16,300
TOTAL ACRES					-316,590

Coffee, fruits and macadamia nuts have shown an increase in acreage use since 1960.

According to Decision Analysts Hawaii, Inc., "the acreage released from plantation agriculture has far outpaced the demand for land for diversified crops. The net decrease of land in crop amounts to about 229,900 acres. While some of the released land has been converted or is scheduled to be converted to urban uses and tree plantations, an estimated 160,000+ acres remain available for diversified crops.[xlv]

C. COUNTY OF MAUI

The County of Maui has approximately 402,354 acres within the State Agricultural District, approximately 244,088 of which, or 61%, are located on Maui).[xlvi]

Table 8 identifies the approximate acreage of productive agricultural lands on the island of Maui using the LSB and ALISH rating systems:[xlvii]

Table 8: Hawaii's Important Agricultural Lands by Rating System

Hawaii's Important Agricultural Lands by Rating System	*Acres*	*Percentage of State Ag District Lands on Maui*
University of Hawaii Land Study Bureau (LSB) Lands Lands Rated "A", "B", "C"	82,592	34
Agricultural Lands of Importance to the State of Hawaii (ALISH) Prime, Unique, Other	149,242	61

61% of the agricultural lands on Maui are rated Prime, Unique or Other by ALISH.

Table 9 identifies the amount of zoned agricultural acreage on Maui in each of the five LSB classifications, historical use of these lands, ALISH and LESA ratings, and other suitable agricultural uses.[xlviii]

Table 9: Maui Island's LSB Designated Agricultural Lands

LSB Overall Productivity Rating	Acres	Dominant Historical Crop (s)	Other Historical Crop (s)	Other Ratings ALISH / LESA		Crop Suitability (P, V, S, O, F)[3]	Grazing Suitability
A	31,650	Sugarcane	Field Crops	Yes	Yes	Very Highly Suitable	Very Highly Suitable
B	17,378	Sugarcane	Pineapple, Orchards, Field Crops, Animal Husbandry	Yes	Yes	Highly Suitable	Highly Suitable
C	33,554	Pineapple	Sugarcane, Orchards, Field Crops	Yes	Yes	Suitable	Highly Suitable
D	39,029	Animal Husbandry, Field Crops	Pineapple, Sugarcane	Yes; No	Yes; No	Somewhat Suitable	Suitable
E	114,845	Animal Husbandry	Sugarcane	Yes; No	Yes; No	Limited Suitability	Suitable

82,582 Acres, almost 35%, of Maui Island's LSB designated acreage is classified as A, B, or C.

[3] Pineapple, Vegetable, Sugarcane, Orchards, and Forestry

D. AVAILABILITY OF AGRICULTURAL LANDS ON MAUI

As discussed, in Maui County there are 402,354 acres within the State Agricultural District and 61% of these lands, or 244,088 acres, are on Maui. Using the LSB rating system, on Maui alone there are approximately 82,592 acres that are classified "A", "B", or "C". These lands should be considered very suitable for agriculture. Using the ALISH rating system, there are 82,592 acres of "Prime", "Unique" or "Other" agricultural lands on Maui.[xlix]

As Table 10 shows, there has been a release of approximately 64,150 acres from crop farming, primarily sugar and pineapple, since 1960 within Maui County.[l] While some of these lands have been absorbed by urban development and other agricultural uses – such as seed crops, forestry crops, macadamia nuts, and floriculture – much of this land is fallow and is spread throughout the islands of Maui, Molokai, and Lanai.

On the island of Maui, there were three sugar plantations in operation until the 1980s: Wailuku Sugar Company, Pioneer Mill and Hawaiian Commercial & Sugar Company (HC&S). In 1988, Wailuku Sugar Company harvested its last crop of sugar. Of the approximate 4,500 acres it had in sugar in 1979, approximately 1,350 were planted in macadamia nuts, some was urbanized, and much of the remainder was fallow, in sugar or diversified crops. Pioneer Mill had about 6,867 acres in production until 1999, when the last crop was harvested.[li] Today, much of the 6,867 acres of former cane land remains fallow but is under pressure for urbanization and the development of two-acre rural/residential lots. In December 2009, Maui Land & Pineapple Company harvested its last pineapple crop. Of the approximate 20,000 acres that were in pineapple production in 1995, only about 1,350 acres are in pineapple production today.[lii] Of the lands released from pineapple, a small amount has been transitioned to diversified crops and some has been developed as rural/residential lots or is planned for urban use. However, much of this former pineapple land is available for agricultural use in West, East and Upcountry Maui.

Table 10: Acreage in Crop in Maui County between 1987 and 2010

Crop	1960	1987	1997	2010	Difference 1960-2010
Sugarcane	53,700	43,900	43,100	34,500	-19,200
Pineapple	48,900	23,700	9,100	1,350	-47,550
Vegetables and Melons	N/A	2,200	1,400	700	-1,500
Fruits (Excluding Pineapples	N/A	100	300	600	+500
Coffee	N/A	NA	NA	NA	NA
Macadamia Nuts	N/A	1,300 (wai ag)	NA	NA	Na
All other crops	NA	1,600	1,200	5,200	+3,600
TOTAL ACRES					-64,150

64,150 acres of agricultural land in Maui County has come out of production since 1960.

As discussed, within Maui County a significant amount of land once planted in sugar and pineapple is now fallow. Much of this land is available for diversified agriculture. On the island of Maui, HC&S is still farming over 34,000 acres of sugarcane. Most of the release of agricultural lands over the past two decades has come from the closure of Wailuku Sugar Company and Pioneer Mill and the dramatic reduction in land used for pineapple production. While some of the lands released from sugar and pineapple have been urbanized or are planned for urban development, most of this agricultural land is available for new crops.

1. **Agricultural Parks in Maui County**

   The State Department of Agriculture currently manages 10 agricultural parks in Hawaii. These parks are located on Oahu, Kauai, Hawaii and Molokai. The County of Maui operates Maui's only agricultural park. The purpose of agricultural parks is to facilitate diversified agriculture by offering high quality agricultural lots for long-term lease at affordable rents. According to the State Department of Agriculture's website, of the State's ten agricultural parks, which comprise 3,123 acres and 227 lots, only 2 lots are currently available. These lots are at the Waianae Agricultural Park on Oahu.[liii]

There are two public Agricultural Parks in Maui County:

- Kula Agricultural Park.

  The Kula Agricultural Park comprises 445 acres in Upcountry Maui and is the only agricultural park on Maui. The Park provides farm lots that range from 10 to 30 acres. According to the County's Office of Economic Development, the Park's purpose is to "promote the development of diversified agriculture by providing appropriately sized agricultural lots at reasonable rent with long-term tenure thereby contributing to the economic growth of our agricultural industry".[liv] There are currently 26 farmers leasing land at the park. However, there are no lots available at the park.

- Molokai Agricultural Park

  The State Department of Agriculture manages the only agricultural park on Molokai. The Molokai Agricultural Park comprises 753 acres that are subdivided into 22 lots. According to the State Department of Agriculture website, there are no lots available at the park.

2. Agricultural Lands Proposed for Urban Development in the MIP

In December, 2012, Maui County adopted the Maui Island Plan (MIP)[lv] to plan for, manage and direct growth through the year 2030. The MIP's housing projections were based on population projections prepared by the State Department of Business Economic Development & Tourism (DBEDT) and a detailed land use forecast prepared by Plan Pacific, Inc. and the Department of Planning's Long-range Planning Division. According to the Land Use Forecast, there is demand for an additional 29,589 housing units through 2030. Of these units, approximately 18,744 are already entitled (i.e. have the appropriate zoning, and 10,845 are not yet entitled).

To accommodate the projected population growth through 2030, the MIP places approximately 7,718[4] acres of State Agricultural District lands into "Urban" and "Rural" growth boundaries.

3. Impact of the MIP on Agricultural Land Availability

Despite the MIP's planned long-term urbanization of agricultural lands, there is still a considerable amount of agricultural land that will be available for farming and ranching on Maui. The MIP's planned urbanization represents just three (3) percent of the agricultural lands on Maui and just 1.9% of all agricultural lands within the County. Moreover, as discussed in the prior section, since 1960 approximately 64,000 acres of productive agricultural lands have been taken out of crop production, mostly from sugar and pineapple. Much of these lands remain fallow or are being used for grazing and other low intensity agricultural uses.

The Maui Agricultural Development Plan (July, 2009), prepared by the Maui County Farm Bureau in association with the County of Maui, Office of Economic Development states in part,

> "Since much of Maui's most productive lands are used for land extensive sugarcane, pineapple[5], and ranching, and much of what remains has experienced tremendous land value appreciation due to urban encroachment of residential uses, access to affordable long-term tenure is a significant impediment to industry growth."
>
> "For Maui's agricultural industry to realize sustained growth, existing farmers wishing to expand their operations and new farmers desiring to

[4] This includes the 502 acres of WCT lands placed within Urban and Rural growth boundaries

[5] Since the publication of the Agricultural Development Plan, much of the production of pineapple on Maui has ceased. As noted, of the 9,100 acres of land in pineapple in 1997, just 1,350 acres remain in pineapple.

enter the market must have access to land at a cost and terms that will allow a reasonable opportunity for profitability".

"Land must also be available with long-term tenure so that high up-front capital costs in new crops, equipment, and infrastructure can be amortized over many growing seasons." [lvi]

While there is an abundant supply of currently fallow and productive agricultural land on Maui and within the State of Hawaii, providing long-term and affordable tenure to these lands for small and medium sized farmers impedes agricultural development on Maui. The current shortage of available agricultural park lots is symptomatic of this issue.

E. CONCLUSIONS

There are 1.93 million acres within the State Agricultural District. Since 1960, there has been a release of approximately 316,590 acres from crop farming, primarily sugar and pineapple. While some of these lands have been absorbed by urban development and other agricultural uses – such as seed crops, forestry crops, macadamia nuts, and floriculture – much of the lands are fallow and are available on Oahu, Maui, Molokai, Lanai and Kauai.[lvii]

The County of Maui has approximately 402,354 acres within the State Agricultural District, approximately 244,088 of which, or 61%, are located on Maui.[lviii] Using the LSB rating system, on Maui alone there are approximately 82,592 acres that are classified "A", "B", or "C". These lands should be considered very suitable for agriculture. Using the ALISH rating system, there are 82,592 acres of "Prime", "Unique" or "Other" agricultural lands on Maui.[lix] Since 1960, here has been a release of approximately 64,150 acres from crop farming, primarily sugar and pineapple, within Maui County.[lx] While some of these lands have been absorbed by urban development and other

agricultural uses – such as seed crops, forestry crops, macadamia nuts, and floriculture – much of this land is fallow and is spread throughout the islands of Maui, Molokai, and Lanai.

According to the State Department of Agriculture's website, of the state's ten agricultural parks, which comprise 3,123 acres and 227 lots, only 2 lots are currently available. These lots are on Oahu. Within Maui County, there are no agricultural lots available at either Molokai Agricultural Park or at the County owned and managed Kula Agricultural Park.

To accommodate the projected population growth through 2030, the MIP places approximately 7,718[6] acres of State Agricultural District lands into "Urban" and "Rural" growth boundaries. Despite the MIP's planned long-term urbanization of agricultural lands, there is still a considerable amount of agricultural land that will be available for farming and ranching on Maui. The MIP's planned urbanization represents just three (3) percent of the agricultural lands on Maui and just 1.9% of all agricultural lands within the County.

While there is an abundant supply of currently fallow and productive agricultural land on Maui and within the State of Hawaii, providing long-term and affordable tenure to these lands for small and medium sized farmers impedes agricultural development on Maui. The current shortage of available agricultural park lots is symptomatic of this issue.

[6] This includes the 502 acres of WCT lands placed within Urban and Rural growth boundaries

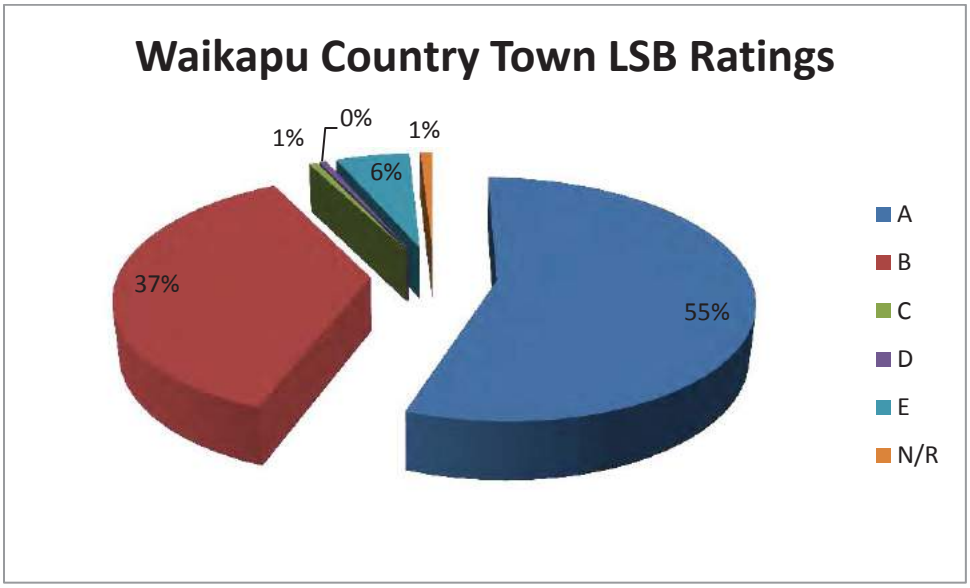
V. AGRICULTURAL IMPACT OF THE PROPOSED PROJECT

A. WAIKAPU COUNTRY TOWN'S EXISTING AGRICULTURAL RESOURCES

1. Land

The Waikapu Country Town comprises approximately 1,675 acres, 50 acres of which are within the State Urban District, and the remaining land is within the State Agricultural District. As Figures 17a-b and 18a-b show, WCT agricultural lands are rated very highly by the LSB and ALISH rating systems. Approximately 92% of WCT agricultural lands, or 1,495 acres, are rated "A" or "B" by the LSB. According to the ALISH rating system, 97%, or 1,576 acres, is "Prime" agricultural land.

Figure 17a: Waikapu Country Town LSB Ratings



Approximately 92% of WCT agricultural lands are rated A or B by LSB.

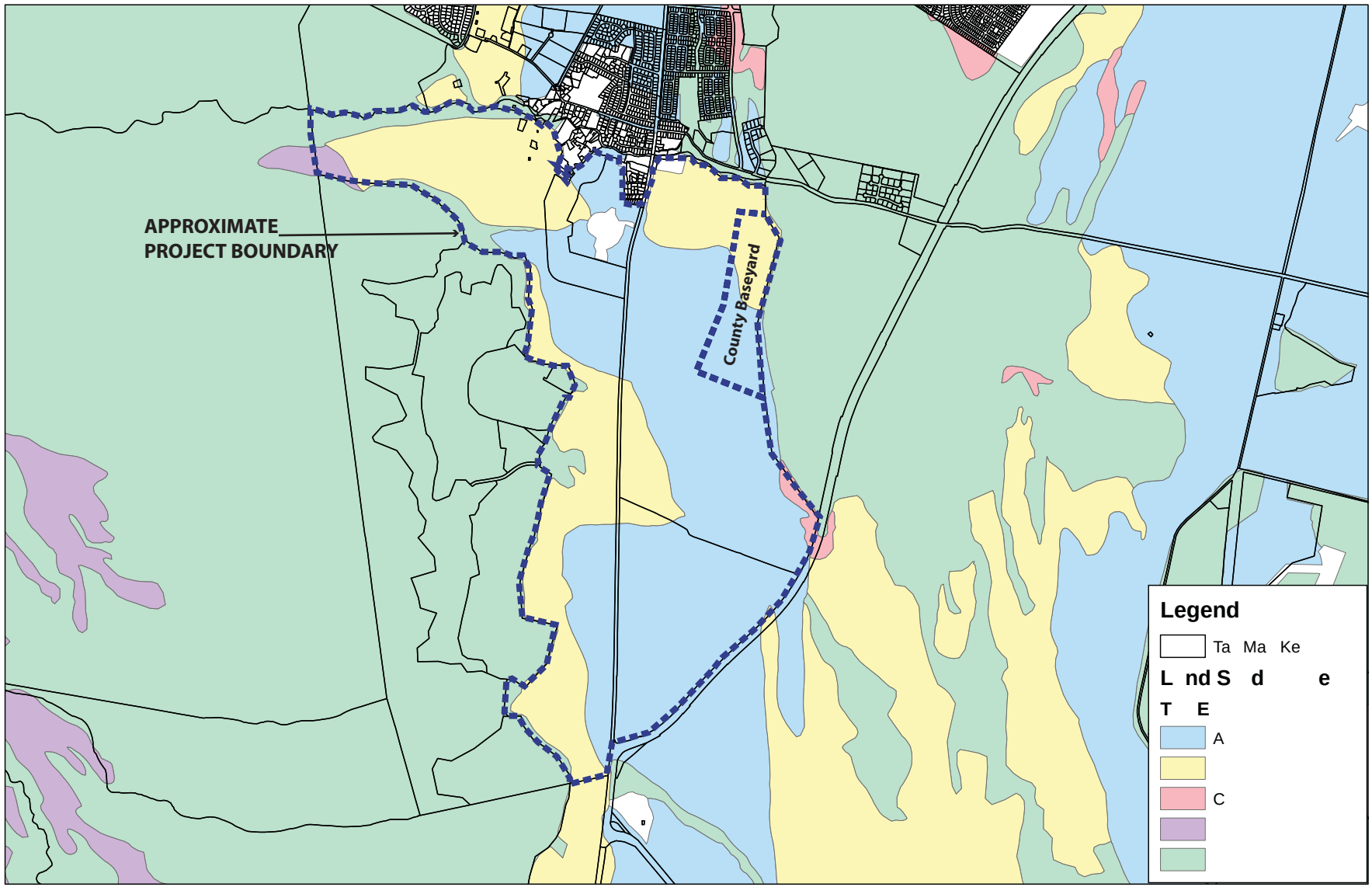


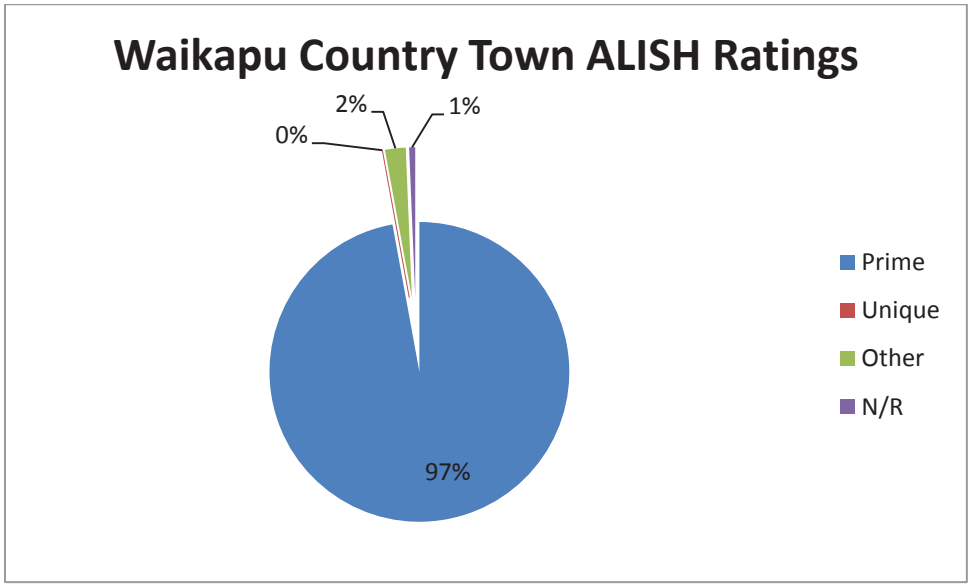
FIGURE 17b
LAND STUDY BUREAU
DETAILED LAND CLASSIFICATION

Not to Scale

WAIKAPU COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

Figure 18a: Waikapu Country Town ALISH Ratings



97% of Waikapu Country Town agricultural acres are designated Prime by ALISH.

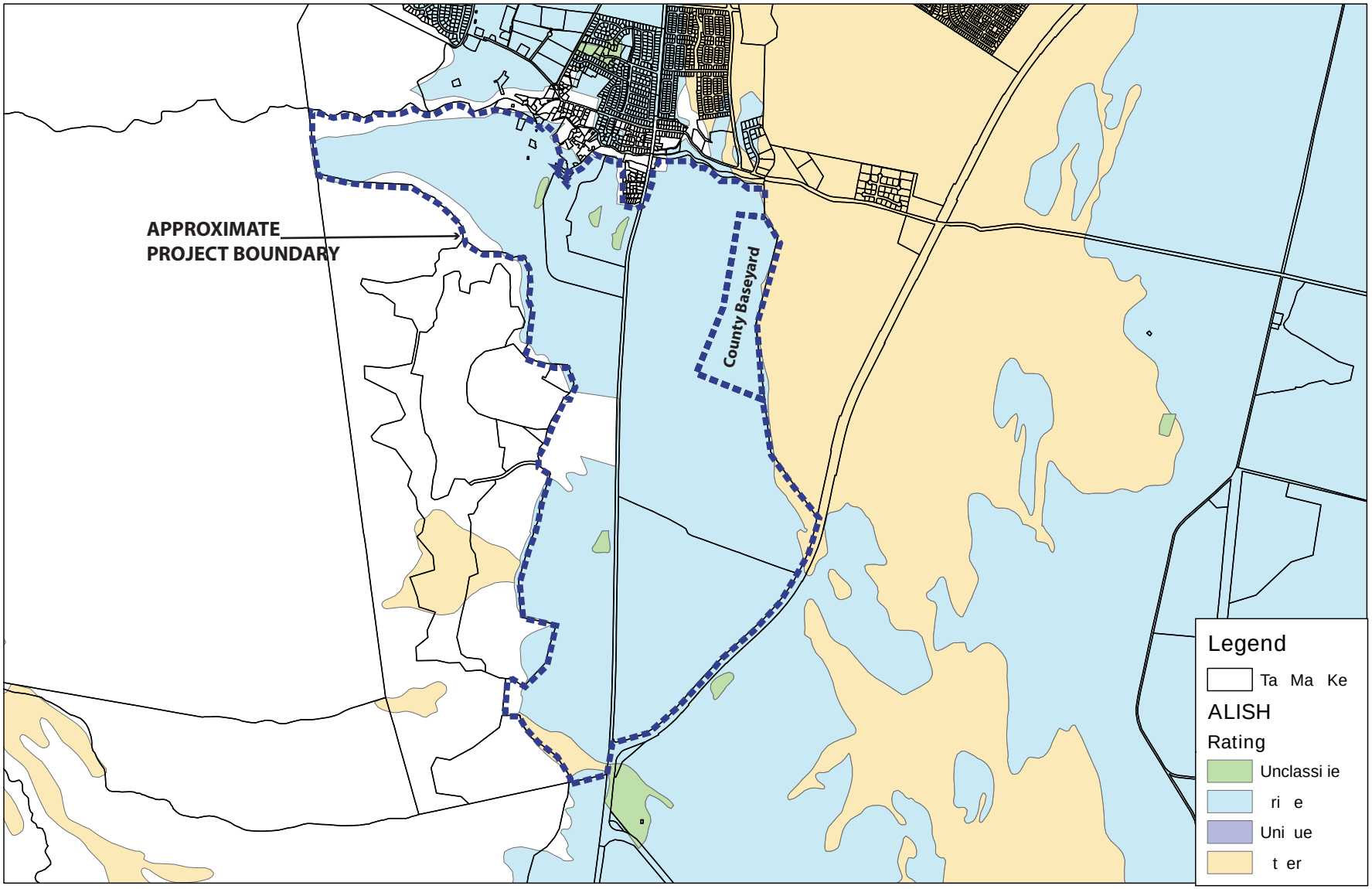


FIGURE 18b

AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAII

Not to Scale

WAIKAPU COUNTRY TOWN

PLANNING CONSULTANTS HAWAII, LLC

2. Soil Types

As shown in Figure 19, the project site consists of 11 soil types. Table 11 describes each soil type.[lxi]

Table 11: Waikapu Country Town Soil Types

Waikapu Country Town Soils Types
Ewa silty clay, 3 to 7 percent slopes (ESB)
This is considered prime farmland if irrigated. It occurs at elevations of 0 to 150 feet with slopes that range from 3 to 7 percent. It is a well-drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 18 inches of Silty clay and 18 to 60 inches of Silty clay loam. The available water capacity is moderate at about 7.8 inches.
Iao clay, 3 to 7 percent slopes
This is considered prime farmland if irrigated. It occurs at elevations of 100 to 500 feet with slopes that range from 3 to 7 percent. It is a well-drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 15 inches of Clay, 15 to 48 inches of Clay, and 48 to 60 inches of Silty clay. The available water capacity is moderate at about 8.4 inches.
Pulehu silt loam, 0 to 3 percent slopes (PpA)
This is considered prime farmland if irrigated. It occurs at elevations of 0 to 300 feet with slopes that range from 0 to 3 percent. It is a well drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 21 inches of Silt loam and 21 to 60 inches of Silty clay loam. The available water capacity is moderate at about 8.4 inches.
Pulehu silt loam, 3 to 7 percent slopes (PpB)
This is considered prime farmland if irrigated. It occurs at elevations of 0 to 300 feet with slopes that range from 3 to 7 percent. It is a well drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 21 inches of Silt loam and 21 to 60 inches of Silty clay loam. The available water capacity is moderate at about 8.4 inches.

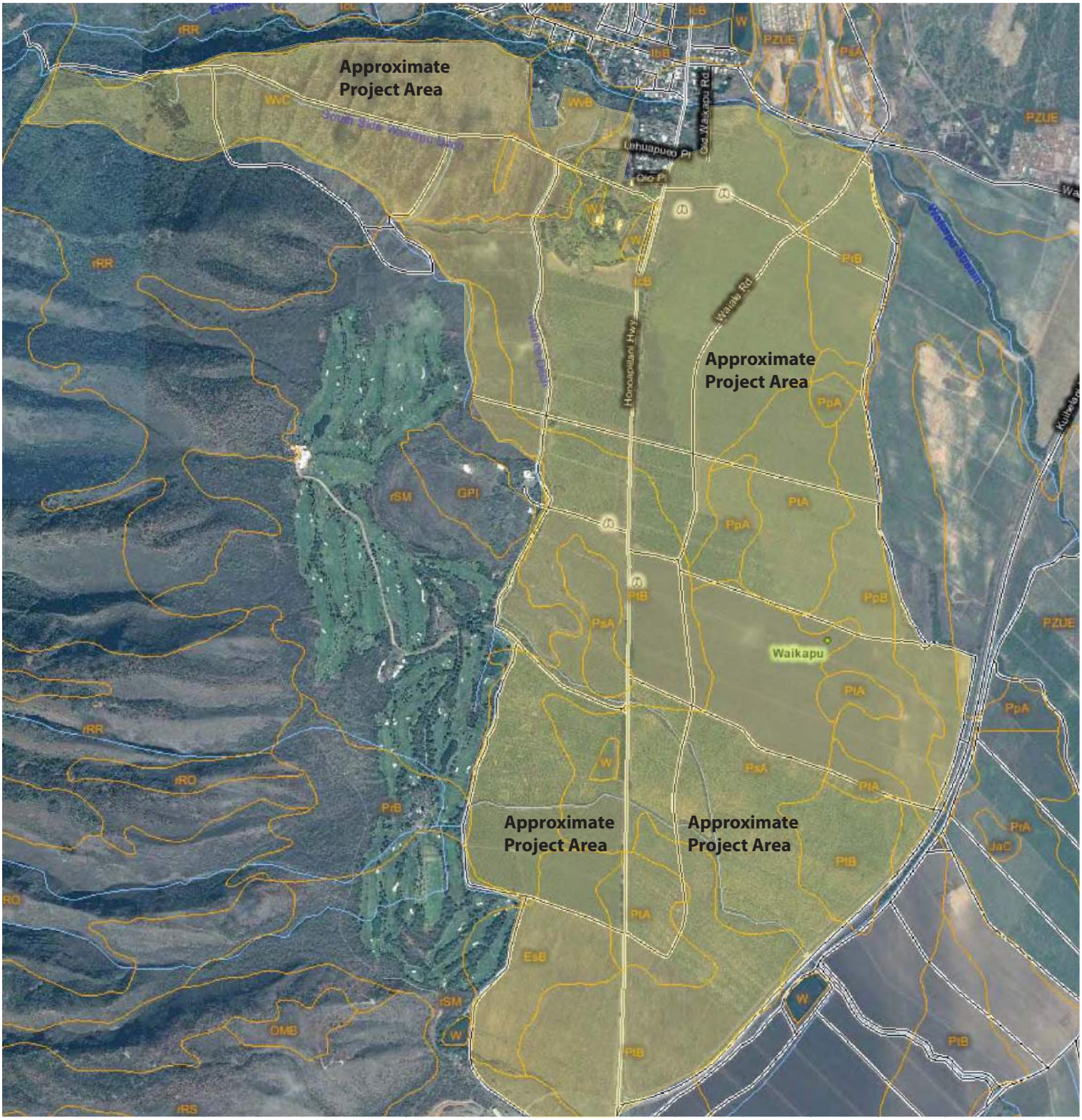


Figure 19

Maui Island Plan
USDA Soils Map

Not to Scale

WAIKAPU COUNTRY TOWN

PLANNING
CONSULTANTS
HAWAII, LLC

Pulehu cobbly silt loam, 3 to 7 percent slopes (PrB)
This is considered prime farmland if irrigated. It occurs at elevations of 0 to 300 feet with slopes that range from 3 to 7 percent. It is a well drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 21 inches of Cobbly silt loam and 21 to 60 inches of Silty clay loam. The available water capacity is moderate at about 7.5 inches.
Pulehu clay loam, 0 to 3 percent slopes (PsA)
This is considered prime farmland if irrigated. It occurs at elevations of 0 to 300 feet with slopes that range from 0 to 3 percent. It is a well drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 21 inches of Clay loam and 21 to 60 inches of Silty clay loam. The available water capacity is moderate at about 8.4 inches.
Pulehu cobbly clay loam, 0 to 3 percent slopes (PtA)
This is considered prime farmland if irrigated. It occurs at elevations of 0 to 300 feet with slopes that range from 0 to 3 percent. It is a well drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 21 inches of Cobbly clay loam and 21 to 60 inches of Silty clay loam. The available water capacity is moderate at about 7.5 inches.
Pulehu cobbly clay loam, 3 to 7 percent slopes (PtB)
This is considered prime farmland if irrigated. It occurs at elevations of 0 to 300 feet with slopes that range from 3 to 7 percent. It is a well drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 21 inches of Cobbly clay loam and 21 to 60 inches of Silty clay loam. The available water capacity is moderate at about 7.5 inches.
Water > 40 acres (W)
Water bodies greater than 40 acres.
Wailuku silty clay, 3 to 7 percent slopes

This is considered prime farmland if irrigated. It occurs at elevations of 50 to 1000 feet with slopes that range from 3 to 7 percent. It is a well drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 12 inches of Silty clay and 12 to 60 inches of Silty clay. The available water capacity is moderate at about 8.4 inches.
Wailuku silty clay, 7 to 15 percent slopes
This is considered prime farmland if irrigated. It occurs at elevations of 50 to 1000 feet with slopes that range from 7 to 15 percent. It is a well drained soil that is more than 80 inches in depth. The typical soil profile is 0 to 12 inches of Silty clay and 12 to 60 inches of Silty clay. The available water capacity is moderate at about 8.4 inches.

3. Elevation and Slopes

The project site generally slopes from west to east with a high elevation of approximately 200-feet at the northwest corner of the property to a low point of approximately 20-feet above mean sea level at the southeastern corner of the property.

Slopes across most of the property are mild and range from 3% to 7%. At the higher elevations the slopes increase to about 10%.

4. Solar Radiation

The project site receives a significant amount of sunshine throughout the year. The average daily solar radiation received across the project site ranges from a low of approximately 350 solar calories per square centimeter per day at the higher elevations to a high of 450 solar calories per square centimeter per day at the lower elevations.

5. Rainfall

The project site receives its highest rainfall during the winter and lowest rainfall during the summer. Throughout the year rainfall is relatively low, averaging approximately 20- to 30-inches per year, with the monthly average ranging from 0.25 inches in August to approximately 5-inches in January.

6. Temperatures

Central Maui's coldest month is February when the average nighttime temperature drops to 63.1°F. The warmest month is September with the average day time temperature rising to 88.1°F.

7. Winds

The project site experiences relatively strong trade winds that blow from north to south across the isthmus and out to sea. At 30-feet above the ground, wind speeds across the site range from approximately 5.5 meters per second to 7.5 meters per second, which is approximately 12 to 17 miles per hour.

8. Irrigation Water

The MTP currently receives its agricultural water from the Wailuku Water Company (WWC). WWC delivers water to MTP and HC&S from the Iao-Waikapu Ditch via the Waihee Ditch, the Waihee Ditch below the Hopoi Chute, and the South Waikapu Ditch. Water to irrigate HC&S's fields that are leased from the Atherton Group, approximately 1,230 acres known as the "Iao-Waikapu Fields", is from the Iao Stream via the Iao-Waikapu Ditch and Waikapu Stream via the South Waikapu Ditch and Waihee Ditch. HC&S reportedly uses between 8 and 10 mgd of ditch water to irrigate its Iao-Waikapu fields.

9. Road Access

Access to the property is from Honoapiilani Highway. Within the highway, agricultural roads provide access throughout the site.

B. PRIOR AGRICULTURAL USE

Historically, WCT's lands were owned by Wailuku Agribusiness before being sold to the current owner in 2006. WCT land has been farmed since pre-contact, with taro cultivation occurring along the Waikapu Stream. During the sugar boom of the late 1800s, WCT land was placed into

sugar production. Wailuku Sugar Company grew sugarcane on the lands until 1988. Thereafter, the Maui Land & Pineapple Company leased land for pineapple production and HC&S leased land both mauka and makai of Honoapiilani Highway to supplement its sugar production. Pineapple ceased to be farmed on the property in about 1997. Meanwhile, HC&S continues to lease 1,230 acres for sugarcane.

C. CURRENT AGRICULTURAL USE

1. HC&S.

Alexander & Baldwin (A&B), owners of HC&S, began producing sugar in Central Maui as far back as 1870. Today, HC&S is Hawaii's sole sugar plantation and the state's largest farm, with over 36,000 acres in cultivation and approximately 754 employees. The firm's business pursuits include growing and milling sugar cane, producing raw sugar and specialty food grade sugars, producing molasses and generating and selling electricity generated from cane fiber.

In 2010, HC&S produced 171,800 tons of raw sugar, which was equivalent to 5% of the U.S. production. The farm also produced 52,800 tons of molasses, which it sells as feedstock for the livestock industry. HC&S also generates power by burning residual cane fiber in its generating plants

HC&S owns 32,400 acres and leases 1,450 acres from the State and approximately 1,230 acres from the Applicant (Waikapu Properties LLC and Waiale 905 Parterns LLC). HC&S is a major water user using approximately 200 million gallons per day (MGD) for irrigation.

2. Kumu Farms

Kumu Farms was established in Hawaii in 1980. Its founder and owner, Mr. Gram Schmlle, first established the farm on Oahu's North Shore, but quickly moved his operation to the Molokai Agricultural Park.

Today, Kumu Farms is one of the largest certified organic producers in the State of Hawaii and the only exporter of fresh organic papaya to the U.S. Mainland Market. The Molokai farm spreads over 120 acres and produces over 20,000 pounds of papayas, 4,000 pounds of sweet basil, 500 pounds of fresh herbs, and specialty fruit and vegetable crops. Kumu Farms also produces value added products, including lotion and a pesto line. Kumu products are sold on Maui, Oahu and the U.S. Mainland. Products are marketed directly to consumers at the Farm's on-site store as well as on-line. Products are also sold to wholesalers and retailers such as Armstrong Produce and Whole Foods.

In 2012 Mr. Schmlle expanded his farm to the MTP. The MTP farm is on 75 acres and grows mixed-fruits, vegetables, and herbs. Like the Molokai farm, the MTP's products are sold on-site at a farm stand as well as on-line and directly and indirectly to restaurants and retail stores.

3. Hawaii Taro Farm LLC

Hawaii Taro Farm LLC is owned by Robert Pahia. Mr. Pahia was an agricultural researcher at the University of Hawaii for over 20 years. He has 20 years of farming experience in a variety of crops, including taro, vegetables, banana, sweet potato and melons.

Hawaii Taro Farm LLC has been at the MTP since 2009. The 68 acre farm is producing dry-land taro, sweet potato, and banana. Its primary market is Maui, but products are also sold on Oahu.

4. Mr. Michael Atherton, Coffees of Hawaii; Cerro de Jesus Coffee Plantation Nicaragua; Part Owner of the MTP and abutting Agricultural Lands

Mr. Atherton comes from a farming and ranching family in northern California. He established the Cerro de Jesus (Jesus Mountain) coffee plantation in Nicaragua in 1972. The plantation produces specialty coffee, including several Arabica varieties, like Bourbon, Caturra, Catuai Rojo and Pacamara, on approximately 1,000 acres with over a million trees

planted. Mr. Atherton also owns Coffees of Hawaii, which sells coffee from Molokai, Maui and Kona, as well as blends that utilize his Nicaraguan beans. Mr. Atherton owns approximately 100 acres of coffee trees on Molokai.

In addition to coffee farming, Mr. Atherton has experience raising cattle. Mr. Atherton has a small herd of Texas Long-horn cattle that graze on the MTP.

D. IMPACT OF THE PROJECT ON AGRICULTURE

1. Loss of State and County Agricultural Lands

As discussed, the project will result in the conversion of approximately 450 acres of prime agricultural land to urban and rural use. It should be assumed that once urbanized the opportunity to use these lands for commercial agriculture will be irrevocably lost.

As described, the loss of approximately 450 acres of prime agricultural land caused by the subject development represents a very small percentage of agricultural lands statewide and on Maui, as is shown below:

- There are approximately 2 million acres in the State Agricultural District. The subject development represents just .022% of this area.
- There are approximately 846,363 acres of agricultural lands state-wide rated by ALISH as Prime, Unique or Other. The subject development represents just .053% of these lands.
- There are approximately 447,250 acres of agricultural lands state-wide rated by the LSB as A, B, or C. The subject development represents just .10% of these lands.
- On Maui, there are approximately 82,582 acres of agricultural lands rated by the LSB as A, B, or C. The subject development represents just .54% of these lands.

- Within Maui County, approximately 64,000 acres has been released from crop production since 1987. The subject development represents just .7% of these lands.

However, to mitigate the loss of prime agricultural lands caused by urbanization, the Applicant will permanently protect 800 acres of prime farm land through a conservation easement. As noted above and in Sections III.B and IV of this report, there is a considerable amount of agricultural land throughout the state that is fallow. However, despite the availability of land, the ability of farmers to secure access to affordable lands for long-term tenure is still an impediment to agricultural development. High land costs, coupled with high labor costs, transportation costs, and energy costs are among the most significant barriers to Hawaii's agricultural development.

By establishing an agricultural park on agricultural lands surrounding the proposed Waikapu Country Town, the project will provide farmers with long-term access to agricultural land at an affordable rate. As noted, there are 3,123 acres and 227 lots within the State of Hawaii's agricultural parks, but only two lots are currently available. In Maui County there are no agricultural park lots available at either the Molokai Agricultural Park or the Kula Agricultural Park. The proposed agricultural park will expand the opportunity for Maui farmers to gain access to highly productive Central Maui agricultural lands. These lands provide easy market access to Maui's primary population centers and to major air and seaport facilities.

2. Impact of the Project on Existing Agricultural Operations

On May 17, 2013, Kumu Farms, Hawaii Taro LLC, and land owner and farmer Michael Atherton were interviewed to determine the potential impact of the project upon their agricultural operations. On June 26, 2013, an interview was conducted with HC&S to discuss the impact of the project on their sugar business.

During the interview it was explained that no lands would be urbanized for at least three years while entitlements and building permits are being obtained. Thereafter, urbanization would occur in phases at a rate determined by market demand. It was acknowledged that lands currently being farmed could be impacted by the development over the next five to 10 years.

Both Kumu Farms and Hawaii Taro LLC desire to shift their farms to the MTP's private agricultural park as urban development is phased in. They anticipate that, together with other farmers, the Park could encompass several hundred acres. Most of each farm's future production will be sold to the Maui market, but production is also expected to be shipped to Oahu and the Mainland.

Land owner Michael Atherton is grazing Texas Long-Horn cattle on the property. Mr. Atherton indicated that the herd will likely remain on the mauka agricultural lands above the existing MTP even after urbanization occurs on the makai lands. Mr. Atherton also intends to plant an orchard of coffee trees. The orchard will be located outside of the urban and rural growth boundaries on existing agricultural lands. The beans will be marketed and sold under the Coffees of Hawaii label.

HC&S is farming 1,230 acres of MTP lands. These lands are leased on a 10-year term, which is due to expire for some of the lands, but is being renegotiated for a new 10-year term. MTP leased lands comprise approximately 3.6% of HC&S lands that are in production. Of the 1,230 acres leased by HC&S, approximately 330 acres will eventually be urbanized over an approximate 20-year build-out. In addition, about 75 acres currently in cane production may be used to establish a portion of the agricultural park discussed in this report. The agricultural park would also comprise agricultural lands not currently in cane production, which are located mauka (west) and south of the existing MTP.

HC&S desires to continue farming MTP lands. The farm's General Manager, Mr. Rick Volner, noted that MTP lands are highly productive with access to a reliable source of water. Mr. Volner noted that the amount of acres to be urbanized is very small relative to the total number of acres being farmed by HC&S. However, since HC&S is a commodity farmer the profitability of the plantation depends upon having sufficient economy of scale in its production. The incremental loss of agricultural land is therefore a concern to the plantation; however, Mr. Volner noted that HC&S has access to other, currently fallow, lands and that the Plantation's viability will not be significantly impacted by the urbanization of the subject MIP lands.

An additional concern of the Plantation is urban development that is located within close proximity of its fields. Land use conflicts, such as the impact of dust, noise, and smoke from cane burning, can be a problem if not carefully managed. However, Mr. Volner noted that the subject property is upwind of its fields and that the consistent trade winds will help to mitigate such impacts. Mr. Volner also noted that cane burning is carefully managed in order to minimize its impact to neighboring residential communities.

3. Impact of the Project on Future Agricultural Opportunities

   As discussed in this report, the impact of the proposed urbanization on future agricultural opportunities should be minimal since other lands are currently available throughout the State and County.

   As noted, a significant impediment to agricultural development on Maui, and throughout the State, is the scarcity of affordable agricultural land that is readily available and affordable for long-term lease to diversified farmers. The project's agricultural component includes nearly 1,100 acres of agricultural land, 800 acres of which will be permanently dedicated to agricultural use with no residential structures to be permitted. The long-term vision for this land is to establish a private agricultural

park. This park will be anchored by highly qualified farmers, such as Kumu Farms, Coffees of Hawaii and Hawaii Taro LLC. Future agricultural users will have the opportunity to grow crops ranging from fresh vegetables and fruits, to taro, coconuts, coffee and kakau. It is expected that sugarcane, bio-fuels or cattle will also be major agricultural land users.

E. CONCLUSIONS

The Waikapu Country Town comprises approximately 1,675 acres, of which 50 acres are within the State Urban District and the remaining land is within the State Agricultural District. Approximately 92% of WCT agricultural lands, or 1,495 acres, are rated "A" or "B" by the LSB. According to the ALISH rating system, 97%, or 1,576 acres, is "Prime" agricultural land. The MTP, and surrounding HC&S fields, currently receive agricultural water from WWC. HC&S's Iao-Waikapu fields, which are leased from the Atherton Group, reportedly use between 8 to 10 mgd of irrigation water.

The loss of approximately 450 acres of prime agricultural land caused by the subject development represents a very small percentage of agricultural lands statewide and on Maui. There are approximately 2 million acres in the State Agricultural District. The subject development represents just .022% of this area. On Maui, there are approximately 82,582 acres of agricultural lands rated by the LSB as A, B, or C. The subject development represents just .54% of these lands. Within Maui County, approximately 64,000 acres has been released from crop production since 1987. The subject development represents just .7% of these lands.

There are currently three commercial farms farming MTP lands. These include Kumu Farms, Hawaii Taro LLC, and HC&S. The proposed urbanization will require both Kumu Farms and Hawaii Taro LLC to relocate their agricultural operations to the proposed agricultural park. It is anticipated that this might occur in about five to ten years. The

project will also impact the current lands being leased by HC&S. It is anticipated that these lands will gradually begin to be impacted in about five to ten years. Over the long-term, HC&S may lose approximately 330 acres to urbanization and up to 75 acres for a private agricultural park. According to HC&S General Manager Mr. Rick Volner, HC&S would desire to continue farming its lands to maximize its current economy of scale in production. However, Mr. Volner acknowledged that HC&S has additional lands available that are currently fallow and the subject project will not impact the Plantation's long-term viability.

A significant impediment to agricultural development on Maui, and throughout the State, is the scarcity of affordable agricultural land that is readily available and affordable for long-term lease to diversified farmers. The project's agricultural component includes nearly 1,100 acres of agricultural land, 800 acres of which will be permanently dedicated to agricultural use with no residential structures to be permitted. Several hundred acres of MTP agricultural lands may be developed as a private agricultural park to help facilitate Maui's agricultural development. The establishment of a strategic and centrally located agricultural park, with the availability of highly productive agricultural land and affordable irrigation water, should significantly bolster the ability of Maui farmers to compete in local, mainland and international markets.

VI. CONSISTENCY WITH STATE AND COUNTY AGRICULTURAL POLICIES

A. STATE AGRICULTURAL LAND USE POLICY

1. Hawaii State Plan and Hawaii State Functional Plans

The Hawaii State Plan and Hawaii State Functional Plans establish policy to protect the viability of the State's sugar and pineapple industries, support the growth of diversified agriculture, and protect productive agricultural lands from development. Hawaii State Plan policies that are directly relevant to the proposed action include those listed below:

Hawaii State Plan, Chapter 226, HRS Part 1. Overall Themes, Goals, Objectives and Policies
Chapter 226-7 Objectives and policies for the economy-agriculture.
Objectives; Planning for the State's economy with regard to agriculture shall be directed toward achievement of the following objectives:
Objectives:
(1) Viability of Hawaii's sugar and pineapple industries.
(2) Growth and development of diversified agriculture throughout the State.
(3) An agriculture industry that continues to constitute a dynamic and essential component of Hawaii's strategic, economic, and social well-being.
(10) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.
(12) Expand Hawaii's agricultural base by promoting growth and development of flowers, tropical fruits and plants, livestock, feed grains, forestry, food crops, aquaculture, and other potential enterprises.
(13) Promote economically competitive activities that increase Hawaii's agricultural self-sufficiency.
(c) Priority guidelines to promote the continued viability of the sugar and pineapple industries:
Priority Guidelines:
(1) Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.

(d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:
(1) Identify, conserve, and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands.
(7) Encourage the development and expansion of agricultural and aquacultural activities which offer long-term economic growth potential and employment opportunities.
(8) Continue the development of agricultural parks and other programs to assist small independent farmers in securing agricultural lands and loans.
(10) Support the continuation of land currently in use for diversified agriculture.
Chapter 226-104, HRS, Population Growth and Land Resources Priority Guidelines
(a) Priority guidelines to effect desired statewide growth and distribution:
Priority Guidelines:
(2) Make available marginal or nonessential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.
Chapter 226-106 Affordable housing. Priority guidelines for the provision of affordable housing:
Priority guidelines for the provision of affordable housing:
(1) Seek to use marginal or nonessential agricultural land and public land to meet housing needs of low- and moderate-income and gap-group households.

The Hawaii State Plan directs State agencies to prepare functional plans for their respective program areas. There are fourteen (14) State Functional Plans that serve as the primary implementing vehicle for goals, objectives and policies of the Hawaii State Plan. Hawaii State Functional Plan policies directly relevant to the proposed action include those listed below:

Hawaii State Functional Plans
Agriculture State Functional Plan
Objectives:

g. Achievement of effective protection and improved quality of Hawaii's land, water, and air.
h. Achievement of productive agricultural use of lands most suitable and needed for agricultural use.

Analysis: The Hawaii State Plan and State Functional Plans establish policy to protect the viability of the sugar and pineapple industries, protect agriculturally suitable lands for future needs, and promote the growth of diversified agriculture.

The proposed action will result in the urbanization of approximately 450 acres of productive agricultural land that are currently in sugar production. However, as documented in this report, the following provides sufficient justification for the proposed action:

- Approximately 245 acres, or 54% of the area, will be impacted by the County's planned Waiale By-pass Road. Once constructed, the by-pass road will make large-scale sugar farming considerably more difficult on those lands.
- A considerable amount of sugar and pineapple land throughout the State and within Maui County has been released from sugar and pineapple production over the last two decades. Within Maui County, the acreage released from crop production since 1987 is approximately 64,000 acres. The subject development represents just .7% of these lands. Thus, alternative agricultural lands are available to support future agricultural development.
- In consultation with HC&S, the Plantation's General Manager indicated that HC&S's financial viability will not be significantly impacted by the development and that other A&B lands, as well as former pineapple lands, can be utilized to make up for the lost sugar production.
- The recently adopted Maui Island Plan places the subject property within an urban growth boundary because of its proximity to infrastructure, public facilities, and employment. The Plan's population projections and land use forecast demonstrate a need for additional urban land through 2030.

- The land owner has committed to establishing an agricultural conservation easement, or similar mechanism, to permanently protect approximately 800 acres of prime agricultural land adjoining the south and western boundaries of the subject development; an additional 300 acres will remain within the State agricultural district and will be restricted to large lots.
- The land owner intends to establish a private agricultural park. The agricultural park will offer affordable and highly productive agricultural lots to diversified farmers.
- The existing diversified farmers, Kumu Farms and Hawaii Taro LLC, will be relocated to the agricultural park as development is phased in over the next 10 to 20 years.

B. COUNTY AGRICULTURAL LAND USE POLICY

The County of Maui's General Plan is comprised of the County-wide Policy Plan, Maui Island Plan and nine Community Plans. The County-wide Policy Plan is the overarching policy document for the County. The Maui Island Plan is a regional plan for the Island of Maui and is responsible for directing the island's future population growth, protecting the Island's natural and cultural resources, and locating large-scale intraregional infrastructure and public facility investments. The Community Plans define the character of community development, priority of sub-regional infrastructure and public facility investments, and needed policies and actions to protect sensitive environmental and cultural resources within each community plan area.

1. County-wide Policy Plan

The County-wide Policy Plan establishes a list of county-wide goals, objectives, policies, and implementing actions related to key strategies. The following County-wide Policy Plan goals, objectives and actions are directly relevant to the proposed action:

Countywide Policy Plan
Objective:

(2) Diversify and expand sustainable forms of agriculture and aquaculture.
Policies:
b. Prioritize the use of agricultural land to feed the local population, and promote the use of agricultural lands for sustainable and diversified agricultural activities.
d. Assist farmers to help make Maui County more self-sufficient in food production.
e. Support ordinances, programs, and policies that keep agricultural land and water available and affordable to farmers.
Implementing Actions:
c. Create agricultural parks in areas distant from genetically modified crops.
J. Promote Sustainable Land Use and Growth Management
Goal: Community character, lifestyles, economies, and natural assets will be preserved by managing growth and using land in a sustainable manner.
(2) Improve planning for and management of agricultural lands and rural areas.
Policies:
a. Protect prime, productive, and potentially productive agricultural lands to maintain the islands' agricultural and rural identities and economies.
Implementing Actions:
a. Inventory and protect prime, productive, and potentially productive agricultural lands from competing non-agricultural land uses.

2. Maui Island Plan

The Maui Island Plan serves as the regional plan for the Island of Maui. The Plan is comprised of the following ten elements: 1) Population; 2) Heritage Resources; 3) Natural Hazards; 4) Economic Development; 5) Housing; 6) Infrastructure and Public Facilities; 7) Land Use; 8) Directed Growth Plan; 9) Long Range Implementation Plan; and 10) Monitoring and Evaluation. Each element contains goals, objectives, policies and implementing actions. The Directed Growth Plan is intended to guide the location and general character of future urban

development and will direct zoning changes and guide the development of the County's short-term and long-term capital improvement plan budgets.

Maui Island Plan policies directly relevant to the proposed action include those listed below:

GOAL, OBJECTIVES, POLICIES, AND ACTIONS

Goal:

4.3 Maui will have a diversified agricultural industry contributing to greater economic, food, and energy security and prosperity.

Objective:

4.3.1 Strive for at least 85 percent of locally-consumed fruits and vegetables and 30 percent of all other locally-consumed foods to be grown in-State.

Policies:

4.3.1.a Strive to substitute food/agricultural product imports with a reliable supply of locally produced food and agricultural products.

4.3.1.b Facilitate and support the direct marketing/sale of the island's agricultural products to local consumers, through farmers markets and similar venues.

4.3.1.c Encourage growing a diverse variety of crops and livestock to ensure the stewardship of our land while safeguarding consumer safety.

Implementing Actions:

4.3.1-Action 1 Encourage the development of community gardens, including gardens on greenbelts that separate communities.

Objective:

4.3.2 Maintain or increase agriculture's share of the total island economy.

Policies:

4.3.2.c Encourage the continued viability of sugar cane production, or other agricultural crops, in central Maui and all of Maui Island.

GOAL, OBJECTIVES, POLICIES, AND ACTIONS

Goal:

7.1 Maui will have a prosperous agricultural industry and will protect agricultural lands.

Objective:

7.1.1 Significantly reduce the loss of productive agricultural lands.

7.1.1.e Focus urban growth, to the extent practicable, away from productive and important agricultural lands.

7.1.1.f Strongly discourage the conversion of productive and important agricultural lands (such as sugar, pineapple, and other produce lands) to rural or urban use, unless justified during the General Plan update, or when other overriding factors are present.

Implementing Actions:

7.1.1-Action 1 Implement the Maui Island Directed Growth Strategy.

Objective:

7.1.2 Reduction of the island's dependence on off-island agricultural products and expansion of export capacity.

Policies:

7.1.2.c Actively look to acquire land and provide infrastructure to expand agricultural parks and establish new agricultural parks.

7.1.2.g Consider appropriate subdivision requirements (gravel roads, above-ground utilities, etc.) in those subdivisions creating Agricultural Parks where lots are limited to agricultural production with no dwellings.

Implementing Actions:

7.1.2-Action 1 Identify and acquire productive and community agricultural lands that are appropriate for the development of agricultural parks and community gardens in each community plan area.

3. Wailuku-Kahului Community Plan

Within Maui County, there are nine (9) community plan regions. Each region is governed by a Community Plan. The Waikapu Country Town is located within the Wailuku-Kahului Community Plan region that was adopted by Ordinance No. 3061 on June 5, 2002. Wailuku-Kahului Community Plan policies directly relevant to the proposed action include those listed below:

GOAL, OBJECTIVES, POLICIES, AND IMPLEMENTING ACTIONS

ECONOMIC ACTIVITY

Goal:

A stable and viable economy that provides opportunities for growth and diversification to meet long-term community and regional needs and in a manner that promotes agricultural activity and preserves agricultural lands and open space resources.

Objectives and Policies:

1. Support agricultural production so agriculture can continue to provide employment and contribute to the region's economic well-being.
9. Support the establishment of agricultural parks for truck farming, piggery operations, bee keeping and other diversified agricultural operations within larger unsubdivided agricultural parcels and in locations that are compatible with residential uses.

ENVIRONMENT

Goal:

A Clean and attractive physical and natural environment in which man-made developments or alterations to the natural environment relate to sound environmental and ecological practices, and important scenic and open space resources are maintained for public use and enjoyment.

Objectives and Policies:

1. Preserve agricultural lands as a major element of the open space setting that borders the various communities within the planning region. The close relationship between open space and developed areas is an important characteristic of community form.

HOUSING

Goal:

A sufficient supply and choice of attractive, sanitary and affordable housing accommodations for the broad cross section of residents, including the elderly.

Objectives and Policies:

2. Provide sufficient land areas for new residential growth which relax constraints on the housing market and afford variety in type, price, and location of units. Opportunities for the provision of housing are presently constrained by a lack of expansion areas. This condition should be relieved by a choice of housing in a variety of locations, both rural and urban in character.
3. Seek alternative residential growth areas within the planning region, with high priority given to the Wailuku and Kahului areas. This action should recognize that crucial issues of maintaining important agricultural lands, achieving efficient patterns of growth, and providing adequate housing supply and choice of price and location must be addressed and resolved.

LAND USE

Goal:

An attractive, well-planned community with a mixture of compatible land uses in appropriate areas to accommodate the future needs of residents and visitors in a manner that provides for the social and economic well-being of residents and the preservation and enhancement of the region's environmental resources and traditional towns and villages.

Objectives and Policies:

1. Ensure that adequate lands are available to support the region's present and future agricultural activities.
2. Identify prime or productive agricultural lands, and develop appropriate regulations for their protection.
6. Establish an adequate supply of urban land use designations to meet the needs of the community over the next 20 years.

Analysis: The Maui County General Plan (County-wide Policy Plan, Maui Island Plan, and Wailuku-Kahului Community Plan) seek to preserve productive agricultural lands and facilitate agricultural self-sufficiency in food production. The Plans also recognize the need to provide sufficient land areas to accommodate future population growth. Goal 7.1.1.f of the Maui Island Plan states, "*Strongly discourage the conversion of productive and important agricultural lands (such as sugar, pineapple, and other produce lands) to rural or urban use, unless justified during the General Plan update, or when other overriding factors are present*." Although the area to be urbanized is considered prime farmland, other overriding considerations include the desire to locate future growth within close proximity of the Central Maui employment center; and to take advantage of existing and planned infrastructure and public facility improvements, such as the proposed Waiale Bypass road that bisects the subject property, the County's proposed 100-acre Central Maui baseyard located along the eastern boundary of the project, and the approximate 200-acre Central Maui regional park proposed on abutting A&B lands along Kuhilani Highway. Other important factors include the availability of potable and non-potable water on-site to serve the development, the suitability of the land and its location for affordable housing, and the project's close proximity to the small town of Waikapu and A&B Properties' proposed Waiale Development. Moreover, the landowner's willingness to permanently protect approximately 800 acres of prime agricultural lands to serve as a permanent open space separation between Waikapu and the small coastal community of Maalaea was an important consideration.

In addition, as documented in this report, the urbanization of the subject lands will not significantly impact the future viability of the sugar or pineapple industries or the growth of diversified agriculture. As noted, there has been a tremendous amount of land released from sugar and pineapple over the last thirty years. Much of this land is available for agricultural use. Moreover, the land owners desire to establish an agricultural park will directly address the difficulty that many farmers have when trying to lease productive agricultural lands at an affordable rate for long-term tenure. With successful diversified farmers, such as Kumu Farms and Hawaii Taro LLC, being key tenants at the Park, the island of Maui should be able to become

more self-sufficient in food production, while also diversifying and growing the island's agricultural economy.

REFERENCES

[i] Capital in Hawaiian Sugar: Its Formation and Relation to Labor and Output, 1870-1957. Prepared by J. A. Mollet. Hawaii Agricultural Experiment Station, College of Tropical Agriculture, University of Hawaii in cooperation with the Agricultural Experiment Stations of the Western States. Agricultural Economics Bulletin 21. June 1961.

2011 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[ii] 2011 State of Hawaii Data Book; Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[iii] 2011 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

Statistical Abstract of Hawaii. Prepared by the State of Hawaii, Department of Planning & Research, Honolulu, Hawaii. May 1962.

[iv] Maui County Data Book 2011. Prepared by the County of Maui, Office of Economic Development. Hawaii Small Business Development Center. Hawaii Business Research Library. December 2011.

[v] Agricultural Resources Technical Issue Paper, June 2007. Prepared by Chris Hart & Partners, Inc. Prepared for County of Maui, Department of Planning, Long-range Planning Division.

[vi] Maui County Data Book 2011. Prepared by the County of Maui, Office of Economic Development. Hawaii Small Business Development Center. Hawaii Business Research Library. December 2011.

Statistical Abstract of Hawaii. Prepared by the State of Hawaii, Department of Planning & Research, Honolulu, Hawaii. May 1962.

Maui County Data Book 1993. Prepared by the County of Maui, Office of Economic Development and the Maui County Economic Development Board. December 1993.

Maui County Data Book 2000. Prepared by the County of Maui, Office of Economic Development. Hawaii Small Business Development Center. Hawaii Business Research Library. December 2000.

[vii] Maui Island Plan. Prepared by County of Maui, Department of Planning, Long-range Planning Division. December 2012.

[viii] Capital in Hawaiian Sugar: Its Formation and Relation to Labor and Output, 1870-1957; Prepared by J. A. Mollet. Hawaii Agricultural Experiment Station, College of Tropical Agriculture, University of Hawaii in cooperation with the Agricultural Experiment Stations of the Western States. Agricultural Economics Bulletin 21. June 1961.

[ix] 2011 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[x] Maui County Data Book 2011. Prepared by the County of Maui, Office of Economic Development. Hawaii Small Business Development Center. Hawaii Business Research Library. December 2011.

[xi] Web Soil Survey. United States Department of Agriculture, Natural Resources Conservation Service.

[xii] Maui Agriculture Development Plan. Maui County Farm Bureau in association with the County of Maui, Office of Economic Development. July 2009.

[xiii] Growth and Stability of Agricultural Production in Hawaii: A Portfolio Analysis. Economic Issues April 2009 El-6. Prepared by Junning Cai and PingSun Leung, Department of Molecular Biosciences and Bioengineering. Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Andrew G. Hashimoto, Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i.

[xiv] 2011 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[xv] Growth and Stability of Agricultural Production in Hawaii: A Portfolio Analysis. Economic Issues April 2009 El-6. Prepared by Junning Cai and PingSun Leung, Department of Molecular Biosciences and Bioengineering. Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Andrew G. Hashimoto, Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i.

[xvi] 2011 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[xvii] 2011 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

2006 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[xviii] Economic Impacts of Increasing Hawai'i's Food Self-Sufficiency. Economic Issues, December 2008 El-16. Prepared by PingSun Leung and Mathew Loke, CTAHR College of Molecular Biosciences and Bioengineering and Hawai'i' Department of Agriculture. Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Andrew G. Hashimoto, Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i.

[xix] Comparative Advantage Trends of Selected Hawai'elected Hawaivantage Trends of Selected nd Market, Economic Issues, February 2008 El-14. Prepared by Run Yu, Junning Cai, PingSun Leung, and Matthew K. Loke, Department of Molecular Biosciences and Bioengineering, Hawai'i Department of Agriculture, Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Andrew G. Hashimoto, Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i.

[xx] Competitiveness of Hawai'i's Agricultural Products in Japan. Economic Issues, June 2010 El-19. Prepared by Hazel Parcon, Run Yu, Matthew Loke, and PingSun Leung, Department of Natural Resources and Environmental Management, Agricultural Development Division, Hawai'i Department of Agriculture. Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Andrew G. Hashimoto, Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i.

[xxi] Comparison of Cost Structure and Economic Performance of Hawai'i and U.S. Mainland Farms, Economic Issues, March 2012 El-21 Prepared by Shawn Arita, Emiko Naomasa, and PingSun Leung, Department of Natural Resources and Environmental Management, College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa, Department of Economics, University of Hawai'i at Mānoa. Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Andrew G. Hashimoto, Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i.

[xxii] Cost of Transporting Fresh Fruits and Vegetables to Honolulu from Hilo and Los Angeles. Economic Issues, March 2010 (slightly revised June 2010) El-18. Prepared by Hazel Parcon, Matthew Loke, and PingSun Leung CTAHR Department of Natural Resources and Environmental Management UH Department of Economics. Agricultural Development Division, Hawai'i Department of Agriculture. Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Andrew G. Hashimoto, Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i.

[xxiii] A Comparison of Agricultural Input Prices: Hawai'I vs. Its Major Export Competitors. Economic Issues, October 2011 El-20. Prepared by Hazel Parcon, Shawn Arita, Matthew Loke, and PingSun Leung, Department of Natural Resources and Environmental Management, College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa, School of Economics, De La Salle University, Agricultural Development Division, Hawai'i Department of Agriculture. Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Andrew G. Hashimoto, Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i.

[xxiv] Cost of Transporting Fresh Fruits and Vegetables to Honolulu from Hilo and Los Angeles. Economic Issues, March 2010 (slightly revised June 2010) El-18. Prepared by Hazel Parcon, Matthew Loke, and PingSun Leung CTAHR Department of Natural Resources and Environmental Management UH Department of Economics. Agricultural Development Division, Hawai'i Department of Agriculture. Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Andrew G. Hashimoto, Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i.

[xxv] Comparison of Cost Structure and Economic Performance of Hawai'i and U.S. Mainland Farms, Economic Issues, March 2012 El-21 Prepared by Shawn Arita, Emiko Naomasa, and PingSun Leung, Department of Natural Resources and Environmental Management, College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa, Department of Economics, University of Hawai'i at Mānoa. Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Andrew G. Hashimoto, Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i.

[xxvi] 2011 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[xxvii] Economic Impacts of Increasing Hawai'i's Food Self-Sufficiency. Economic Issues, December 2008 El-16. Prepared by PingSun Leung and Mathew Loke, CTAHR College of Molecular Biosciences and Bioengineering and Hawai'i' Department of Agriculture. Published by the College of Tropical Agriculture and Human Resources

(CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Andrew G. Hashimoto, Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i.

[xxviii] 2011 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

2006 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[xxix] A Comparison of Agricultural Input Prices: Hawai'I vs. Its Major Export Competitors. Economic Issues, October 2011 El-20. Prepared by Hazel Parcon, Shawn Arita, Matthew Loke, and PingSun Leung, Department of Natural Resources and Environmental Management, College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa, School of Economics, De La Salle University, Agricultural Development Division, Hawai'i Department of Agriculture. Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Andrew G. Hashimoto, Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i.

[xxx] Hawaii's Seed Crop Industry: Current and Potential Economic and Fiscal Contributions. Prepared by Thomas Laudat, PhD, President TAL Associates and Prahlad Kasturi, PhD, Professor Economics Department Radford University, Radford, Virginia. February 2013. Published by the Hawaii Farm Bureau Federation and the Hawaii Crop Improvement Association.

[xxxi] Hawaii's Seed Crop Industry: Current and Potential Economic and Fiscal Contributions. Prepared by Thomas Laudat, PhD, President TAL Associates and Prahlad Kasturi, PhD, Professor Economics Department Radford University, Radford, Virginia. February 2013. Published by the Hawaii Farm Bureau Federation and the Hawaii Crop Improvement Association.

[xxxii] 2011 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

2006 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[xxxiii] Hawaii's Seed Crop Industry: Current and Potential Economic and Fiscal Contributions. Prepared by Thomas Laudat, PhD, President TAL Associates and Prahlad Kasturi, PhD, Professor Economics Department Radford University, Radford, Virginia. February 2013. Published by the Hawaii Farm Bureau Federation and the Hawaii Crop Improvement Association.

[xxxiv] Renewable Energy in Hawaii June 2011. Hawaii Economic Issues. Prepared by State of Hawaii, Department of Business Economic Development & Tourism, Research & Economic Analysis Division.

[xxxv] 2011 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[xxxvi] Renewable Energy in Hawaii June 2011. Hawaii Economic Issues. Prepared by State of Hawaii, Department of Business Economic Development & Tourism, Research & Economic Analysis Division.

[xxxvii] HCEI Road Map 2011 Edition. Prepared by Ralph Braccio and Patrick Finch, Booz Allen Hamilton, Inc. McLean Virgina. Prepared by the National Renewable Energy Laboratory (NREL), a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. NREL is operated by the Alliance for Sustainable Energy, LLC. August 2011.

[xxxviii] HCEI Road Map 2011 Edition. Prepared by Ralph Braccio and Patrick Finch, Booz Allen Hamilton, Inc. McLean Virgina. Prepared by the National Renewable Energy Laboratory (NREL), a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. NREL is operated by the Alliance for Sustainable Energy, LLC. August 2011.

[xxxix] The Potential for Biofuels Production in Hawai'I. Prepared by Black and Veatch. January 2010. Prepared for the State of Hawaii, Department of Business Economic Development & Tourism.

[xl] 2011 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[xli] Agricultural Land Rating Systems Presentation by Earl Yamamoto, State Department of Agriculture, February 5, 2000.

[xlii] Agricultural Land Rating Systems Presentation by Earl Yamamoto, State Department of Agriculture, February 5, 2000.

[xliii] 2000 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2000.

Ma'alaea Mauka Residential Subdivision: Impact on Agriculture. Prepared by Decision Analysts Hawai'I, Inc.. Prepared for Maalaea Properties, LLC. January 2007.

2011 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[xliv] Maui Gold Website. http://www.pineapplemaui.com/history.php.

[xlv] Ma'alaea Mauka Residential Subdivision: Impact on Agriculture. Prepared by Decision Analysts Hawai'I, Inc.. Prepared for Maalaea Properties, LLC. January 2007.

[xlvi] Maui County Data Book 2011. Prepared by the County of Maui, Office of Economic Development. Hawaii Small Business Development Center. Hawaii Business Research Library. December 2011.

[xlvii] Agricultural Resources Technical Issue Paper, June 2007. Prepared by Chris Hart & Partners, Inc. Prepared for County of Maui, Department of Planning, Long-range Planning Division.

[xlviii] Agricultural Resources Technical Issue Paper, June 2007. Prepared by Chris Hart & Partners, Inc. Prepared for County of Maui, Department of Planning, Long-range Planning Division.

[xlix] Agricultural Resources Technical Issue Paper, June 2007. Prepared by Chris Hart & Partners, Inc. Prepared for County of Maui, Department of Planning, Long-range Planning Division.

[l] Statistical Abstract of Hawaii. Prepared by the State of Hawaii, Department of Planning & Research, Honolulu, Hawaii. May 1962.

Maui County Data Book 1993. Prepared by the County of Maui, Office of Economic Development and the Maui County Economic Development Board. December 1993.

Maui County Data Book 2000. Prepared by the County of Maui, Office of Economic Development. Hawaii Small Business Development Center. Hawaii Business Research Library. December 2000.

Maui County Data Book 2011. Prepared by the County of Maui, Office of Economic Development. Hawaii Small Business Development Center. Hawaii Business Research Library. December 2011.

[li] Sugar Islands: The 165-Year Story of Sugar in Hawaii. By William H. Dorrance and Francis S. Morgan. Mutual Publishing. June 2001.

[lii] 2001 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

Maui Gold Website. http://www.pineapplemaui.com/history.php.

[liii] State of Hawaii, Department of Agriculture Website. http://hdoa.hawaii.gov/arm/agricultural-parks/.

[liv] State of Hawaii, Department of Agriculture Website. http://hdoa.hawaii.gov/arm/agricultural-parks/.

[lv] Maui Island Plan. Prepared by County of Maui, Department of Planning, Long-range Planning Division. December 2012.

[lvi] Maui Agriculture Development Plan. Maui County Farm Bureau in association with the County of Maui, Office of Economic Development. July 2009.

[lvii] Statistical Abstract of Hawaii. Prepared by the State of Hawaii, Department of Planning & Research, Honolulu, Hawaii. May 1962.

2000 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2000.

2011 State of Hawaii Data Book. Prepared by the State of Hawaii, Department of Business Economic Development & Tourism, Research & Analysis Division. 2011.

[lviii] Maui County Data Book 2011. Prepared by the County of Maui, Office of Economic Development. Hawaii Small Business Development Center. Hawaii Business Research Library. December 2011.

[lix] Agricultural Land Rating Systems Presentation by Earl Yamamoto, State Department of Agriculture, February 5, 2000.

[lx] Statistical Abstract of Hawaii. Prepared by the State of Hawaii, Department of Planning & Research, Honolulu, Hawaii. May 1962.

Maui County Data Book 1993. Prepared by the County of Maui, Office of Economic Development and the Maui County Economic Development Board. December 1993.

Maui County Data Book 2000. Prepared by the County of Maui, Office of Economic Development. Hawaii Small Business Development Center. Hawaii Business Research Library. December 2000.

Maui County Data Book 2011. Prepared by the County of Maui, Office of Economic Development. Hawaii Small Business Development Center. Hawaii Business Research Library. December 2011.

[lxi] Web Soil Survey. United States Department of Agriculture, Natural Resources Conservation Service.

APPENDIX H

Preliminary Engineering and Drainage Report

PRELIMINARY ENGINEERING REPORT

FOR

WAIKAPU COUNTRY TOWN

Waikapu, Maui, Hawaii

T.M.K.: (2) 3-6-002: 001 & 003, (2) 3-6-004: 003 & 006,
(2) 3-6-005: 007, and (2) 3-6-006: 036

Prepared for:

Waikapu Properties, LLC
P.O. Box 1870
Manteca, California 95336

Prepared by:

OTOMO
ENGINEERING, INC.

CONSULTING CIVIL ENGINEERS
305 SOUTH HIGH STREET, SUITE 102
WAILUKU, MAUI, HAWAII 96793
PHONE: (808) 242-0032

January 2015
Revised October 2015
Revised November 2016

TABLE OF CONTENTS

1.0 INTRODUCTION

2.0 EXISTING INFRASTRUCTURE

2.1 ROADWAYS

2.2 DRAINAGE

2.3 SEWER

2.4 WATER

2.5 ELECTRIC, TELEPHONE, AND CABLE TV

3.0 ANTICIPATED INFRASTRUCTURE IMPROVEMENTS

3.1 ROADWAYS

3.2 DRAINAGE

3.3 SEWER

3.4 WATER

3.5 ELECTRIC, TELEPHONE, AND CABLE TV

EXHIBITS

1 LOCATION MAP

2 VICINITY MAP

3 SOIL SURVEY MAP

4A-4F FLOOD INDURANCE RATE MAP

5 PHASING MAP

6 PROPOSED ROADWAY SYSTEM

6A ROADWAY CLASSIFICATION TABLE

7 EXISTING DRAINAGE PATTERN

8 PROPOSED DRAINAGE SYSTEM

9 PROPOSED ONSITE SEWER SYSTEM

10 OFFSITE SEWER IMPROVEMENTS (WAIKAPU GARDENS)

11 OFFISTE SEWER IMPROVEMENTS (LOWER MAIN STREET)

12 OFFSITE SEWER IMPROVEMENTS (ELUENE PLACE)

13 PROPOSED POTABLE WATER SYSTEM

14 PROPOSED NON-POTABLE WATER SYSTEM

APPENDICES

A HYDROLOGIC CALCULATIONS

B STORM WATER QUALITY CALCULATIONS

C WATER DEMAND CALCULATIONS

D WASTEWATER CALCULATION

E ORDER OF MAGNITUDE COST ESTIMATES

PRELIMINARY ENGINEERING REPORT
FOR
WAIKAPU COUNTRY TOWN
T.M.K.: (2) 3-6-002: 001 & 003, (2) 3-6-004: 003 & 006,
(2) 3-6-005: 007, and (2) 3-6-006: 036

1.0 INTRODUCTION

The purpose of this report is to provide information on the existing infrastructure, which will be servicing the proposed project and to also evaluate the adequacy of the existing infrastructure and anticipated improvements, which may be required for the development of the proposed project.

The subject parcels are identified as T.M.K.: (2) 3-6-002: 001 & 003, (2) 3-6-004: 003 and 006, (2) 3-6-005: 007, and (2) 3-6-006: 036, which encompasses a total area of approximately 1,576 acres. Of the total area, 1,562 acres is within the State Agricultural District and 14 acres is within the State Urban District. Waikapu Country Town (WCT) is situated south of Waikapu around the existing Maui Tropical Plantation and areas to the east of Honoapiilani Highway (See Exhibit 2).

WCT will be a master-planned community with a mixture of single- and multi-family residential, commercial, and civic uses. The Maui Island Plan's Directed Growth Plan designated approximately 485 acres of WCT's 1,562 acres into urban small town and rural growth boundaries. The remaining 1,077 acres will remain in the State's Agricultural District. Approximately 800 acres of the Project's agricultural lands will be preserved in perpetuity for agricultural use through a conservation easement, and the remaining area will be kept as large agricultural lots.

The proposed project will be built in two (2) five-year phases, both mauka and makai of Honoapiilani Highway (See Exhibit 5). The first phase will be from 2017 through 2021 and the second phase will be from 2022 through 2026. The development mauka of Honoapiilani Highway will create a "village center," incorporating the existing Maui Tropical Plantation (MTP) buildings and grounds. The mauka development is bound by Honoapiilani Highway to the south and east,

Waikapu Town and Waikapu Stream to the north, and vacant land to the west. The development makai of Honoapiilani Highway will be mixed use, including residential units, commercial buildings, an elementary school, and parks. The makai development is bound by the planned Waiale Bypass to the south and east, Honoapiilani Highway to the west, and Waikapu Stream to the north.

Phase I of the project includes the development on the mauka side of Honoapiilani Highway and a portion of the makai side of the highway. The Phase I development schedule is 2017 through 2021 and includes the following:

- 332 single-family dwelling units;
- 15 rural residential units;
- 216 multi-family/town home units;
- 127 country town mixed-use dwelling units;
- 41 ohana units,
- Approximately 58,475 square feet of country town mixed-use commercial space;
- Approximately 140,372 square feet of new commercial and employment (it is assumed that the existing 29,250 square feet of commercial space will remain);
- Approximately 26.66 acres of parks and open space; and
- Approximately 12 acres for an elementary school.

Phase II of the development, scheduled for 2022 through 2026, will construct the remainder of the project, including the following:

- 638 single-family dwelling units;
- 65 rural residential units;
- 40 multi-family dwelling units;
- 105 ohana units; and
- Approximately 5.78 acres of parks and open space.

2.0 EXISTING INFRASTRUCTURE

2.1 ROADWAYS

The primary regional access to the Waikapu area is provided by Honoapiilani Highway, which traverses through the project site. It divides the project site into the mauka and makai sections. It is a two-lane undivided State Highway which runs in the north-south direction into Wailuku town. The speed limit is 30 miles per hour (mph) in the vicinity of the project site and Waiko Road. The Waiko Road intersection is signalized with existing left turn pockets into East and West Waiko Road. There is a left turn pocket on Honoapiilani Highway at its intersection with the driveway for the MTP.

Kuihelani Highway is located immediately east of the project site. It is a two-way, four-lane divided State arterial highway which also runs in a north-south direction. The posted speed limit on Kuihelani Highway at Waiko Road is 55 mph. There is an existing traffic signal at the Kuihelani Highway-Waiko Road intersection. The southern terminus of Kuihelani Highway is its intersection with Honoapiilani Highway. The northern terminus is at its intersection with Puunene Avenue, where it turns into Dairy Road.

Waiko Road is a two-lane County-owned collector roadway that runs in an east-west direction and connects Honoapiilani Highway and Kuihelani Highway. The posted speed limit on Waiko Road is 20 mph. Immediately east of Honoapiilani Highway, Waiko Road provides access to a residential community. Further east, Waiko Road provides access to industrial and livestock land uses. There is a weight limit of 10,000 pounds from vehicles entering and exiting Waiko Road from Honoapiilani Highway.

Waiale Road is a two-lane road with its southern terminus at Waiko Road. It turns into Lower Main Street near Kaahumanu Avenue. The section of Waiale Road from Waiko Road to Kuikahi Drive is privately owned. The segment from Kuikahi Drive to Lower Main Street is County owned and used as a collector road.

Kuikahi Drive is an east-west collector road. West of its intersection with Honoapiilani Highway, Kuikahi Drive passes through the Wailuku Heights Subdivision and terminates in a cul-de-sac at the top of the subdivision. Approximately 1,000 feet east of Honoapiilani Highway, it intersects with Waiale Road. The eastern terminus of Kuikahi Drive is at its intersection with Maui Lani Parkway.

Kamehameha Avenue is a County-owned north-south collector road. It is a two-lane roadway which begins at its intersection with Hana Highway and extends southward through the Maui Lani development with its terminus just south of Pomaikai Elementary School.

Maui Lani Parkway is a two-lane, east-west collector road with a raised median. It connects Kuihelani Highway with Kuikahi Drive. When completed, Maui Lani Parkway will extend to Kaahumanu Avenue near Baldwin High School. Upon completion of Maui Lani Parkway, it will connect Kuihelani Highway and Kaahumanu Avenue.

The MTP currently accesses the site from Honoapiilani Highway. There is a left turn lane into the MTP.

2.2 DRAINAGE

The elevation on the mauka development site ranges from approximately 350 feet above mean sea level at its southeasterly corner to approximately

710 feet above mean sea level at its northwesterly corner, with a slope averaging approximately 8%. The elevation on the makai development site ranges from approximately 256 feet above mean sea level at a low point along the southerly border to approximately 408 feet above mean sea level at the northwesterly corner, with a slope averaging approximately 4%. The land within the agriculture preserve areas will remain undeveloped.

According to Panel Numbers 15003 0389F, 15003 0393F, and 15003 0556F, revised November 4, 2015, of the Flood Insurance Rate Map, prepared by the United States Federal Emergency Management Agency, the project site is situated in Flood Zones X, XS, AE, and AEF (See Exhibits 4A to 4F). The vast majority of the site is situated in Flood Zone X. Flood Zone X represents areas that are outside of the 0.2% annual chance flood plain. Flood Zones AE, AEF, and XS are located along the eastern boundary of both the mauka and makai sites, where the Waikapu Stream is located. However, no development is proposed in these areas. The agricultural preserve and a park border the stream on the mauka and makai sites, respectively.

According to the "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii" (August 1972), prepared by the United States Department of Agriculture Soil Conservation Service, the soils within the project site are classified as Ewa silty clay, 3 to 7 percent slopes (EsB), Iao clay, 3 to 7 percent slopes (IcB), Jaucas sand, 0 to 15 percent slopes (JaC), Rough broken land (rRR), Stony alluvial land (rSM), Pulehu silt loam (PpA and PpB), Pulehu cobbly silt loam (PrA and PrB), Pulehu clay loam, 0 to 3 percent slopes (PsA), Pulehu cobbly clay loam (PtA and PtB), Wailuku silty clay (WvB and WvC), Gravel pit (GPI), and Water (W) (See Exhibit 3). EsB is characterized as having moderate permeability, slow runoff, and slight erosion hazard. IcB is characterized as having moderately slow permeability, medium runoff and slight to moderate erosion hazard. JaC is characterized as having rapid permeability, very slow to slow runoff, slight

erosion hazard. rRR consists of very steep land broken by intermittent drainage channels. rSM consists of stones, boulders, and soil deposited by streams along the bottoms of gulches and on alluvial fans. PpA, PpB, PrA, PrB, PsA, PtA, and PtB (Pulehu Series) are characterized as having moderate permeability, slow runoff, and slight erosion hazard. WrC is characterized as having moderate permeability, medium runoff, and severe erosion hazard. WvB and WvC are characterized as having moderate permeability, slow to medium runoff and slight to moderate erosion hazard.

Onsite runoff generally sheet flows in a west to east direction. There are seven (7) existing diversion berms along the upper most portion of the mauka site, which intercepts surface runoff and diverts it into Waikapu Stream (See Exhibit 7). The diversion berms were constructed when the lot was used for pineapple cultivation. It is part of the agricultural preserve that will not be developed and will remain in place and function as it is presently doing. The berms are protected by various grasses and weeds, which help to maintain a low runoff velocity as well filter sediments that are carried by the runoff.

Based on a 50-year, 1-hour storm, the existing diversion berms intercepts approximately 140,509 cubic feet of storm runoff and diverts it into Waikapu Stream. These diversion berms prevent runoff from sheet flowing into the proposed development areas.

Some of the existing runoff sheet flows into the Waihee Ditch, which traverses along the western boundary of T.M.K.: (2) 3-6-005: 007. The ditch flows in a southerly direction toward Maalaea and supplies water to existing agricultural reservoirs.

Runoff from the areas below the existing diversion berms generally sheet flows in a west to east direction toward Honoapiilani Highway. There are several small culverts that divert runoff across Honoapiilani Highway and discharges into the existing cane fields on the makai side of the highway

(See Exhibit 7). The following is a list of culvert crossings at Honoapiilani Highway adjacent to the project site.

Distance from Entrance to WCT Driveway	Culvert Size
4,200 feet south of driveway	24” w/ GICB
3,850 feet south of driveway	24” w/ GICB
2,050 feet south of driveway	24” w/ GICB
1,270 feet south of driveway	4’ x 2’ Box Culvert
1,000 feet south of driveway	72” Culvert
400 feet south of driveway	24” Culvert
1,600 feet north of driveway	Waikapu Stream

There is an existing grass swale traversing across the MTP site parallel to Honoapiilani Highway from the northeast corner of the project site to approximately 1,000 feet south of the MTP driveway. Runoff sheet flowing across the mauka side of the project site is captured by the grass swale and diverted in a southerly direction and across Honoapiilani Highway by the existing 72-inch culvert located 1,000 feet to the south of the MTP driveway. Runoff within the grass swale is conveyed across the MTP driveway by a 30-inch culvert.

It is estimated that the existing 100-year, 24-hour storm runoff from the Phase I project site mauka of Honoapiilani Highway is 452 cfs, corresponding to a runoff volume of 2,418,629 cubic feet and 373 cfs, corresponding to a runoff volume of 2,133,808 cubic feet from the Phase I project site makai of Honoapiilani Highway. Similarly, it is estimated that the existing 100-year, 24-hour storm runoff from the Phase II project site mauka of Honoapiilani Highway is 447 cfs, corresponding to a runoff volume of 2,916,206 cubic feet and 361cfs, corresponding to a runoff volume of 2,062,681 cubic feet from the Phase II project site makai of Honoapiilani Highway.

Presently, onsite runoff sheet flows across the project site in a west to east direction, across Honoapiilani Highway and into the existing sugar cane

fields towards Kuihelani Highway and eventually discharges into Kealia Pond in North Kihei.

2.3 SEWER

There are County sewerlines on the north side of Waikapu Stream. The existing MTP is serviced by a private sewer system which connects to the County's sewer system on Waiko Road near Waikapu Town.

The existing MTP sewer system is a private system consisting of a 6-inch sewerline and manholes from the existing buildings, crossing Honoapiilani Highway to a sewer pump station located approximately 500 feet east of Honoapiilani Highway. A 4-inch forcemain conveys the wastewater from the sewer pump station through the cane fields, across Waikapu Stream, up on Waiko Road and connects to a sewer manhole on Waiko Road east of Waikapu town. There is an 8-inch gravity sewerline from the existing sewer manhole which connects to a County-owned sewer manhole east of Waikapu Town.

The sewer system from the MTP to the County-owned sewer manhole on Waiko Road is privately owned and maintained by the MTP. The County's sewer system traverses from the manhole on Waiko Road through the Waikapu Gardens Subdivision, through privately owned properties, onto Waiale Road, down Lower Main Street and discharges into the Wailuku Sewer Pump Station near the intersection of Kahului Beach Road, Lower Main Street and Waiehu Beach Road. Sewer collected at the Wailuku Sewer Pump Station is pumped to the Kahului Wastewater Reclamation Facility (KWRF) in Kanaha.

According to the Wastewater Reclamation Division, County of Maui, as of July 31, 2016, the KWRF has a capacity of 7.9 million gallons per day (mgd). The average flow into the KWRF is 5.2 mgd and the allocated capacity is

6.55 mgd. The remaining wastewater capacity at the KWRF is approximately 1.35 mgd.

2.4 WATER

Water service in the vicinity of the project site is provided by the County's water system consisting of a 12-inch waterline from the 300,000 gallon tank near the mauka terminus of Waiko Road. The storage tank is at an elevation of 764 feet.

The existing 12-inch waterline crosses Honoapiilani Highway and terminates to the east of Waikapu town in the vicinity of the industrial area. A 4-inch waterline connects to the 12-inch waterline on Honoapiilani Highway and traverses in a southerly direction and ends near the northerly boundary of the MTP. The MTP site is currently being serviced by two 5/8-inch water meters located at the northeast corner of the mauka property.

Fire protection for the MTP is presently provided by a private system consisting of a gravity fireline from the existing lagoon located immediately to the west of the MTP restaurant. Non-potable water from the lagoon is fed to fire pumps located on the exterior of the existing buildings which supplies water to the fire sprinkler systems in the buildings. There are also fire hydrants located on the grounds of the MTP. However, the fire hydrants may not have adequate pressure and capacity.

2.5 ELECTRIC, TELEPHONE, AND CABLE TV

Electric, telephone and cable TV service for the MTP is brought in underground from the overhead utilities along Honoapiilani Highway. There is an existing overhead 69 kv utility line which traverses through the property along the Waihee Ditch.

3.0 ANTICIPATED INFRASTRUCTURE IMPROVEMENTS

3.1 ROADWAYS

Access for the proposed project will be from the roadway connections on Honoapiilani Highway for both the mauka and makai development sites, as well as the future Waiale Road extension for the makai development.

The developers of Waikapu Country Town have subdivided an 80-feet wide right-of-way for the future Waiale Road extension from Waiko Road to Honoapiilani Highway. The right-of-way has been committed to the County for the development of the Waiale Road extension. The proposed improvements for the Waiale Road extension includes two (2) 12-foot travel lanes, 6-foot pave shoulders on both sides, 6-foot grassed swales on both sides, and a 10-feet wide bike/pedestrian path on one side.

The main onsite roadway from the Waiale Road Extension into the MTP will have a right-of-way of 80 feet (major arterial), the major collector road makai of and parallel to Honoapiilani Highway will have a right-of-way of 60 feet, all residential streets will have a right-of-way of 48 feet (minor urban street), and roadways serving rural areas will have a 40 feet right-of-way (minor rural street). All roadways will be improved to County standards. The cul-de-sacs will have an edge of pavement radius of 40 feet and a right-of-way radius of 50 feet to accommodate the larger fire trucks in the Central Maui district (see Exhibits 6 & 6A).

A Transportation Impact Analysis Report (TIAR) was completed for the project on December 2014 by Fehr & Peers, which provided the following summary:

"Future Conditions without Project. The future intersection operating conditions will be significantly affected by regional growth and development in the study area before project implementation. By 2022 and 2026 the

Project area will have experienced significant residential and commercial growth and due to the development of neighboring projects including Waiale, Maui Lani Development, Kehalani Development, Puunani residences, and other developments as outlined in Table 4. Future regional development will be accompanied by roadway network changes will improve mobility options for residents and visitors, as well as expand roadway capacities at various locations within the study area. Nevertheless, with this growth, five (5) of the 14 study intersections are projected to operate at an undesirable LOS E or F during one or both peak hours in each future year.

Project Traffic Impact. The traffic analysis addressed the completion of the first phase (2022) and the second phase (2026) with the Project. Following development of both the first phase and second phase of the Project, six (6) of the fourteen (14) intersections studied (Intersection 1-4 and 7-8) would operate at a LOS (E) or (F) in either the AM and/or PM peak hour. As noted above, all but one of these six intersections (Intersection 8) are projected to operate at undesirable levels without the addition of project traffic. Eight (8) of the study intersections (Intersections 5-6 and 9-14) are projected to operate at acceptable LOS with buildout of the project and will not require mitigation strategies. See Tables 6 and 7.

Mitigation Strategies. Mitigation strategies were developed to identify recommended improvements at the intersections with projected overall intersection levels of service, LOS (E) or LOS (F) in the years 2022 and 2026. Each of the identified project-related cumulative impacts would be fully mitigated (achieving LOS D or better for intersection operations) with recommended improvements as described Chapter 5 and Appendix F of the TIAR. In some cases, certain individual turning movements or approaches would continue to operate at LOS (E) or (F), even with overall intersection mitigation. However, further mitigation measures to address specific

turning movement or approach operations are not recommended because they do not meet typical traffic engineering guidelines or would result in atypical improvements (i.e., triple left turn lanes) that could have significant right-of-way impacts or change community character. The estimated share of traffic mitigation cost shown on Table 8 was calculated for proposed mitigations under Year 2026 with proper conditions

As discussed, improvements are proposed at intersections identified as significantly impacted under Year 2026 with Project Conditions. In the past, development project development projects would make a fair share financial contribution for each mitigation measure to the appropriate governing agency (i.e., the County or HDOT). However, simply providing partial funds for a variety of different improvements does not ensure construction of any individual improvement.

More recently, HDOT has indicated a preference for development projects like WCT to fully design and build improvements at a select set of locations to ensure their implementation. Accordingly, a mitigation program for WCT was developed that would require construction of improvements at intersections closer to the project site where the project contributes to, but does not directly cause a significant impact. Note that the mitigation program is described below is a preliminary recommendation based on the proximity to intersections and without planning level cost estimates. As such, it is subject to change as the planning process continues.

The project proposes to fully fund mitigation measures that would return operations to pre-project levels at Intersection 1: Honoapiilani Highway & Kuikahi Drive and Intersection 8: Kuihelani Highway & Waiko Road. Additionally, although Intersection 13: Honoapiilani Highway & Waiale Road is not significantly impacted under Year 2026 with Project Conditions, the

project may also be responsible for funding intersection improvements necessary to provide access to the project 9i.e., a fourth/west leg).

IMPROVEMENTS TO BE IMPLEMENTED BY OTHERS

For the remaining impacted intersections listed below, it is assumed that other development projects that are adjacent or closer in proximity to these impacted locations would be responsible for implementing the necessary intersection improvements:

- *Intersection 2: Waiale Road & Kuikahi Drive*
- *Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway*
- *Intersection 4: Kuihelani Highway & Maui Lani Parkway*
- *Intersection 7: S. Kamehameha Avenue & Waiko Road"*

The TIAR recommended the following intersection mitigation measures for mid-term 2022: Intersection 1: Honoapiilani Highway & Kuikahi Drive – add separate left turn lane on south bound Honoapiilani Highway onto Kuikahi Drive and separate left turn and straight through lanes west bound on Kuikahi Drive. Intersection 8: Kuihelani Highway & Waiko Road – no improvements. Intersection 13: Honoapiilani Highway & Waiale Road – no improvements.

The recommended intersection mitigation measures for buildout 2026 are: Intersection 1: Honoapiilani Highway & Kuikahi Drive – no further improvements are necessary. Intersection 8: Kuihelani Highway & Waiko Road – create separate left and right turn lanes east bound on Waiko Road onto Kuihelani Highway. Intersection 13: Honoapiilani Highway & Waiale Road – no improvements.

The onsite roadway plan consists of streets classified as major arterial, major collector, minor urban street and minor rural street.

After coordination with local and state agencies during the early preparation stages of the TIAR, it was assumed that the Waiale Bypass would be completed and used in the study's future analysis scenarios. However, during the Draft EIS public circulation period, comments were raised about the impacts on the project design and the study area's transportation facilities if the Waiale Bypass was not funded and constructed in time for the project. In response, Fehr & Peers developed and analyzed forecast traffic volumes in Year 2026 without the Waiale Bypass in place, both before and after the addition of project traffic.

Fehr & Peers outlined the full range of improvements that address both project-related and/or cumulative traffic impacts in their October 17, 2016 Memorandum (Waikapu Country Town Project-Analysis of 2026 Conditions without the Waiale Bypass) as follows:

- *"Intersection 1: Honoapiilani Highway & Kuikahi Drive – Based on the May 2016 field observations, the eastbound and westbound approaches have been re-striped form one shared through/left-turn lane to one left-turn lane, one through lane, and one right-turn lane. Additionally, the eastbound and westbound left-turn phasing has been modified to protected/permitted. These modifications were used in the revised 2026 intersection operations analysis with and without the project in place.*
- *Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway – A Roundabout will be replacing the all-way stop-controlled intersection and construction is likely to begin operation sometime in Summer 2017. This intersection control*

modification was used in the revised 2026 intersection operations analysis with and without the project in place.

- *Intersection 6: Waiko Road & Waiale Road – Signalization and construction of the fourth leg of this intersection are associated with the Waiale Bypass. Since this analysis evaluates no-bypass scenarios, the existing control and configuration were maintained in the revised 2026 intersection operations analysis with and without the project in place.*
- *Intersection 9: Honoapiilani Highway & Main Street – This future intersection will be constructed as part of this project. Due to the increase in volumes at this location without the Waiale Bypass in place, the intersection configuration has been revised from what was assumed in the TIAR in order to yield acceptable operating conditions (i.e., minimum level of service [LOS] D or better). Thus, this analysis assumes that the intersection is configured with one left-turn lane, one through lane, and one right-turn lane across all approaches. Signal phasing is assumed to be protected/permitted across all approaches, and there would be an overlap phase for the westbound right-turn. These modifications were used in the revised 2026 intersection operations analysis.*
- *Intersection 10: Waiale Bypass & Main Street – This future intersection will not exist without the Waiale Bypass in place.*
- *Intersection 12: North-South Street Residential & Waiale Bypass – This future intersection will be constructed as part of the project. Without the Waiale Bypass in place this intersection would be a 2-legged, side-street stop-controlled intersection. These modifications were used in the revised 2026 with project intersection operations analysis.*
- *Intersection 13: Honoapiilani Highway & Waiale Bypass – This future intersection will be constructed as part of the project.*

Without the Waiale Bypass in place, this intersection would be a 4-legged, side-street intersection with stop-control on the minor approach."

The Memorandum also included the potential traffic improvements and stated:

"The full range of improvements that address both project-related and/or cumulative traffic impacts are discussed in detail below.

"Intersection 1: Honoapiilani Highway & Kuikahi Drive – The mitigation presented in the TIAR is not sufficient to mitigate the impact under the no-bypass scenario. Thus, the impact at this intersection could be reduced by widening the northbound approach from a left-turn lane, a through lane, and a right-turn to a left-turn lane, a through lane, and two right-turn lanes, widening the southbound approach from a left-turn lane, a through lane, and a right-turn lane to two left-turn lanes, a through lane, a right-turn lane, and widening the westbound approach from a left-turn lane, a through lane, and a right-turn lane to two left-turn lanes, a through lane, and two right-turn lanes. Additionally, to complement the addition of a second southbound left-turn lane and a second westbound left-turn lane, the east and south legs of the intersection would each need to be widened to provide a second departure lane. Signal modifications at this intersection would include protected phasing on all approaches and right-turn overlap phasing on the westbound and northbound approaches. Additional right-of-way would be needed on both Honoapiilani Highway and Kuikahi Drive to fully implement this improvement, which would result in LOS D operations at an overall intersection level.

Intersection 2: Waiale Road & Kuikahi Drive – The impact at this intersection could be mitigated using a reduced version of the improvements proposed

in the TIAR for this location. The improvements need to mitigate the impacts identified under the no by-pass scenario include widening the eastbound and westbound approaches to provide a left-turn lane, two through lanes, and a right-turn lane. To complement the widening of the eastbound and westbound approaches, both the eastbound and westbound departures would also need to be widened to each provide a second receiving lane. This improvement would result in LOS D operations at an overall intersection level.

Intersection 3: Kamehameha Avenue & Maui Lani Parkway – The impact at this intersection could be mitigated by implementing the improvements presented in the TIAR, which is signalization of the intersection and maintaining the existing lane configuration (i.e., a shared left/through/right lane on the eastbound and westbound approached and a left-turn lane and a shared through/right-turn lane on the northbound and southbound approaches). It should be noted, however, that the updated 2026 No Project Condition now assumes that the intersection would be configured as a single-lane roundabout.

As discussed in the TIAR, the pre-project improvement is install a traffic control signal with permitted phasing at all approaches. For LOS D or better operations at an overall intersection level, not only would a traffic signal need to be installed, but the eastbound and northbound approaches would need to provide a left-turn lane and a shared through/right-turn lane and the westbound and southbound approaches to provide a left-turn lane, a through lane, and a right-turn lane.

Intersection 4: Kuihelani Highway & Maui Lani Parkway – The impact at this intersection could be mitigated by implementing the improvements presented in the TIAR, which is to widen the eastbound approach to provide a left-turn lane, a shared through/left turn lane, and a right-turn lane. In

addition to the change in configuration, the eastbound and westbound left-turn phasing would need to be modified to split phasing. This improvement would result in LOS D operations at an overall intersection level.

Intersection 5: Honoapiilani Highway & Waiko Road – This intersection is a new impact not previously identified in the TIAR. Thus, the impact at this intersection could be reduced by widening the northbound approach from a left-turn lane and a shared through/right-turn lane to provide a left-turn lane, a through lane, and a shared through/right-turn lane, and widening the eastbound and westbound approaches to provide a left-turn lane and a shared through/right-turn lane. The northbound departure of the highway would require widening for a minimum of approximately 250 feet to provide a second receiving lane, which would transition back into the existing single northbound lane. Additional right-of-way may be needed on both Honoapiilani Highway and Waiko Road for fully implement this improvement, which would result in LOS D operations at an overall intersection level.

Intersection 6: Waiale Road & Waiko Road – The impact at this intersection is a new impact not previously identified in the TIAR. It could be mitigated with the installation of a traffic signal, which was assumed to be in place in the Cumulative, pre-project condition in the TIAR due to its key location on the Waiale Bypass. This improvement would result in LOS D operations at an overall intersection level and the turning movement level.

Intersection 7: S. Kamehameha Avenue & Waiko Road – The impact at this intersection could be mitigated using the improvement presented in the TIAR, which is installing a traffic signal with permitted phasing at all approaches. This improvement would result in LOS D or better operations at both the overall intersection level and the turning movement level.

Intersection 8: Honoapiilani Highway & Waiale Road – The impact at this intersection could be mitigated using the improvement presented in the TIAR, which is widening and restriping the eastbound approach to provide a left-turn lane and a right-turn lane. This improvement would result in LOS D or better operations at an overall intersection level.

Intersection 13: Honoapiilani Highway & Waiale Road – The impact at this intersection is a new impact not previously identified in the TIAR. It could be mitigated with the installation of a traffic signal, which was assumed to be in place in the Cumulative, pre-project condition in the TIAR due to its key location on the planned Waiale Bypass. This improvement would result in LOS D or better operations at an overall intersection level and turning movement level."

The Memorandum concluded: *"This memorandum documents analysis conducted to assess project-related and cumulative impacts upon full build-out of the proposed Waikapu Country town project if the planned Waiale Bypass were not constructed by 2026. While three more study intersections would be significantly impacted under this scenario than in the "with Bypass" scenario analyzed in the TIAR, LOS D can be achieved at the locations with an expanded program of roadway improvements as mitigation."*

The State Department of Transportation's (SDOT) 2035 Transportation Plans for the Maui District includes the widening of Honoapiilani Highway fronting the project site. Two additional travel lanes are planned. In anticipation of the future widening of Honoapiilani Highway, the planned development on the mauka and makai side of Honoapiilani will include a landscape buffer between the highway and the proposed development. The width of the landscape buffer will be coordinated with the SDOT to accommodate the future additional two lanes.

3.2 DRAINAGE

The proposed project will require both excavation and embankment for the construction of the roadways, building pads, infrastructure installation and drainage improvements. In general, the drainage design criteria are to minimize any alteration to the existing drainage patterns and volumes.

Since the project area is greater than 100 acres, the NRCS Method will be used to compute and design the storm water detention facilities. The Rational Method will be used to design the onsite drainage systems with drainage areas less than 100 acres. For these onsite drainage systems, the 50-year, 1-hour storm frequency will be used.

It is estimated that the pre-development 100-year, 24-hour storm runoff from the Phase I project site mauka of Honoapiilani Highway is 452 cfs, corresponding to a runoff volume of 2,418,629 cubic feet and 373 cfs, corresponding to a runoff volume of 2,133,808 cubic feet from the Phase I project site makai of Honoapiilani Highway. Similarly, it is estimated that the pre-development 100-year, 24-hour storm runoff from the Phase II project site mauka of Honoapiilani Highway is 447 cfs, corresponding to a runoff volume of 2,916,206 cubic feet and 361 cfs, corresponding to a runoff volume of 2,062,681 cubic feet from the Phase II project site makai of Honoapiilani Highway.

It is estimated that the post-development 100-year, 24-hour storm runoff from the Phase I project site mauka of Honoapiilani Highway is 497 cfs, corresponding to a runoff volume of 2,567,545 cubic feet and 639 cfs, corresponding to a runoff volume of 2,905,771 cubic feet from the Phase I project site makai of Honoapiilani Highway. Similarly, it is estimated that the post-development 100-year, 24-hour storm runoff from the Phase II project site mauka of Honoapiilani Highway is 507 cfs, corresponding to a runoff volume of 3,131,436 cubic feet and 506 cfs, corresponding to a runoff volume of 2,454,805 cubic feet from the Phase II project site makai of Honoapiilani Highway (See Appendix A for Hydrologic Calculations).

In accordance with the County's *"Rules for the Design of Storm Drainage Facilities",* the design of the drainage systems with retention basins shall be based on the following design conditions:

"In areas where the existing drainage systems are inadequate, the existing system shall be upgraded to handle runoff from the new project area or a new system shall be provided to connect to an adequate outlet. When there is no existing drainage system or adequate outlet to connect to, the additional runoff generated by the development may be retained on-site in a temporary retention basin with the following design conditions:

A. *Storage volume of an infiltration basin, infiltration trench piping, or retention basin shall equal at least the total additional runoff volume for the appropriate storm intensity.*
B. *Soil percolation shall not be used in satisfying required storage volumes.*
C. *Fifty percent (50%) of voids within the rock envelope for subsurface drains may be used in satisfying required storage volume provided that filter fabric is installed around the pipe and at the interface of the rock envelope and soil.*
D. *Sumps, detention and retention facilities will remain private.*
E. *Detention or retention ponds with embankment heights equal to or in excess of 50 acre-feet shall conform to all state and federal requirements relative to dams".*

The project will also be required to comply with Ordinance 3902, which requires subdivisions to comply with Section 18.20.130 Post Construction Storm Water Quality Best Management Practices of the Maui County Code. The criteria for sizing of storm water quality facilities are:

"(a) The criteria can be met by:

(1) Either detaining storm water for a length of time that allows storm water pollutants to settle (detention treatment from such methods as

extended detention wet and dry ponds, created wetlands, vaults/tanks, etc.);

(2) By use of filtration or infiltration methods (flow-through based treatment from such methods as sand filters, grass swales, other media filters, and infiltration);

(3) Short-term detention can be utilized with a flow-through based treatment system (e.g., a detention pond designed to meter flows through a swale of filter) to meet the criteria; or

(4) Upstream flow-through treatment and detention treatment can be utilized.

(b) Other proposals to satisfy the water quality criteria may be approved by the director if the proposal is accompanied by a certification and appropriate supporting material from a civil engineer, licensed in the State of Hawaii, that verifies compliance with one of the following (by performance or design):

(1) After construction has been completed and the site is permanently stabilized, reduce the average annual total suspended solid ("TSS") loadings by eighty percent. For the purposes of this measure, an eighty percent TSS is to be determined on an average annual basis for the two-year/twenty-four hour storm.

(2) Reduce the post development loadings of TSS so that the average annual TSS loadings are no greater than predevelopment loadings."

Based on the above drainage design and water quality criteria, the Phase I development mauka of Honoapiilani Highway will be required to mitigate an increase in runoff of 45 cfs and provide a minimum storage volume of 148,916 cubic feet and mitigate 266 cfs and provide a minimum storage volume of 771,963 cubic feet makai of Honoapiilani Highway. In addition, the Phase I development mauka of Honoapiilani Highway will be required to provide approximately 196,020 feet of storage to meet the post construction water quality standards and 217,800 cubic feet of storage for the Phase I development makai of the highway.

The Phase II development mauka of Honoapiilani Highway will be required to mitigate an increase in runoff of 60 cfs and provide a minimum storage volume of 215,230 cubic feet and mitigate 145 cfs and provide a minimum storage volume of 392,124 cubic feet makai of Honoapiilani Highway. In addition, the Phase II development mauka of Honoapiilani Highway will be required to provide approximately 297,660 feet of storage to meet the post construction water quality standards and 210,540 cubic feet of storage for the Phase I development makai of the highway.

The proposed project contains a mix of residential, apartment, commercial, school and open space. Runoff will be collected by drainage systems within the roadways and grassed swales within the landscaped areas and routed to one of several detention basins. A description of the detention basins are as follows (See Exhibit 8):

Detention Basins No. 1 to 4: These basins will be constructed outside of the development area and within a natural swale area to reduce the runoff volume reaching Honoapiilani Highway.

Detention Basin No. 5: Runoff from the most westerly rural lots in Phase II will be diverted into this detention basin.

Detention Basin No. 6: Runoff from the most westerly lots in Phase I will be diverted into this detention basin.

Detention Basin No. 7: The majority of the Phase I and II development makai of Honoapiilani Highway will be diverted into this detention basin.

Detention Basin No. 8: The majority of the Phase I and II development mauka of Honoapiilani Highway between the Waihee Ditch and the highway will be diverted into this detention basin.

The drainage system will be designed to accommodate the increase in surface runoff volume from a 100-year, 24-hour storm created by the project

and the volume required to meet the post construction water quality standards. In addition to the detention basins, large grassed swales will be constructed within the open space areas to divert runoff to designated outlets.

The design of the detention basins will include an overflow pipe which will allow a minimal discharge during a storm event and fully drain the basin within 48 hours after each storm event.
After the development of the proposed project, there will be no change in the volume of runoff diverted to Waikapu Stream from the upper agricultural preservation area. The existing diversion berms will continue to divert runoff from the areas mauka of the project site into Waikapu Stream.

In accordance with the County's *"Rules for the Design of Storm Water Treatment Best Management Practices",* the design of the stormwater system will include water quality treatment to reduce the discharge of pollutants to the maximum extent practicable. Some examples of stormwater best management practices (BMP) are:

Grassed Swales will be implemented within the landscaped areas where practical. Grass and groundcover provides natural filtration and allows for percolation into the underlying soils.

Open Space and Parks will be maintained with grass or other landscape materials, thereby reducing the amount of impervious surfaces and promotes infiltration.

Stormwater Detention serves to collect and store stormwater allowing some of the suspended solids to settle out. The stored runoff will infiltrate into the underlying soils and recharge groundwater.

A maintenance plan will be developed for the stormwater BMPs. The plan will include the requirements for removal of the accumulated debris and

sediment, maintaining vegetation, and performing inspections to insure the BMPs are functioning properly.

Temporary erosion control measures will be incorporated during the construction period to minimize dust and soil erosion. Additional controls will be implemented to protect Waikapu Stream. Temporary BMPs include the construction of diversion berms and swales, dust fences, silt fences, stabilized construction entrances, truck wash down areas, inlet protection, temporary grassing of graded areas, and slope protection. Water trucks and temporary sprinkler systems will be used to minimize dust generated from the graded areas. A National Pollution Discharge Elimination System (NPDES) permit will be required by the Department of Health prior to approval of the grading permit.

The drainage design criteria will be to minimize any alterations to the drainage pattern of the existing onsite surface runoff. No additional runoff will be allowed to sheet flow toward Kealia Pond.

3.3 SEWER

The County Department of Environmental Management (DEM) has projected that wastewater flows from the Waikapu Growth Area may reach two million gallons per day. They have stated that the preferred method of wastewater treatment from this area would be by a wastewater treatment facility located in the Waikapu area. This would eliminate the excessive energy consumption for pumping, reduce the use of shoreline injection wells for disposal and allow the reuse of treated water at the proposed regional park and other nearby sites.

In July 2013 the DEM reviewed the capacity situation of their wastewater system in the Wailuku area. Included in their review were the existing gravity sewer lines, pump station and the treatment facility. The following assumptions were made:

- *"The Kehalani, Waiolani Mauka, Waikapu Gardens multi-family and Maui Lani projects completed their build out (approximately 2,100 units).*
- *Waikapu Sewer Extension on project is completed per the County's 6 year CIP project list.*
- *The upgrade of sewer on Waiale Road fronting Kehalani is completed by the County of Maui.*
- *Any flows accepted from the projects in the Waikapu area (not in the current service area) are introduced to the system on Waiko Road where the existing force main connection is located.*
- *The Kahului Wastewater Reclamation Facility has capacity allocation remaining for approximately 1.11 mgd (3,000 dwelling units) and 0.54 mgd for other supportive uses to issue building permits (as of 6/30/2013).*
- *Wet weather flows have the ability to double the volume within the wastewater system and adequate capacity need to be maintained for these infrequent events.*

After several rounds of hydraulic modeling were conducted to determine the effects of adding flows from outside the service area to the existing County wastewater system the following results were obtained:

1) *The Kahului Wastewater Reclamation Facility does not have the capacity to accept flows from outside the current service area in perpetuity without a project to increase capacity. Plant capacity would need to be expanded by approximately two million gallons per day for the buildout of all projects.*
2) *The Wailuku Wastewater Pump Station would have adequate capacity to accommodate about 2,000 homes above that currently expected for the area, however, additional studies would be needed to determine if any modifications at the Kahului WWRF headworks would be required.*

3) *In order for the collection system to accept any flows from the Tropical Plantation/Waiale area of Waikapu an upgrade of the existing gravity sewer in Lower Main Street from 12" to 15" would be required. This segment stretches from Ainahou Place to Hala Place (Manholes KA20GE0100 to KA20GB0510) and is approximately 1,950 l.f.*
4) *A second upgrade would be required prior to the number of equivalent housing units exceeding two hundred (200). This would require upsizing current lines at two locations: (a) the 8" main trunk line from the force main daylight manhole in Waiko Road through Waikapu Gardens would need to be upgraded to 12" (approximately 2,750 l.f.); (b) upsize the final two pipe segments prior to the Wailuku Pump Station from 24" to 36" (approximately 150 l.f. with a major bypass operation). Upgrade 4(a) would accommodate approximately 450 additional homes.*
5) *Further analysis is required to determine the exact extent of Lower Main Street improvements required for additional units over 650.*
6) *While not modeled we would expect that the existing pump station owned, operated and maintained by the tropical plantation would need to be upgraded in order to handle the flows generated by the new housing development.*

Thus there exists a possibility of allowing a temporary connection for these out of service area projects so that they can proceed with the development and sales while designing and constructing a wastewater reclamation facility for the area. An agreement would be need to be completed between the County and the developer(s) with defined milestones in regards to required upgrades, building permits allowed, possible reimbursements (if any) for improvement work on the existing collection system, provisions for the treatment facility etc".

The policy of the DEM is that wastewater capacity cannot be reserved until the project is ready to receive building permits. If capacity at the KWRF is

available at the time building permits are ready to be issued for the project, the project may consider a temporary connection to the County's sewer system and complete the required upgrades for the connection in the Phase I development.

The Waikapu Country Town development will need to construct a stand-alone private wastewater treatment facility or partner with other projects in the Waikapu area, such as A&B's Waiale project or the County of Maui to construct a regional wastewater treatment facility. The planning and design of a stand-alone or combined wastewater treatment facility will be coordinated with the availability of capacity within the County system. If required, a private wastewater treatment facility will be designed, constructed and in operation upon completion of the first home.

In addition to any capacity that may be available in the County's sewer system, the developers are looking into several private wastewater treatment facility alternatives. The first is a conventional wastewater treatment facility. This alternative generally involves liquids treatment consisting of preliminary treatment, flow equalization, primary sedimentation treatment, secondary biological treatment, secondary sedimentation treatment, disinfection, and disposal. The treatment of solids includes stabilization, dewatering, and disposal.

The second and preferred wastewater treatment alternative is to utilize a Food Chain Reactor (FCR) configuration, consisting of biological treatment in successive reactor zones utilizing fixed biomass on a combination of natural plant roots and engineered biofiber media, along with a limited amount of suspended biomass. This alternative generally involves pretreatment, secondary biological treatment through a FCR zone, process aeration, chemical phosphorus removal/coagulation, flocculation, disinfection and disposal.

Brown and Caldwell Consultants were retained by the Department of Environmental Management to prepare the *"Central Maui Recycled Water Study".* The report dated April 2015, concluded the following:

"A conceptual Central Maui service area wastewater system was developed. The major elements required for the Central Maui service area include:

- *Three new WWPSs.*
- *A wastewater conveyance system that includes gravity sewers and forcemains.*
- *A new Central Maui WWRF to produce R-1 recycled water.*
- *A soil aquifer treatment system for excess recycled water disposal.*
- *A brackish groundwater well to provide supplemental water to the recycled water system.*
- *A recycled water pump station and storage tank.*
- *Recycled water transmission pipelines to the Tier 1 areas.*

The total cost for the system is estimated to be $91.4 million, or $20,300 per market-rate EDU.

The County may consider increasing the size of the service area to include areas outside the defined Central Maui growth area. Future MIP updates could include projects that have been proposed but were excluded from the current Urban Growth Boundaries. Examples include the Department of Hawaiian Homelands project in Puunene, and Maalaea Mauka subdivision. The County could also consider providing capacity for the existing Maalaea development area to eliminate the use of near-shore injection wells there. These additional areas would contribute to wastewater flows, and would have to be considered in the conveyance, treatment, reuse, supplemental water, and disposal systems. Capital costs, O&M costs, and WWRF land area requirements would increase to accommodate projects that are outside of the defined service area boundaries. Assessment of the additional costs and land area requirements was outside the scope of this study.

Approximately 80 percent of the recycled water that is produced by the WWRF throughout a typical year would be beneficially used for irrigation purposes. Supplemental groundwater would be needed to meet the irrigation needs of the recycled water users during the hot season. The system will have no injection wells for effluent disposal. Excess recycled water during the wet season would be disposed in a soil aquifer treatment system. The soil aquifer treatment system will provide additional natural treatment as the applied water percolates through the soil to groundwater. The soil aquifer treatment system will provide an additional layer of environmental protection compared to the status-quo injection well systems used for effluent disposal at the County's existing WWRF's.

If the County decides to proceed with a public wastewater system for the Central Maui growth area it should consider preparing a master plan for the wastewater and recycled water systems."

The Waikapu Country Town development could construct a stand-alone private wastewater treatment plant near the northeast corner of the project site after the maximum units is serviced by the County's wastewater system. However, the treatment plant will be needed in about 2017 and the developers will continue to work with the County and other projects within the Waikapu area on a collaborative wastewater treatment facility. At the time the wastewater treatment plant is constructed, any units which temporarily connected to the County's wastewater system will be connected to the new wastewater treatment plant.

3.4 WATER

Water and fire protection for the project will be provided from a private onsite water system. Five (5) wells have been drilled on the site (See Exhibit 12). Three (3) wells have been designated for potable use and two (2) for non-potable purposes. All of the wells are located within the Waikapu Aquifer.

According to the Commission on Water Resource Management, the sustainable yield of the Waikapu aquifer is 3.0 million gallons per day. The three potable water wells have been approved by the State of Hawaii, Commission on Water Resource Management for a total pumping capacity of 2,300 gallons per minute (gpm).

Waikapu Country Town Well No. 1 (State Well No. 5030-01) was drilled at a ground elevation of approximately 654 feet above mean sea level (MSL) and will be used as a potable water source. It has a rated capacity of 500 gpm. Waikapu Country Town Well No. 2 (State Well No. 5131-02) was drilled at a ground elevation of approximately 778 feet above MSL and will be used as a potable water source. It has a rated capacity of 700 gpm. Waikapu Country Town Well No. 3 (State Well No. 5131-04) was drilled at a ground elevation of approximately 523 feet above MSL and will be used as a potable water source. It has a rated capacity of 1,000 gpm.

A 10-day pump test was conducted from April 26, 2016 to May 6, 2016 for Potable Wells 1, 2 and 3 by Water Resource Associates (WRA). The results of the pump test at each well were:

Well 1 was pumped at a constant rate of 972 gpm (1.39 mgd) for 10 days for a total pumpage of 13,600,000 gallons. The chloride content varied from 41 mg/L to 47 mg/L (potable water limit is 250 mg/l). WRA suggested that Well 1 is capable of yielding 1.4 mgd with a static water level of 8.5 feet above mean sea level.

Well 2 was pumped at a constant rate of 720 gpm (1.03 mgd) for 10 days for a total pumpage of 10,238,400 gallons. The chloride content decreased from 132 mg/L to 100 mg/L. WRA suggested that Well 2 is capable of yielding 1.0 mgd with a static water level of 15.0 feet above mean sea level.

Well 3 was pumped at a constant rate of 747 gpm (1.07 mgd) for 10 days for a total pumpage of 10,487,8800 gallons. The chloride content varied from 25 mg/L to 109 mg/L. WRA suggested that the sustainable capacity of Well 3 is less than 700 gpd, despite a static water level of 8.5 feet above mean sea level. They recommended further testing at lower pumping rates and drawdowns to assess Well 3's sustainable pumping capacity with regard to chlorides.

The WRA report stated the following regarding water quality:

"The water quality parameter which is of most concern during a pumping test is chloride because it is an easily determined indicator of salt water intrusion. The potable water limit for chloride content is 250 mg/L, which indicates that Well 1 produces the freshest water at approximately 40 mg/L, followed close behind by basalt Well 2 at approximately 100 mg/L and alluvial Well 3 varying between 25 and 109 gm/L.

In addition to the frequent tests for chlorides, representative water samples were carefully collected from Wells 1, 2 and 3 for testing by Eurofins Analytical, an approved lab, in accordance with the requirements of the Hawaii Department of Health for new potable water sources. The results indicate that all three wells are capable of producing potable water of excellent quality. The chlorides are low and the tested inorganic constituents are well within the Federal maximum contaminant levels (MCL) of public water systems. Further, all volatile and non-volatile organic contaminants and pesticides analyzed were non-detectable."

Two non-potable water wells were drilled as designated as Waikapu Country Town Wells No. 4 (State Well No. 5130-03) and No. 5 (State Well No. 5130-04). Well No. 4 was drilled at a ground elevation of approximately 459 feet above MSL and Well No. 5 was drilled at a ground

elevation of approximately 482 feet above MSL. The capacity of Well No. 4 is 500 gpm and 650 gpm for Well No. 5. Both wells have preliminarily shown low salinity levels, and testing is being conducted to determine the viability of those wells for domestic use. If not viable for domestic use, it will be used for non-potable agricultural use.

Water pumped from the non-potable wells will be discharged into the Waihee Ditch or lined onsite reservoirs and used for irrigation purposes for the residential lots, agricultural farming, parks and open areas (See Exhibit 14).

The following Non-Potable Irrigation Calculations table was prepared by Planning Consultants Hawaii, LLC and Hawaii Land Design, LLC. The State Department of Agriculture irrigation rate of 3,400 gallons per acre was used.

Land Use	**Acres**	**Factor**	**Irrigated Acres**	**Irrigation Rate @ 3400/acre**
Single Family	131.05	0.25	32.76	111392.50
MF/Town Home	21.203	0.25	5.30	18022.55
Rural	124.82	0.5	62.41	212194.00
CT Mixed Use	16.168	0.25	4.04	13742.80
Commercial	12.89	0.25	3.22	10956.50
Town Center/Lagoon	4.28	1	4.28	14552.00
School	12	0.25	3.00	10200.00
Active/Passive Park	32.44	1	32.44	110296.00
Greenways/Open Space	49.66	1	49.66	168844.00
TOTAL	404.511		197.1178	670,200.35
Agriculture	1077	0.75	807.75	2,746,350.00
TOTAL				**3,416,550.35**

The estimated potable water demand for the project was determined from the Department of Water Supply's Water System Standards (DWSWSS), dated 2002, as follows:

- Single-Family: 600 gallons per day (gpd) per unit
- Rural Residential: 1,000 gpd/unit*
- Multi-Family: 560 gpd/unit
- Country Town Mix-Use: (Dwelling) 560 gpd/unit
- Country Town Mix-Use: (Commercial) 140 gallons/1,000 s.f.
- Commercial/Employment: 140 gallons/1,000 s.f.
- Parks and Open Space: 1,700 gallons/acre
- School: 1,700 gallons/acre

*Note-the DWSWSS does not have a value for the potable demand for a Rural Residential designation. The 1,000 gpd/unit used is based on discussion with the Department of Water Supply engineers as an acceptable demand for this designation.

The Department of Water Supply (DWS) does not have water demand standards for a dual water system (both potable and non-potable). However, in discussions with the DWS, it was determined that the DWSWSS standards could be conservatively reduced by one-third if a dual water system was used for a project. Based on this criteria, the estimated water demand for the project would be reduced to:

- Single-Family: 400 gallons per day (gpd) per unit
- Rural Residential: 667 gpd/unit
- Multi-Family: 373 gpd/unit
- Country Town Mix-Use: (Dwelling) 373 gpd/unit
- Country Town Mix-Use: (Commercial) 93 gallons/1,000 s.f.
- Commercial/Employment: 93 gallons/1,000 s.f.

- Parks and Open Space: 0 gallons/acre (irrigation will be from the non-potable water source)
- School: 1,133 gallons/acre

Based on the water usage, the projected water projected average daily water demand for Phase I is 311,033 gallons per day (gpd). In accordance with the DWSWSS, the maximum daily water demand is calculated as being 1.5 times the average daily demand, or 466,550 gpd. Based on the commercial uses, the maximum fire demand is 2,000 gpm (See Appendix B for Water Demand Calculations). The projected average daily water demand for Phase II is 334,475 gpd and the maximum daily water demand 501,713 gpd. Irrigation of parks and open spaces will be provided by the non-potable water system.

Water conservation measures such as low-flow toilets and shower heads will be considered for use in the project, which will decrease the water demand. Irrigation of the parks and open space will be from the non-potable water source, which will also decrease the water demand.

The reservoir capacity is based on the DWSWSS Criterion 1 for Reservoir Capacity, which is to meet the maximum daily consumption with the reservoir full at the beginning of the 24-hour period with no source input into the reservoir. Based on this criterion, the required storage volume for the two phases is 968,263 gallons. It is recommended that a 1.0 million gallon reservoir be constructed to accommodate the two phases of the project. As an alternative, the developer can also construct two storage reservoirs, each with a storage volume of 0.50 million gallons. Each 0.50 million gallon reservoir can be constructed at the beginning of each phase. The two reservoir option can allow the second reservoir to be constructed as the demand increases and allow for more flexibility during maintenance and repair should one of the reservoirs have to be taken out of service.

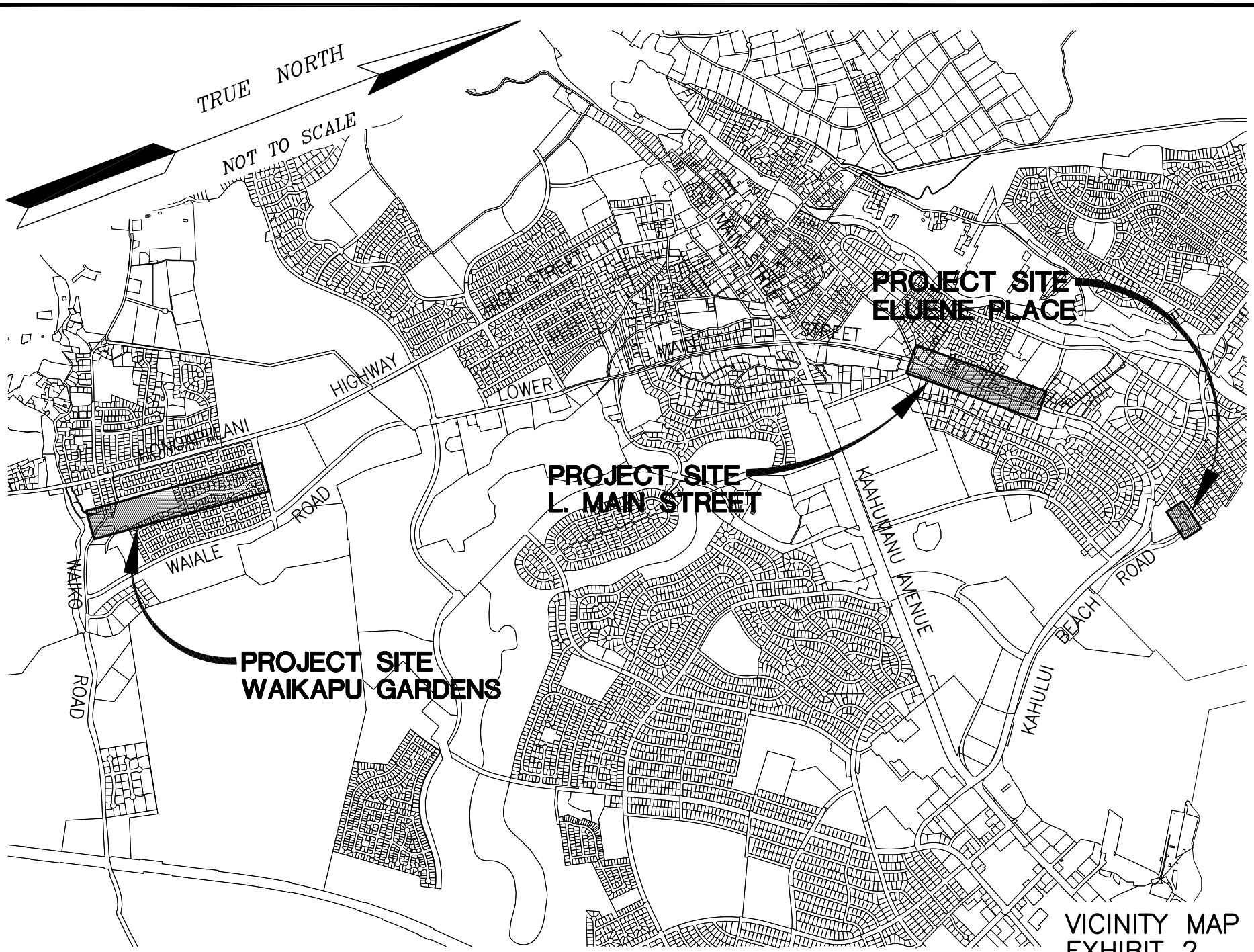
The 1.0 million gallons of water storage will be constructed mauka of Well No. 5 at an elevation of approximately 800 feet MSL. This will allow for the entire project to be serviced by gravity flow from the reservoir(s).

3.5 ELECTRIC, TELEPHONE, AND CABLE TV

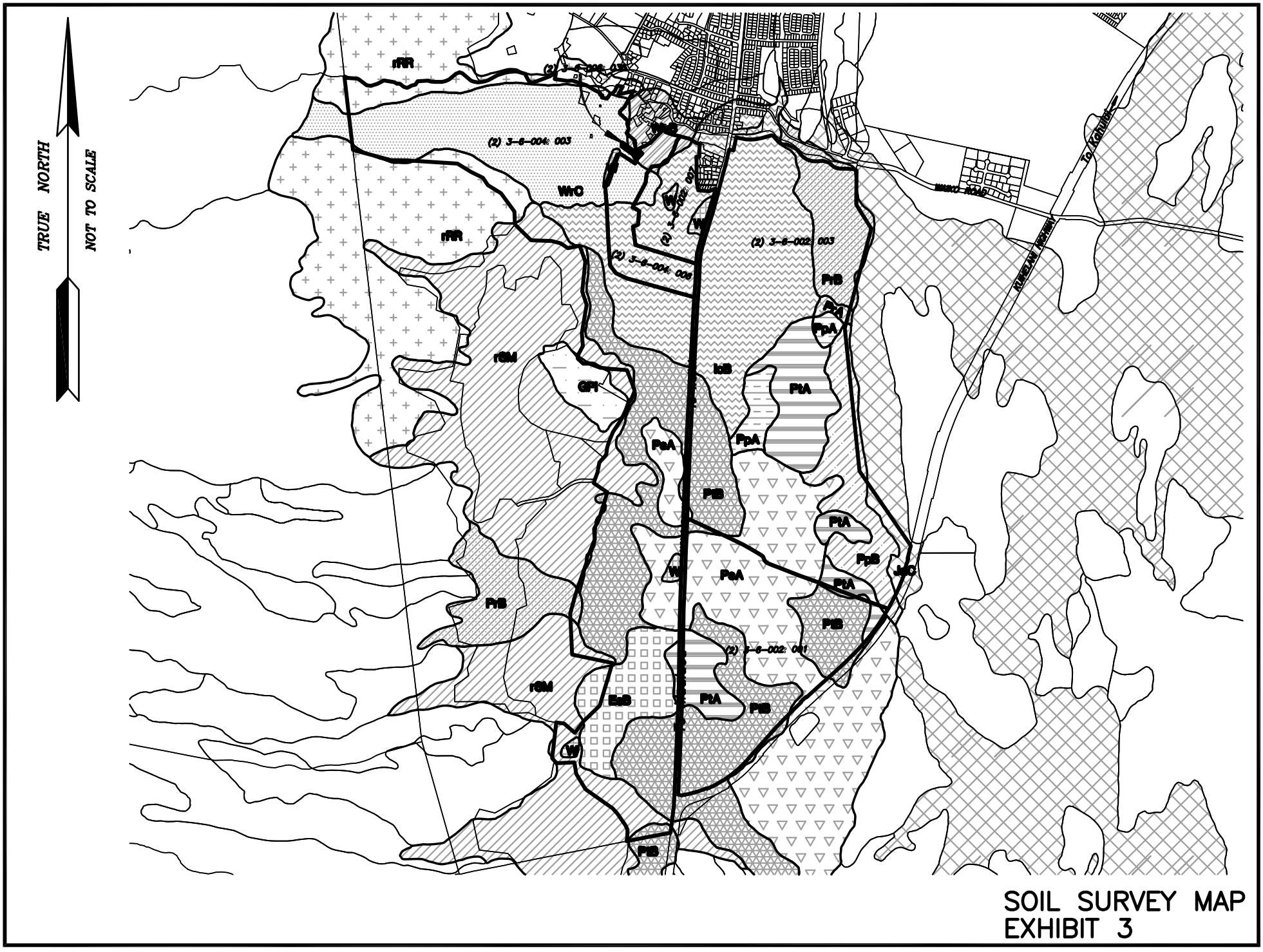
Electric, telephone and cable TV service will be provided by the existing facilities in the area. The project's electrical engineering consultant will coordinate the required improvements with the utility companies to determine the required onsite and offsite improvements to support the project.

EXHIBITS

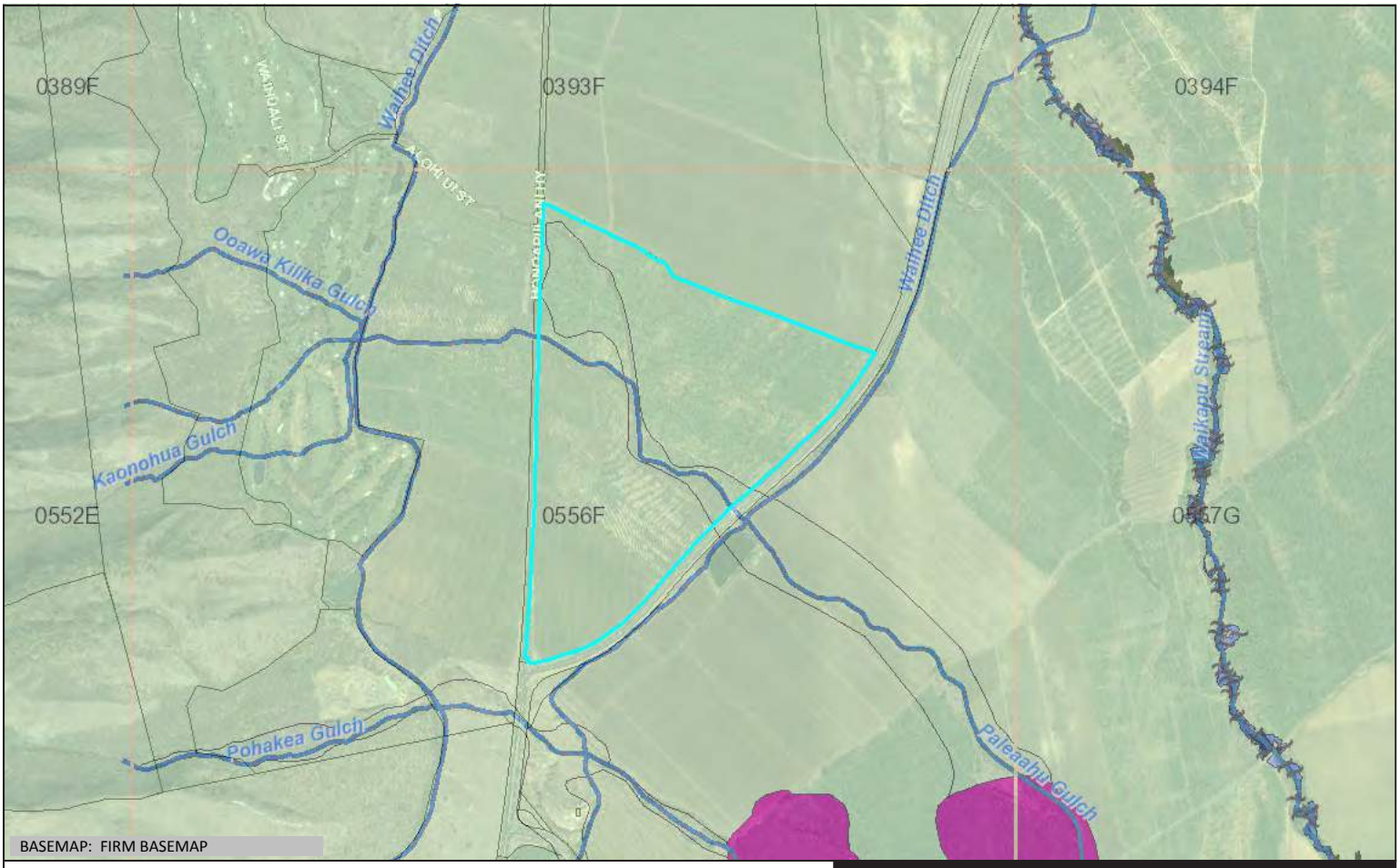
1	LOCATION MAP
2	VICINITY MAP
3	SOIL SURVEY MAP
4A-4F	FLOOD INDURANCE RATE MAP
5	PHASING MAP
6	PROPOSED ROADWAY SYSTEM
6A	ROADWAY CLASSIFICATION TABLE
7	EXISTING DRAINAGE PATTERN
8	PROPOSED DRAINAGE SYSTEM
9	PROPOSED ONSITE SEWER SYSTEM
10	OFFSITE SEWER IMPROVEMENTS (WAIKAPU GARDENS)
11	OFFISTE SEWER IMPROVEMENTS (LOWER MAIN STREET)
12	OFFSITE SEWER IMPROVEMETNS (ELUENE PLACE)
13	PROPOSED POTABLE WATER SYSTEM
14	PROPOSED NON-POTABLE WATER SYSTEM



VICINITY MAP
EXHIBIT 2



SOIL SURVEY MAP
EXHIBIT 3



Flood Hazard Assessment Report

www.hawaiinfip.org

Waikapu Country Town

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-002:001
WATERSHED:	POHAKEA; WAIKAPU
PARCEL ADDRESS:	0 HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030556F
PANEL EFFECTIVE DATE:	SEPTEMBER 25, 2009

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 0.30 0.60 mi

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL)*

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

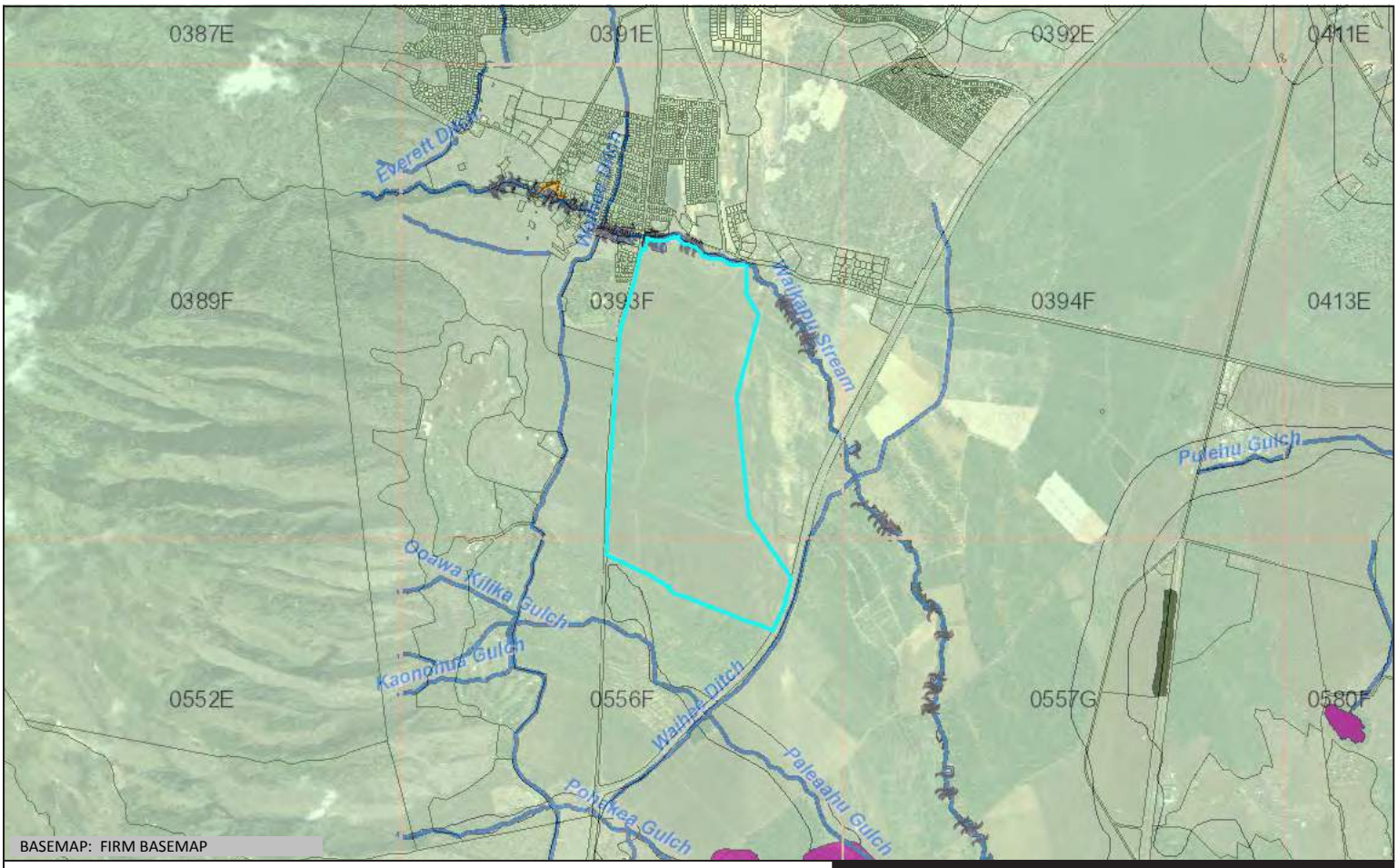
NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

EXHIBIT 4A - FLOOD INSURANCE RATE MAP



Flood Hazard Assessment Report

www.hawaiinfip.org

Waikapu Country Town

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-002:003
WATERSHED:	IAO; WAIKAPU
PARCEL ADDRESS:	0 HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL - EFFECTIVE DATE:	1500030393F - NOVEMBER 04, 2015 1500030556F - SEPTEMBER 25, 2009

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 0.60 1.20 mi

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL)*

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

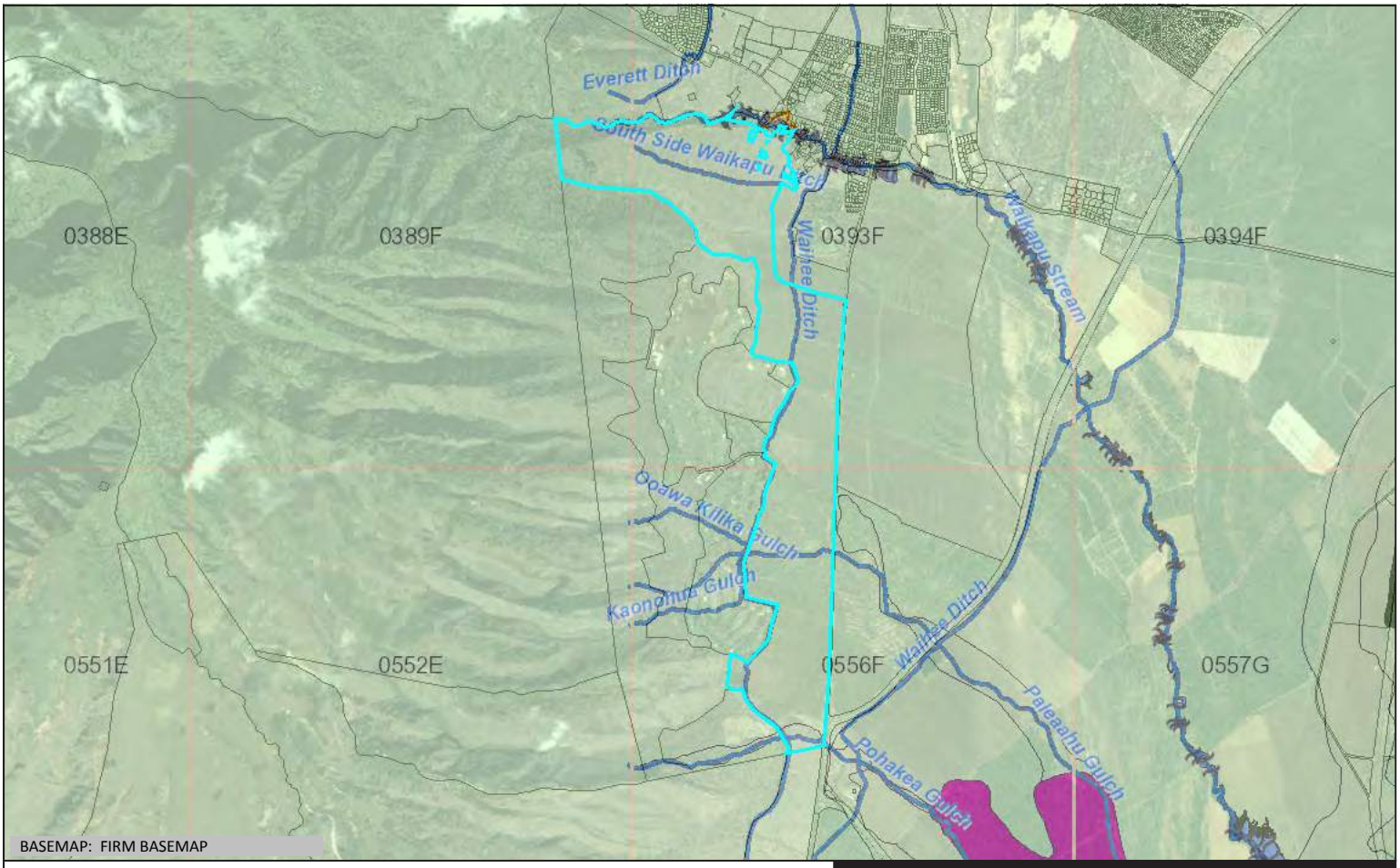
NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

EXHIBIT 4B - FLOOD INSURANCE RATE MAP



Flood Hazard Assessment Report

www.hawaiinfip.org

WAIKAPU COUNTRY TOWN

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-004:003
WATERSHED:	POHAKEA; WAIKAPU
PARCEL ADDRESS:	0 HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL - EFFECTIVE DATE:	1500030389F - NOVEMBER 04, 2015 1500030393F - NOVEMBER 04, 2015 1500030556F - SEPTEMBER 25, 2009

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 0.60 1.20 mi

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL)*

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

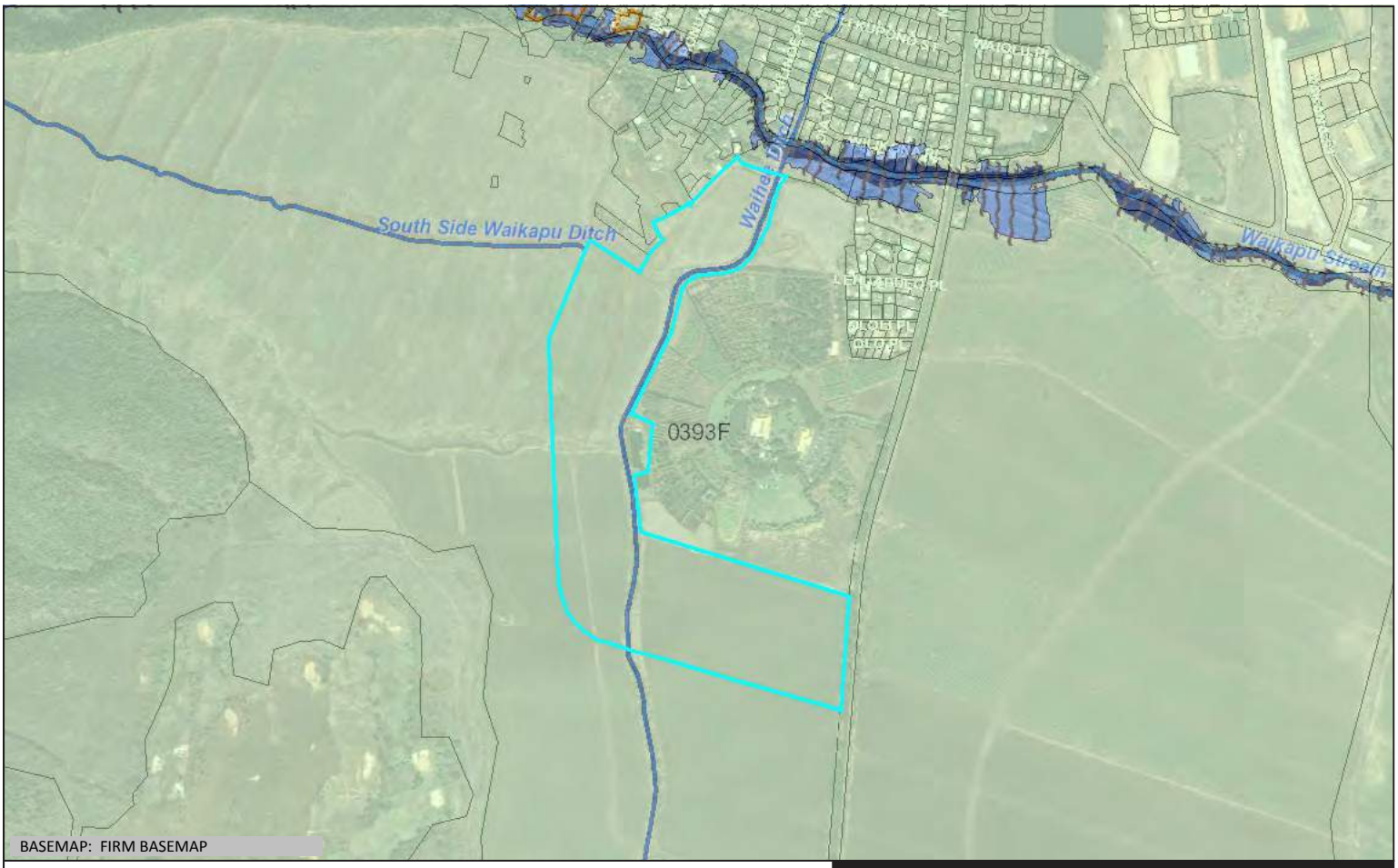
NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

EXHIBIT 4C - FLOOD INSURANCE RATE MAP



Flood Hazard Assessment Report

www.hawaiinfip.org

WAIKAPU COUNTRY TOWN

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-004:006
WATERSHED:	WAIKAPU
PARCEL ADDRESS:	2000 HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030393F
PANEL EFFECTIVE DATE:	NOVEMBER 04, 2015

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 600 1,200 ft

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL)*

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

EXHIBIT 4D - FLOOD INSURANCE RATE MAP

BASEMAP: FIRM BASEMAP

Flood Hazard Assessment Report

www.hawaiinfip.org

WAIKAPU COUNTRY TOWN

Property Information

COUNTY: MAUI

TMK NO: (2) 3-6-005:007

WATERSHED: WAIKAPU

PARCEL ADDRESS: 1670 HONOAPIILANI HWY
WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030393F
PANEL EFFECTIVE DATE:	NOVEMBER 04, 2015

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 600 1,200 ft

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL)*

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

EXHIBIT 4E - FLOOD INSURANCE RATE MAP

Flood Hazard Assessment Report

www.hawaiinfip.org

WAIKAPU COUNTRY TOWN

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-006:036
WATERSHED:	WAIKAPU
PARCEL ADDRESS:	0 WAIKAPU WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030393F
PANEL EFFECTIVE DATE:	NOVEMBER 04, 2015

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 100 200 ft

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL)*

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

EHXIBIT 4F - FLOOD INSURANCE RATE MAP

TRUE NORTH

SCALE: 1 IN. = 800 FT.

To Wahiawa

W. WAIKO ROAD

HONOAPIILANI HIGHWAY

WAIALEE ROAD (COUNTY) EXTENSION

PHASE I

PHASE I

PHASE II

PHASE II

PHASE II

To Maalaea

EXHIBIT 5
PHASING MAP

TRUE NORTH

SCALE: 1 IN. = 800 FT.

To Wailuku

W. WAIKO ROAD

HONOAPIILANI HIGHWAY

WAIALE (BY COUNTY) ROAD EXTENSION

PHASE I

PHASE II

PHASE I

PHASE II

PHASE II

To Maalaea

LEGEND:

- MAJOR ARTERIAL
- MAJOR COLLECTOR
- MINOR URBAN STREET
- MINOR RURAL STREET

EXHIBIT 6
PROPOSED ROADWAY SYSTEM

ROADWAY CLASSIFICATION TABLE

ROADWAY CLASSIFICATION	RIGHT-OF-WAY WIDTH (MIN.)	PAVEMENT WIDTH (MIN.)	PAVEMENT STRUCTURE*
Major Arterial	80 Ft.	56 Ft.	Class “A”
Major Collector	60 Ft.	44 Ft.	Class “A”
Minor Urban Street	48 Ft.	28 Ft.	Class “B”
Minor Rural Street	40 Ft.	22 Ft.	Class “C”

* The pavement structures listed below are the minimum. Modified pavement structures submitted by a licensed Soils Engineer will be considered.

Class “A”
2-1/2” asphalt concrete
5” asphalt treated base
8” subbase
Curbed median island
Concrete curb & gutters
Concrete sidewalks on both sides of street

Class “B”
2-1/2” asphalt concrete
4” asphalt treated base
6” subbase
Concrete curb & gutters
Concrete sidewalks on both sides of street

Class “C”
2” asphalt concrete
6” base course
Grassed swales in shoulders

EXHIBIT 6A
ROADWAY CLASSIFICATION TABLE

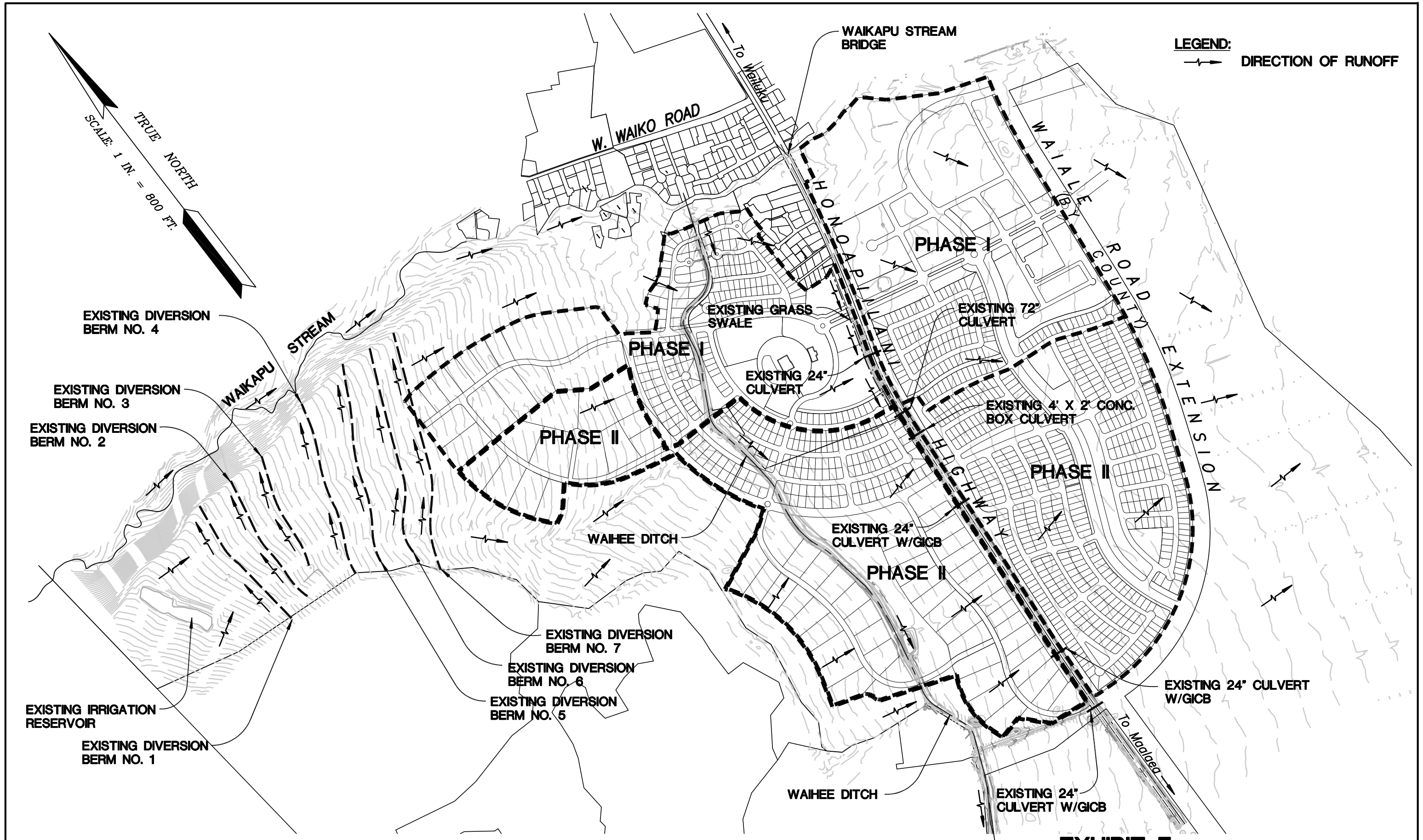


EXHIBIT 7
EXISTING DRAINAGE PATTERN

TRUE NORTH

SCALE: 1 IN. = 800 FT.

To Waiehuku

W. WAIKO ROAD

INLET HEADWALL FOR WAIHEE DITCH

PROPOSED DETENTION BASIN NO. 6

EXISTING DIVERSION BERMS TO REMAIN

PHASE I

PHASE II

PHASE I

GRASSED SWALE

PHASE II

PHASE II

HONOAPILANI HIGHWAY

WAIALE ROAD COLLECTOR ROADWAY EXTENSION

PROPOSED DETENTION BASINS NO. 1 - 4 TO MITIGATE NON-PROJECT AREA RUNOFF

PROPOSED DETENTION BASIN NO. 5

GRASSED SWALE

SECTION OF WAIHEE DITCH TO BE REPLACED WITH CULVERT SYSTEM

OUTLET HEADWALL FOR WAIHEE DITCH

GRASSED SWALE

To Maalaea

PROPOSED DETENTION BASIN NO. 7

PROPOSED DETENTION BASIN NO. 8

EXISTING 24" CULVERT TO BE REPLACED

LEGEND:

- PROPOSED DRAINLINES
- PROPOSED DETENTION BASINS
- CULVERT SYSTEM
- GRASSED SWALE
- EXISTING DIVERSION BERMS

EXHIBIT 8
PROPOSED DRAINAGE SYSTEM

TRUE NORTH

SCALE: 1 IN. = 800 FT.

To Wailuku

W. WAIKO ROAD

HONOAPI'ILANI HIGHWAY

WAIALE ROAD EXTENSION (BY COUNTY)

PHASE I

PHASE II

PHASE I

PHASE II

PHASE II

WATER RECLAMATION FACILITY

To Maalaea

LEGEND:

8" SEWERLINE

12" SEWERLINE

SEWER MANHOLE

EXHIBIT 9
PROPOSED ONSITE SEWER SYSTEM

TRUE NORTH

SCALE: 1 IN. = 100 FT.

WAIKO RD.

CONNECT TO EXT'G SMH

S12"

NEW SMH

HAAWI STREET

MATCHLINE (SEE BELOW FOR CONT.)

TRUE NORTH

SCALE: 1 IN. = 100 FT.

HAAWI STREET

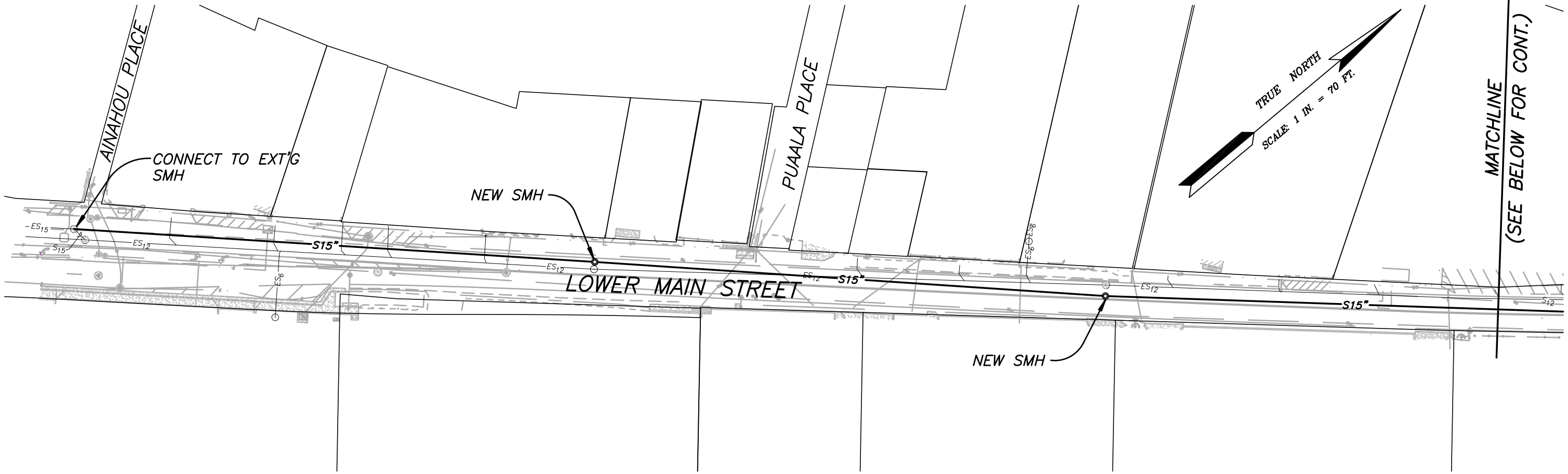
MATCHLINE (SEE ABOVE FOR CONT.)

KOKOLOLIO STREET

NEW SMH

S12"

EXHIBIT 10
OFFSET SEWERLINE IMPROVEMENTS (WAIKAPU GARDENS)



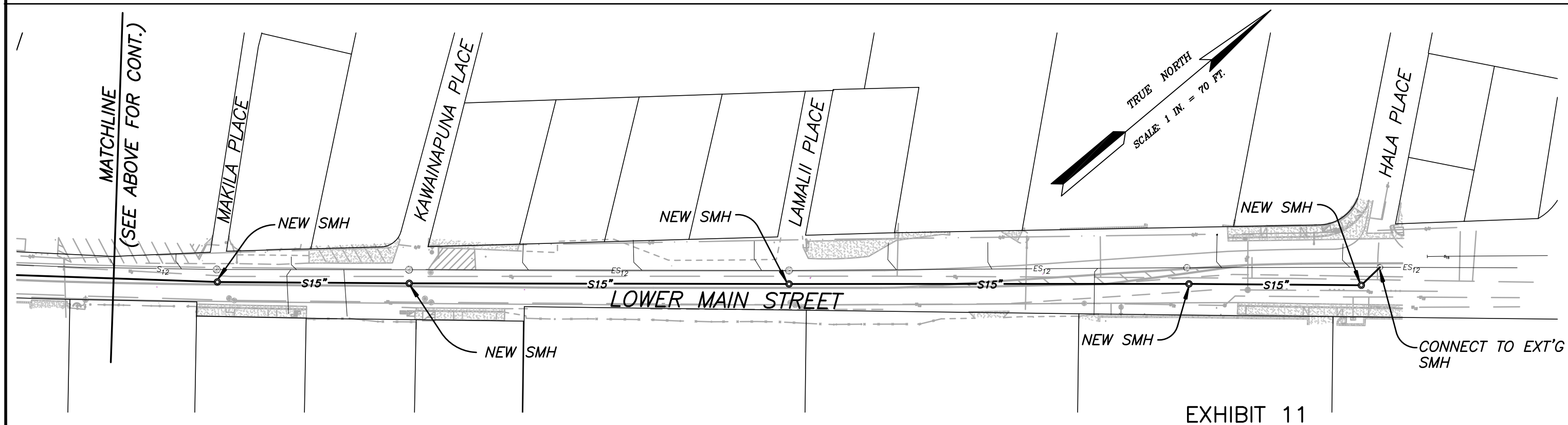


EXHIBIT 11
OFFSET SEWERLINE IMPROVEMENTS
(LOWER MAIN STREET)

TRUE NORTH

SCALE: 1 IN. = 30 FT.

ELUENE PLACE

TMK: (2) 3-4-027: 043

TMK: (2) 3-4-027: 044

TMK: (2) 3-4-027: 036

TMK: (2) 3-4-027: 001

CONNECT TO EXT'G MH

CONNECT TO EXT'G SMH

W6

W6

"+" ON CONC. (FND.)

"+" ON CONC. (FND.)

MAG NAIL (FND.)

1/2" PIPE (FND.)

ES

ES12

S12

CL FENCE, H=6'

CONC. NAIL (FND.)

ES8 (ABAND.)

APPROX. LOCATION

EDGE PAVT.

A.C. PARKING

WV
TOP=11.29
TV=10.03

CMU WALL

SMH (PER PLAN)

W2

ES18

ES24

S36"

WIRE FENCE, H=6'

BOT. BANK

TOP BANK

RUBBISH PILE

CONC. BARRIER

BFP

TANK

GATE

C.L. FENCE, H=6'

SMH
TOP=11.65
INV=(-)7.25

SMH
TOP=11.66
INV=(-)4.54

SMH
TOP=11.58
INV=(-)8.10

2-RISER

2-RISER

H.V.

TP=14.59(12")
TOP GRATE=12.33
INV=(-)18.78

TP=14.55(12")

GATE

MH
TOP=11.09

2-RISER

SMH
TOP=11.05
(FROZEN)

ES21

ES30

SMH
TOP=9.96
INV=(-)3.50
INV=(-)4.75(In)
INV=(-)4.63(Out)

ES8 (ABAND.)

EXHIBIT 12
OFFSET SEWERLINE IMPROVEMENTS
(ELUENE STREET)

TRUE NORTH

SCALE: 1 IN. = 800 FT.

To Wailuku

WELL NO. 4
(NON-POTABLE)

WELL NO. 5
(NON-POTABLE)

W. WAIKO ROAD

MONITORING WELL

HONOAPI'ILANI HIGHWAY

WAIALE (BY COUNTY) ROAD EXTENSION

PHASE I

PHASE I

PHASE II

PHASE II

PHASE II

WELL NO. 3
(POTABLE)

WELL NO. 2
(POTABLE)

WELL NO. 1
(POTABLE)

STORAGE TANK(S)
1.1 MG TOTAL

To Maalaea

LEGEND:

- 8" WATERLINE
- 12" WATERLINE
- 16" WATERLINE

EXHIBIT 13
PROPOSED POTABLE WATER SYSTEM

TRUE NORTH

SCALE: 1 IN. = 800 FT.

WELL NO. 5
(NON-POTABLE)

MONITORING WELL

W. WAIKO ROAD

To Wailuku

WELL NO. 4
(NON-POTABLE)

HONOAPILANI HIGHWAY

WAIALEY ROAD (COUNTY) EXTENSION

PHASE I

PHASE I

PHASE II

PHASE II

PHASE II

WELL NO. 3
(POTABLE)

NON-POTABLE
STORAGE AREA

WELL NO. 2
(POTABLE)

WELL NO. 1
(POTABLE)

To Maalaea

LEGEND:

NON-POTABLE WATERLINE

EXHIBIT 14
PROPOSED NON-POTABLE WATER SYSTEM

APPENDIX A

HYDROLOGIC CALCULATIONS

Hydrologic Calculations – Diversion Berms

Purpose: Determine the volume of water upstream of the development being diverted into Waikapu Stream.

A. Determine the Runoff Coefficient (C):

DRAINAGE AREA CHARACTERISTICS:

LANDSCAPE AREAS:

Infiltration (Medium)	=	0.07
Relief (Hilly)	=	0.06
Vegetal Cover (Good)	=	0.03
Development Type (Landscape)	=	0.15
C	=	0.31

B. Determine the 50-year 1-hour rainfall:

i_{50} = 3.0 inches

Adjust for time of concentration to compute Rainfall Intensity (I):

Diversion Berm	1	2	3	4	5	6	7
Tc [min]	25	14	14	15	14	13	13
I [in]	4.56	5.77	5.77	5.62	5.77	5.93	5.93

C. Drainage Area (A):

Diversion Berm	1	2	3	4	5	6	7
Area [acres]	19.90	8.60	7.30	16.30	13.10	12.90	13.70

D. Compute the 50-year storm runoff (Q):

$$\mathbf{Q = CIA}$$

Q1 = (0.31)(4.56)(19.90)
= 28.12 cfs

Q2 = (0.31)(5.77)(8.60)
= 15.38 cfs

Q3 = (0.31)(5.77)(7.30)
= 13.15 cfs

Q4 = (0.31)(5.62)(16.30)
= 28.32 cfs

Q5 = (0.31)(5.77)(13.10)
= 23.52 cfs

Q6 = (0.31)(5.93)(12.90)
= 23.71 cfs

Q7 = (0.31)(5.93)(13.70)
= 25.18 cfs

E. 50-year, 1-hour storm Volume (V):

Diversion Berm	1	2	3	4	5	6	7	**Total**
Volume [cu. ft.]	42,177	12,920	11,042	25,488	19,755	18,490	19,637	**148,509**

HYDROLOGIC CALCULATIONS BY PHASING

Phase	Pre-Development Flow (cfs)	Post-Development Flow (cfs)	Increase in Flow (cfs)
I Mauka	452	497	45
I Makai	373	639	266
II Mauka	447	507	60
II Makai	361	506	145

RUNOFF VOLUME CALCULATIONS BY PHASING

Phase	Pre-Development Flow (C.F.)	Post-Development Flow (C.F.)	Storage Required (C.F.)
I Mauka	2,418,629	2,567,545	148,916
I Makai	2,133,808	2,905,771	771,963
II Mauka	2,916,206	3,131,436	215,230
II Makai	2,062,681	2,454,805	392,124

Hydrograph Plot

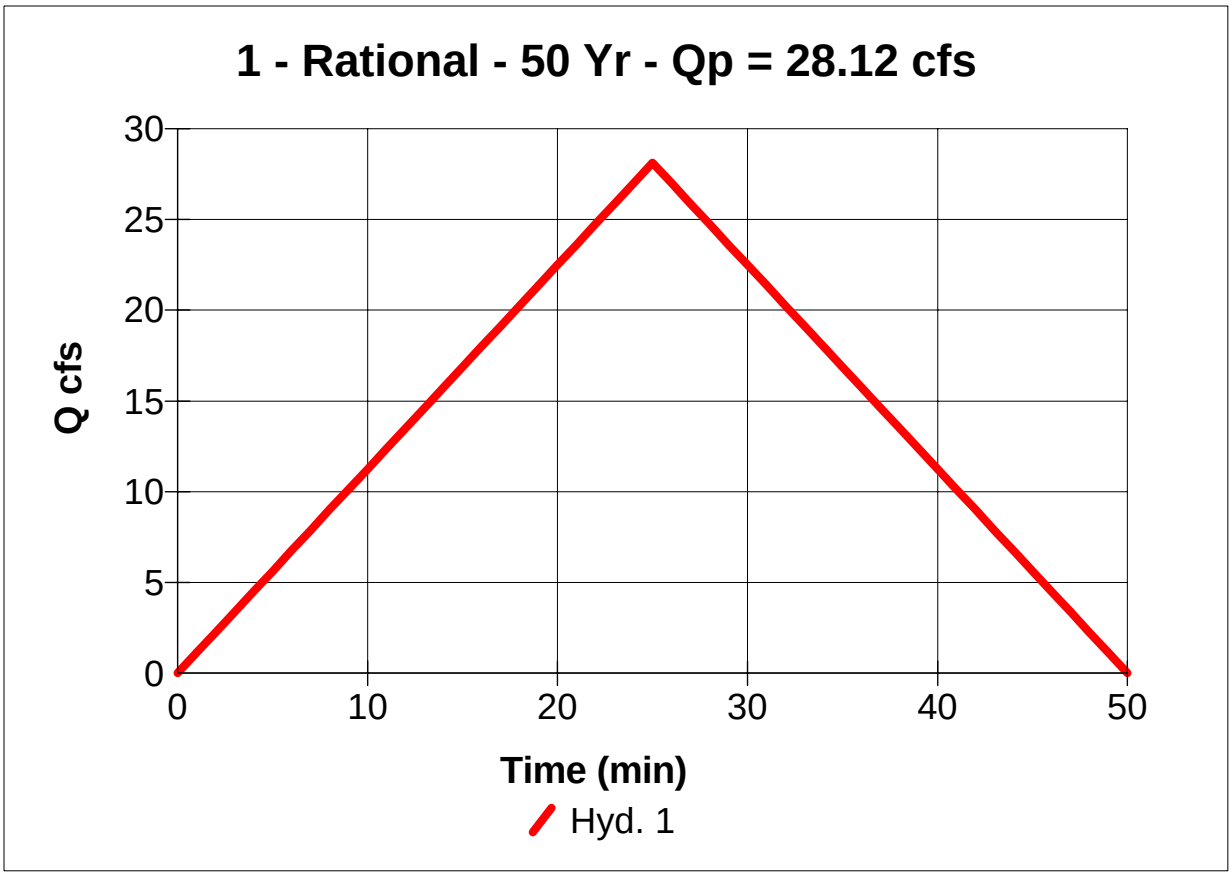
English

Hyd. No. 1

Diversion Berm 1

Hydrograph type	= Rational	Peak discharge	= 28.12 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 19.9 ac	Runoff coeff.	= 0.31
Intensity	= 4.56 in	Time of conc. (Tc)	= 25 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 42,177 cuft



Hydrograph Plot

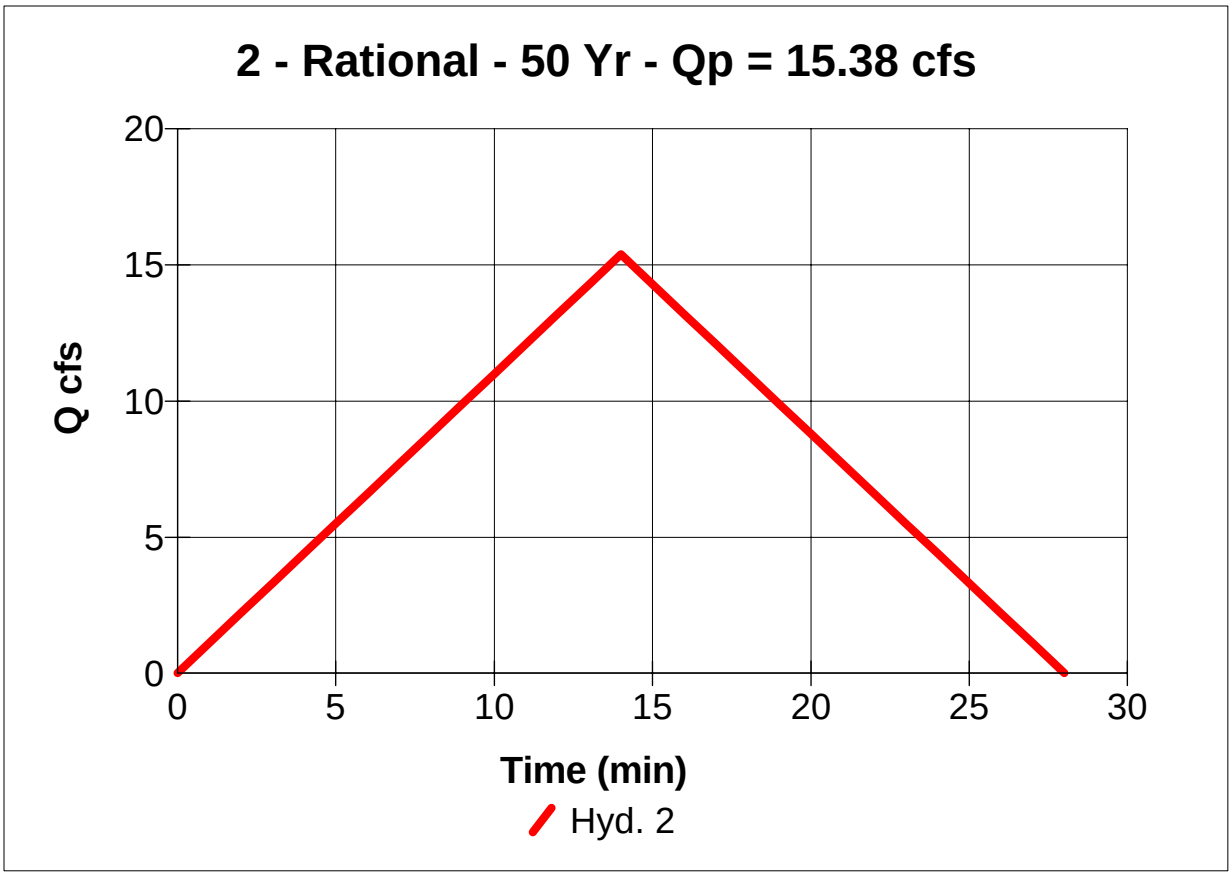
English

Hyd. No. 2

Diversion Berm 2

Hydrograph type	= Rational	Peak discharge	= 15.38 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 8.6 ac	Runoff coeff.	= 0.31
Intensity	= 5.77 in	Time of conc. (Tc)	= 14 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 12,920 cuft



Hydrograph Plot

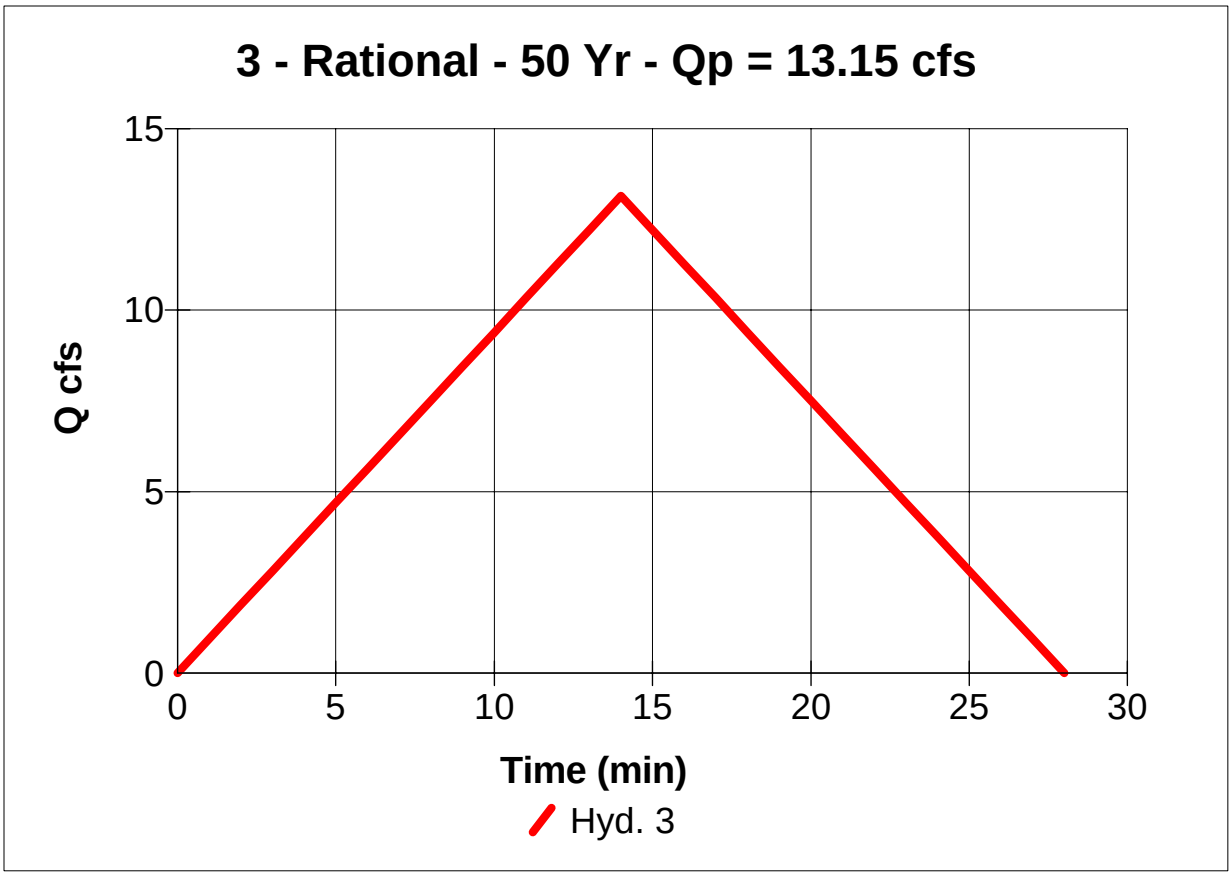
English

Hyd. No. 3

Diversion Berm 3

Hydrograph type	= Rational	Peak discharge	= 13.15 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 7.3 ac	Runoff coeff.	= 0.31
Intensity	= 5.77 in	Time of conc. (Tc)	= 14 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 11,042 cuft



Hydrograph Plot

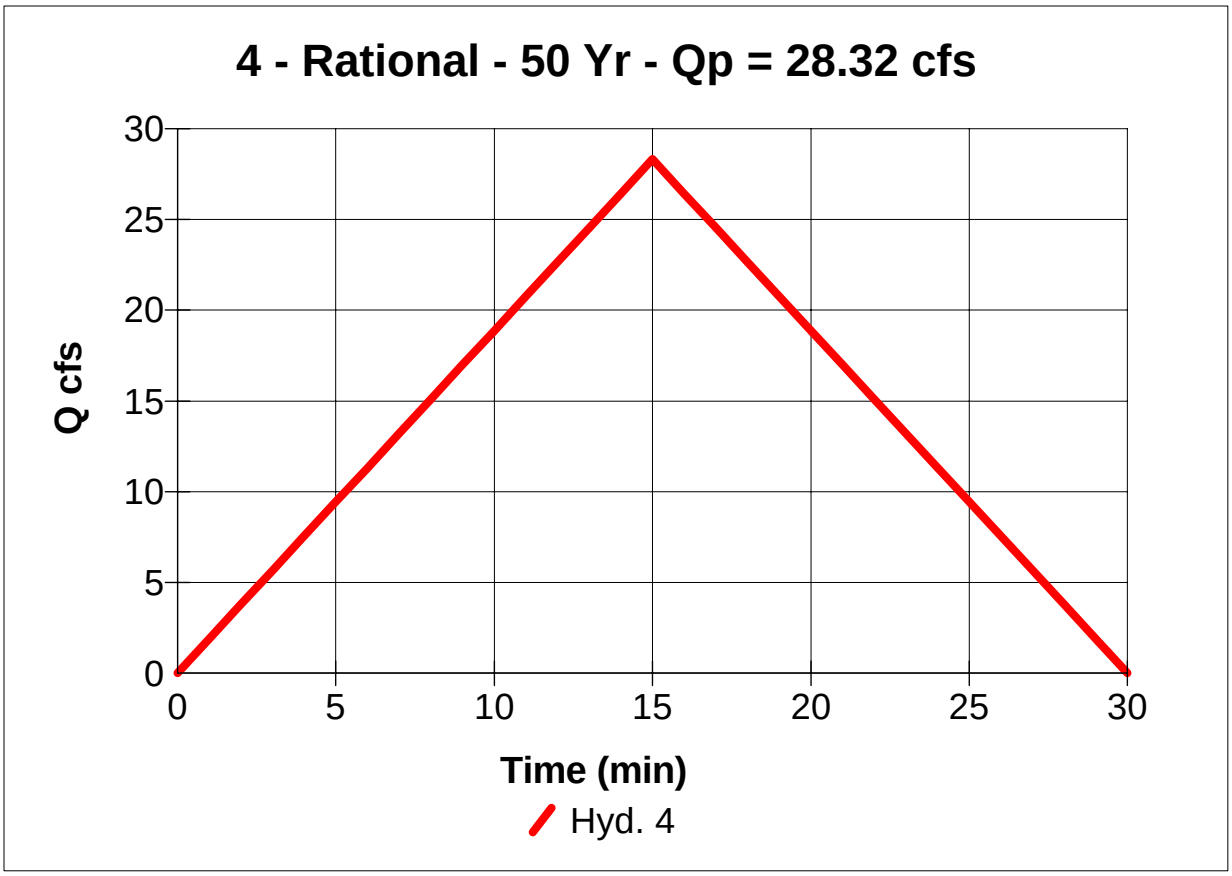
English

Hyd. No. 4

Diversion Berm 4

Hydrograph type	= Rational	Peak discharge	= 28.32 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 16.3 ac	Runoff coeff.	= 0.31
Intensity	= 5.62 in	Time of conc. (Tc)	= 15 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 25,488 cuft



Hydrograph Plot

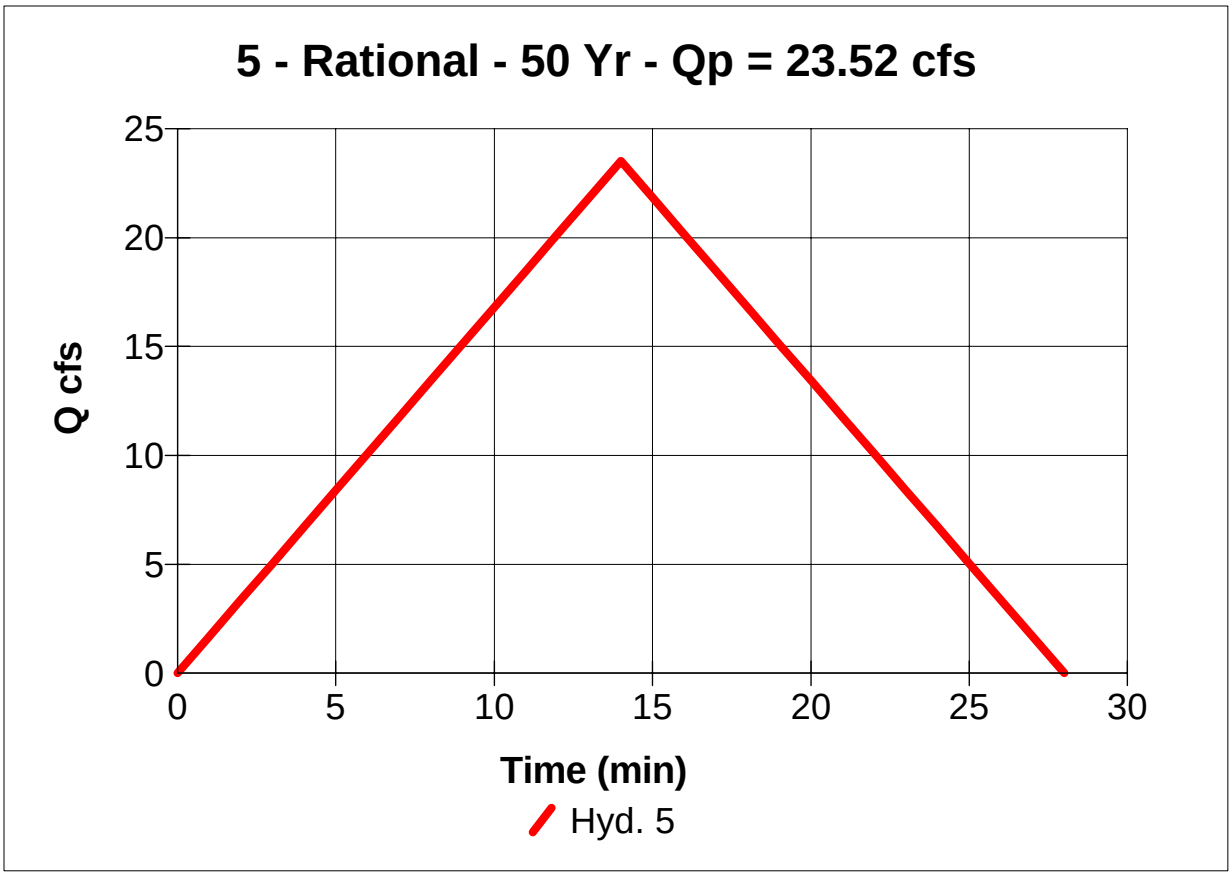
English

Hyd. No. 5

Diversion Berm 5

Hydrograph type	= Rational	Peak discharge	= 23.52 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 13.1 ac	Runoff coeff.	= 0.31
Intensity	= 5.77 in	Time of conc. (Tc)	= 14 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 19,755 cuft



Hydrograph Plot

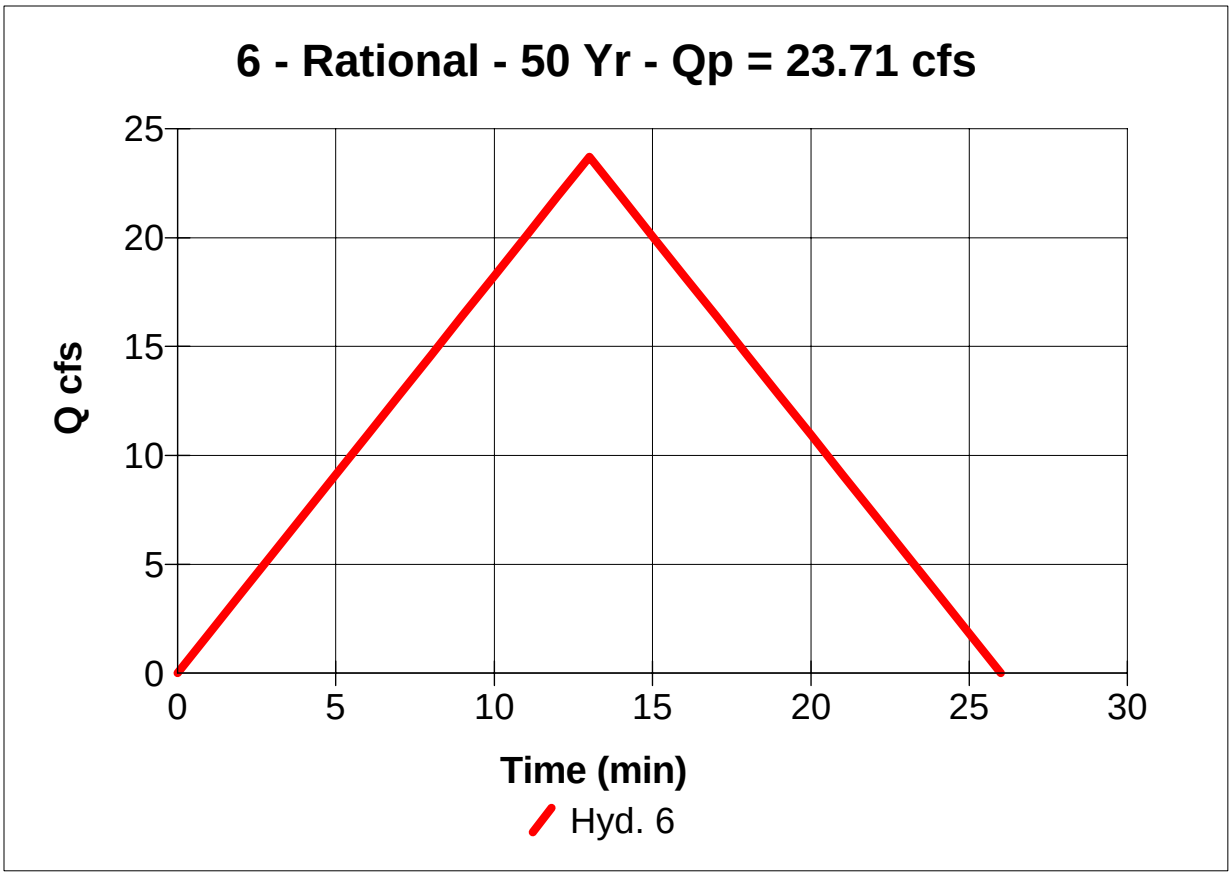
English

Hyd. No. 6

Diversion Berm 6

Hydrograph type	= Rational	Peak discharge	= 23.71 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 12.9 ac	Runoff coeff.	= 0.31
Intensity	= 5.93 in	Time of conc. (Tc)	= 13 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 18,490 cuft



Hydrograph Plot

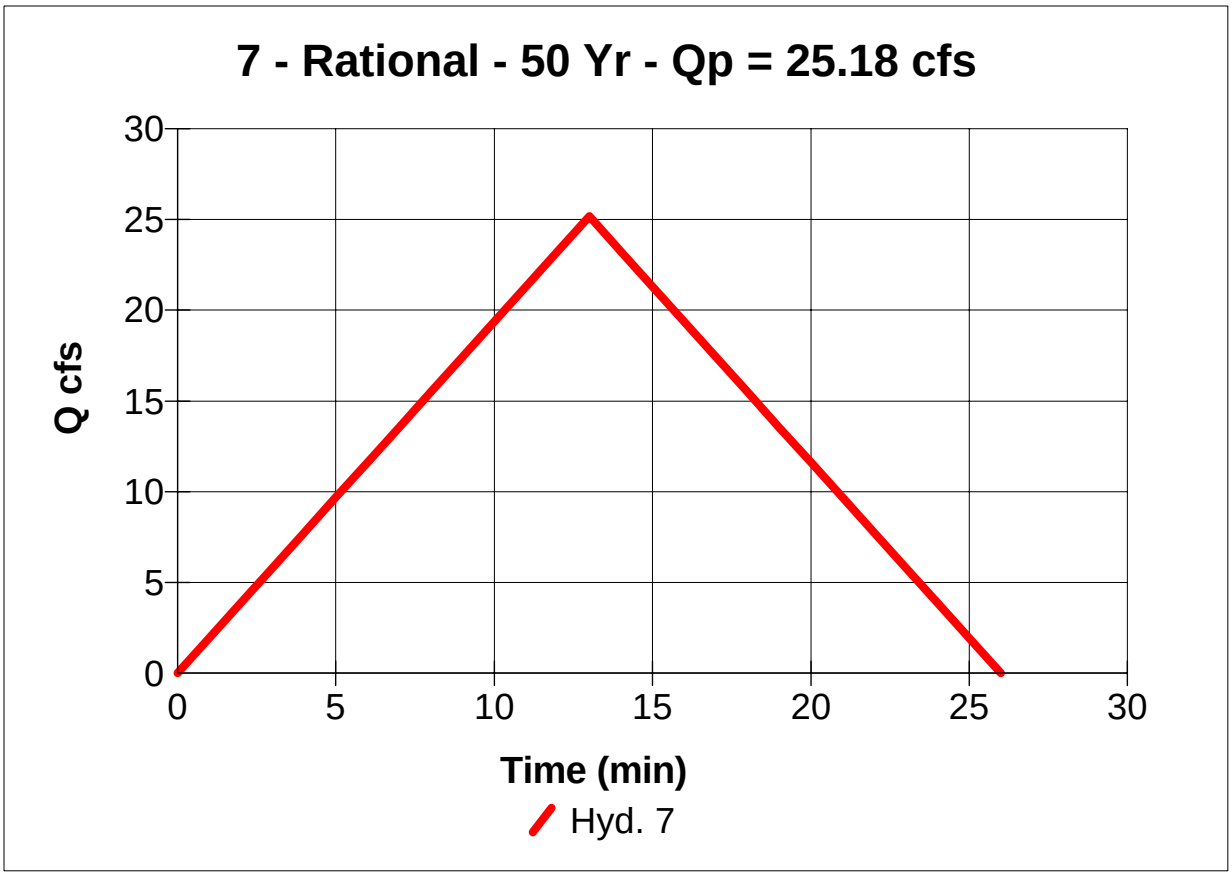
English

Hyd. No. 7

Diversion Berm 7

Hydrograph type	= Rational	Peak discharge	= 25.18 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 13.7 ac	Runoff coeff.	= 0.31
Intensity	= 5.93 in	Time of conc. (Tc)	= 13 min
I-D-F Curve	= 3-0.IDF	Reced. limb factor	= 1

Total Volume = 19,637 cuft



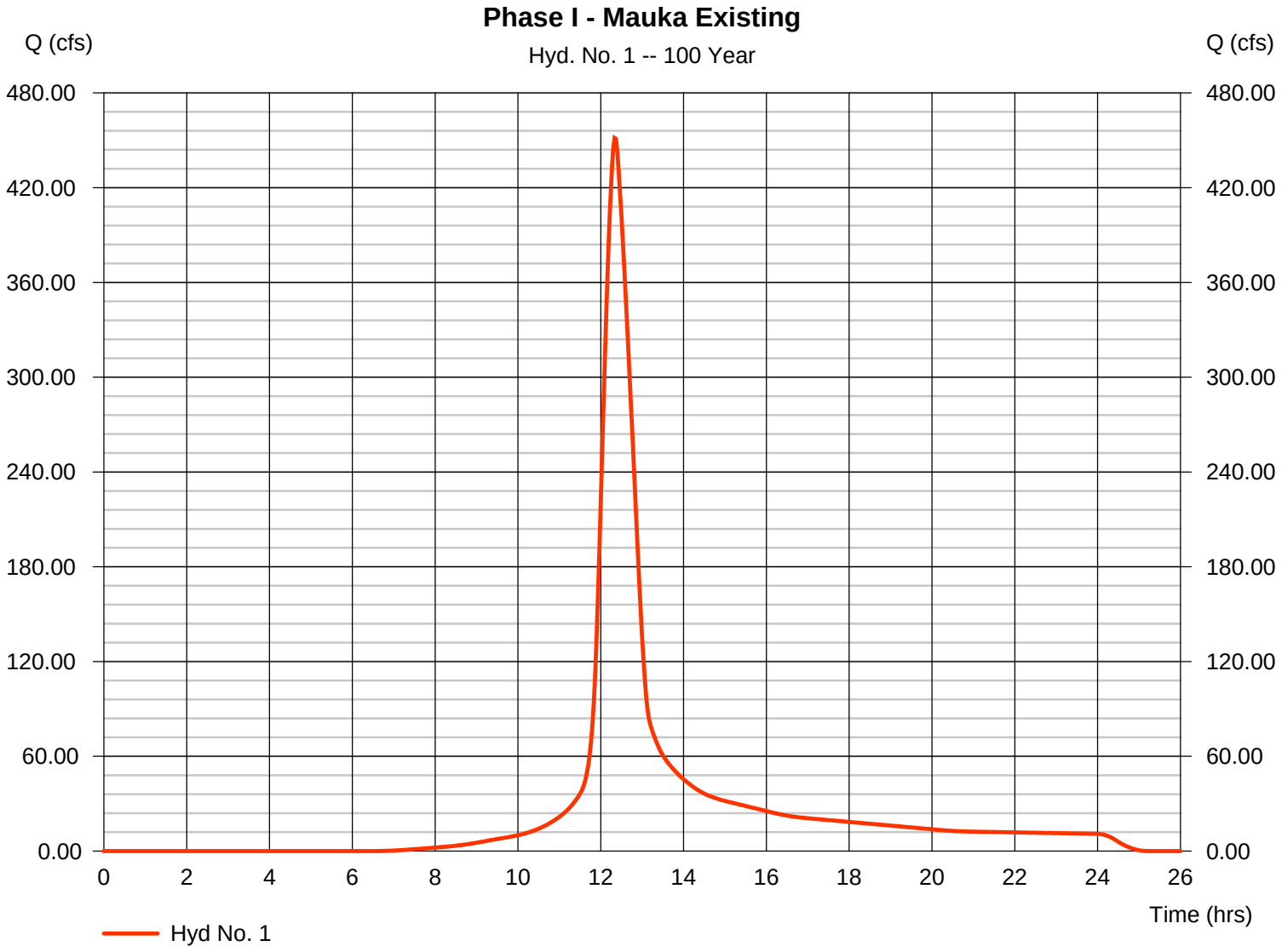
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Tuesday, 12 / 30 / 2014

Hyd. No. 1

Phase I - Mauka Existing

Hydrograph type	=	SCS Runoff	Peak discharge	=	451.50 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.33 hrs
Time interval	=	2 min	Hyd. volume	=	2,418,629 cuft
Drainage area	=	108.000 ac	Curve number	=	70
Basin Slope	=	8.0 %	Hydraulic length	=	4000 ft
Tc method	=	LAG	Time of conc. (Tc)	=	45.54 min
Total precip.	=	10.00 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



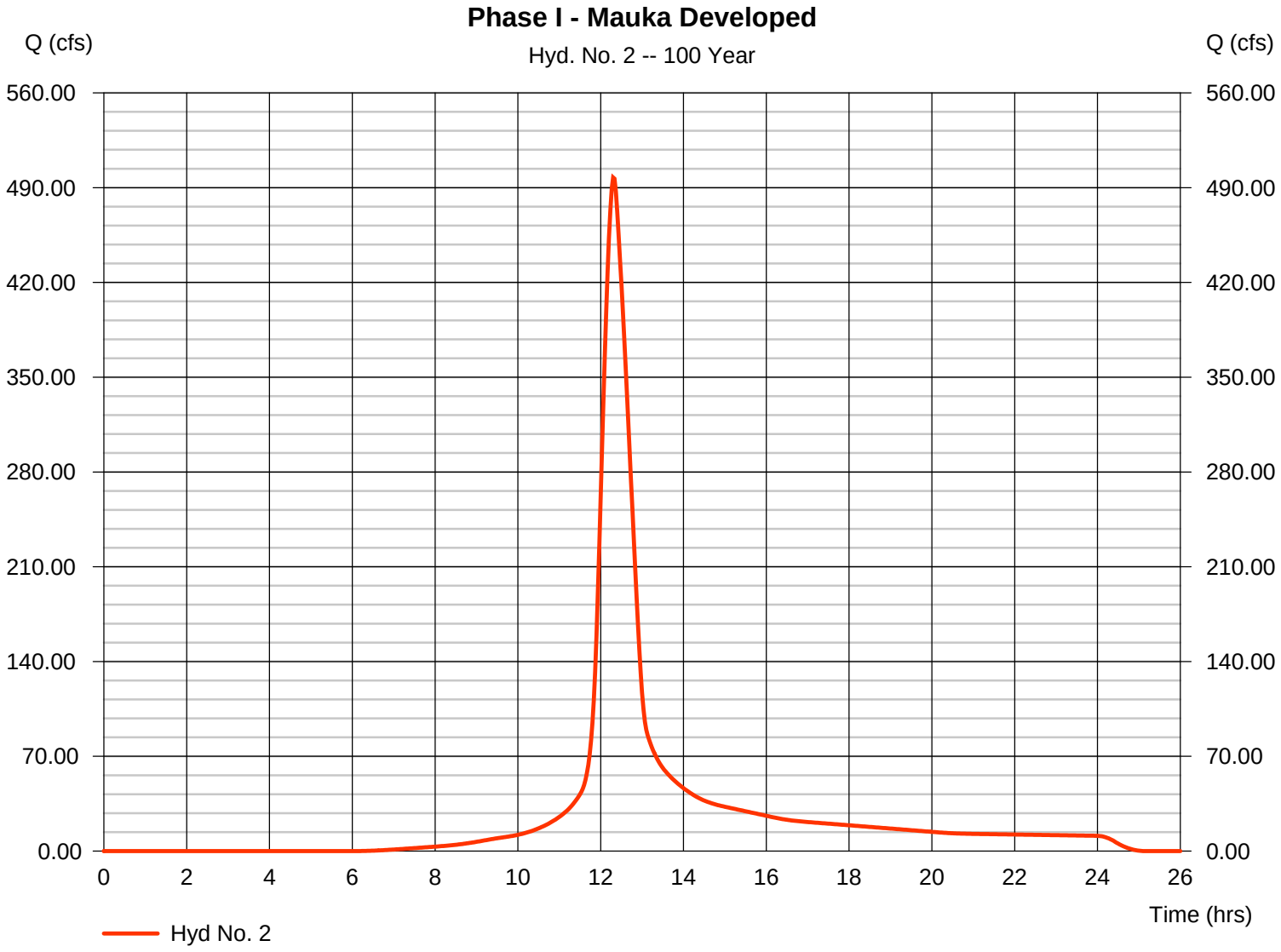
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Tuesday, 12 / 30 / 2014

Hyd. No. 2

Phase I - Mauka Developed

Hydrograph type	=	SCS Runoff	Peak discharge	=	497.48 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.30 hrs
Time interval	=	2 min	Hyd. volume	=	2,567,545 cuft
Drainage area	=	108.000 ac	Curve number	=	72
Basin Slope	=	8.0 %	Hydraulic length	=	4000 ft
Tc method	=	LAG	Time of conc. (Tc)	=	43.12 min
Total precip.	=	10.00 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

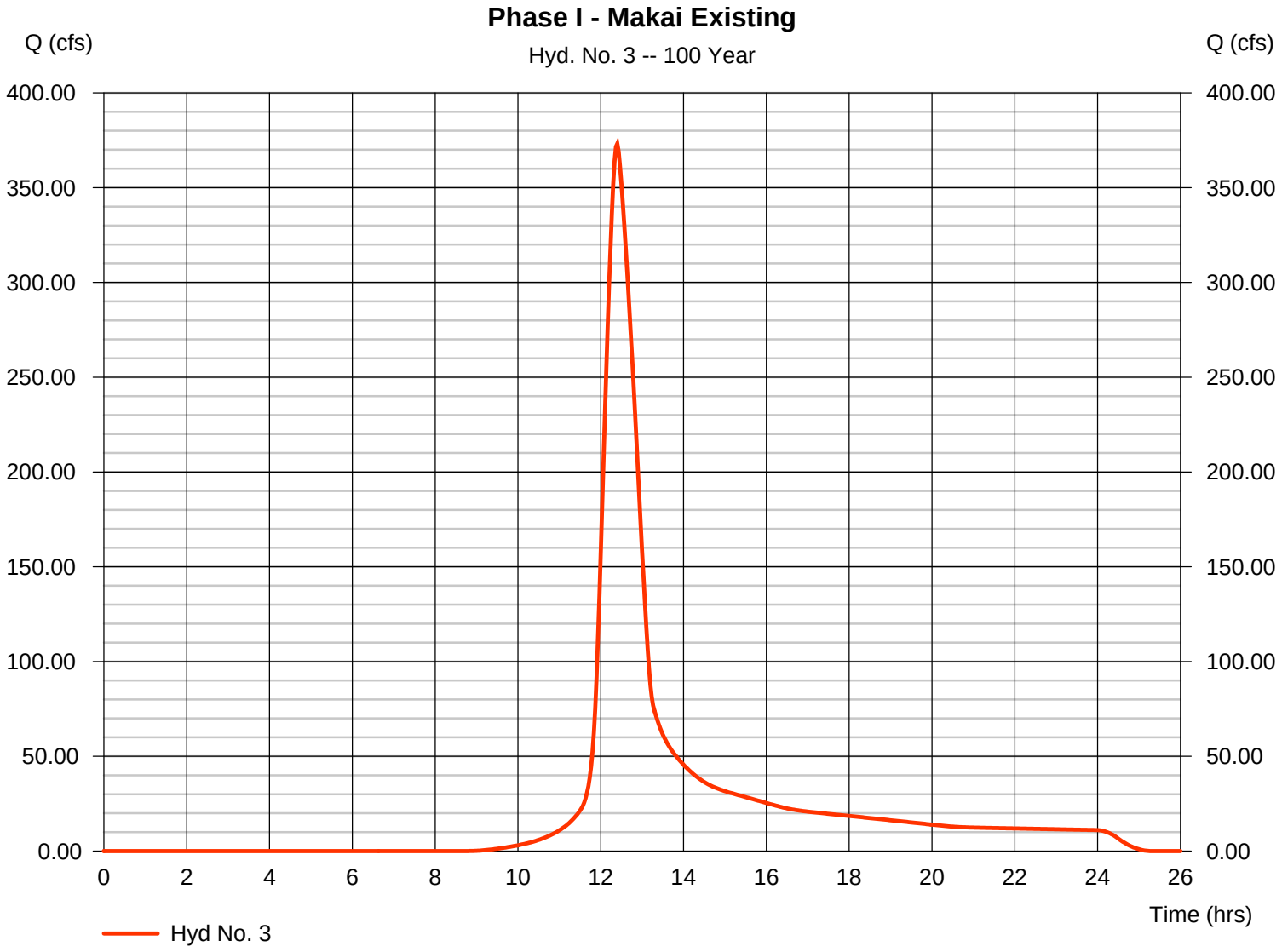


Hydrograph Report

Hyd. No. 3

Phase I - Makai Existing

Hydrograph type	=	SCS Runoff	Peak discharge	=	373.19 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.40 hrs
Time interval	=	2 min	Hyd. volume	=	2,133,808 cuft
Drainage area	=	120.000 ac	Curve number	=	60
Basin Slope	=	4.0 %	Hydraulic length	=	2050 ft
Tc method	=	LAG	Time of conc. (Tc)	=	48.95 min
Total precip.	=	10.00 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

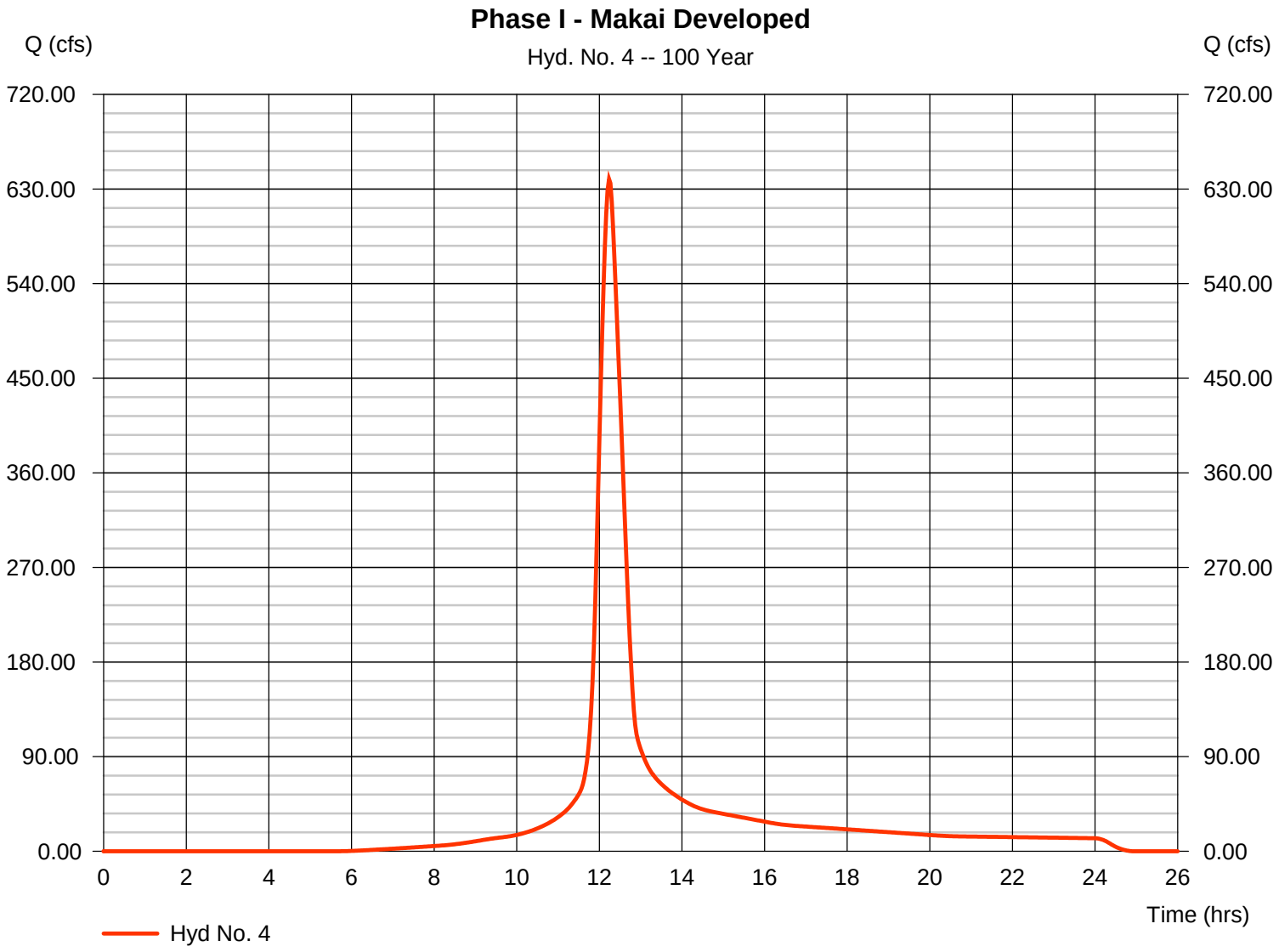


Hydrograph Report

Hyd. No. 4

Phase I - Makai Developed

Hydrograph type	=	SCS Runoff	Peak discharge	=	639.39 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	2,905,771 cuft
Drainage area	=	120.000 ac	Curve number	=	74
Basin Slope	=	4.0 %	Hydraulic length	=	2050 ft
Tc method	=	LAG	Time of conc. (Tc)	=	33.78 min
Total precip.	=	10.00 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

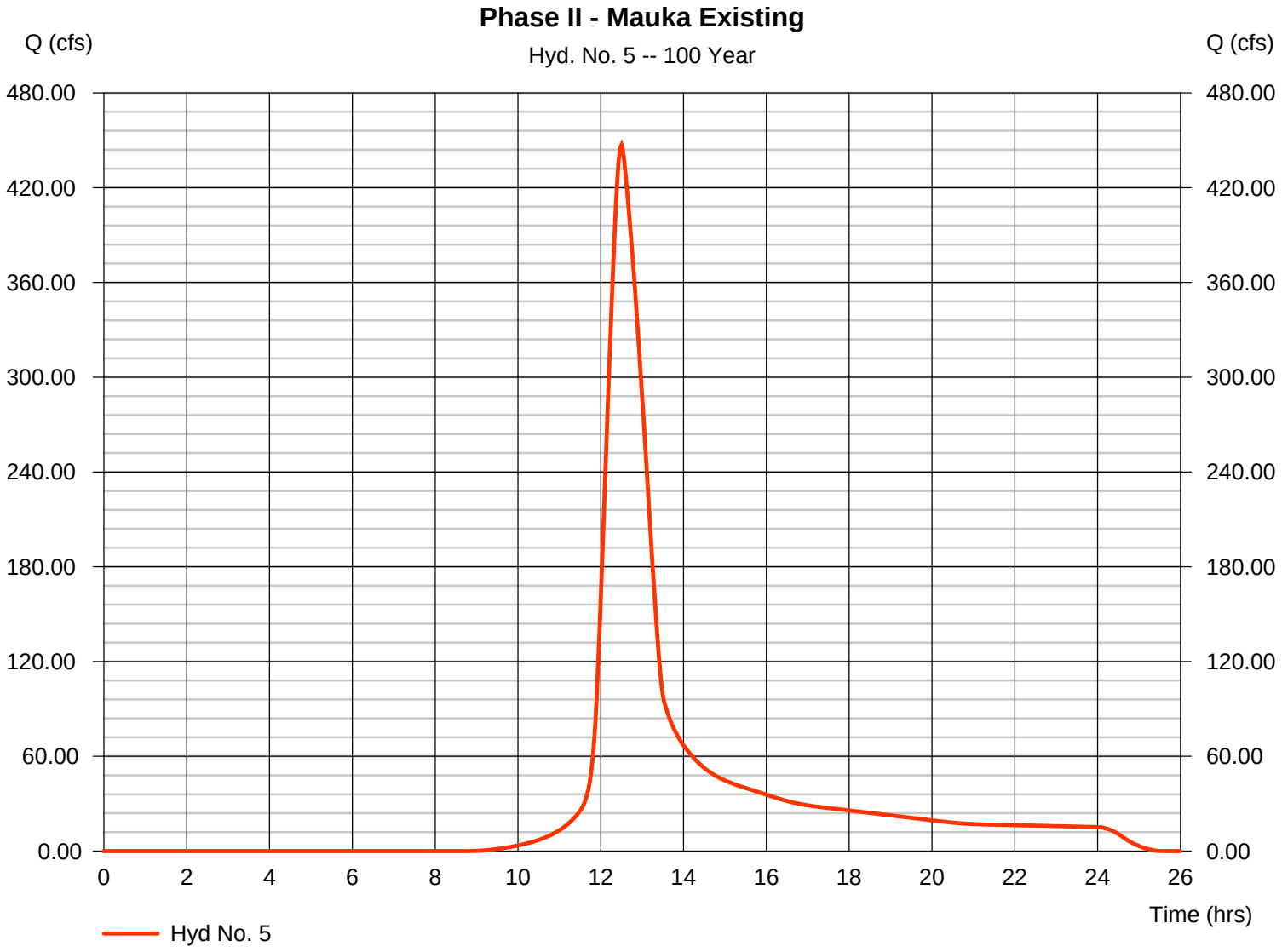


Hydrograph Report

Hyd. No. 5

Phase II - Mauka Existing

Hydrograph type	=	SCS Runoff	Peak discharge	=	447.09 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.50 hrs
Time interval	=	2 min	Hyd. volume	=	2,916,206 cuft
Drainage area	=	164.000 ac	Curve number	=	60
Basin Slope	=	8.0 %	Hydraulic length	=	4000 ft
Tc method	=	LAG	Time of conc. (Tc)	=	59.08 min
Total precip.	=	10.00 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



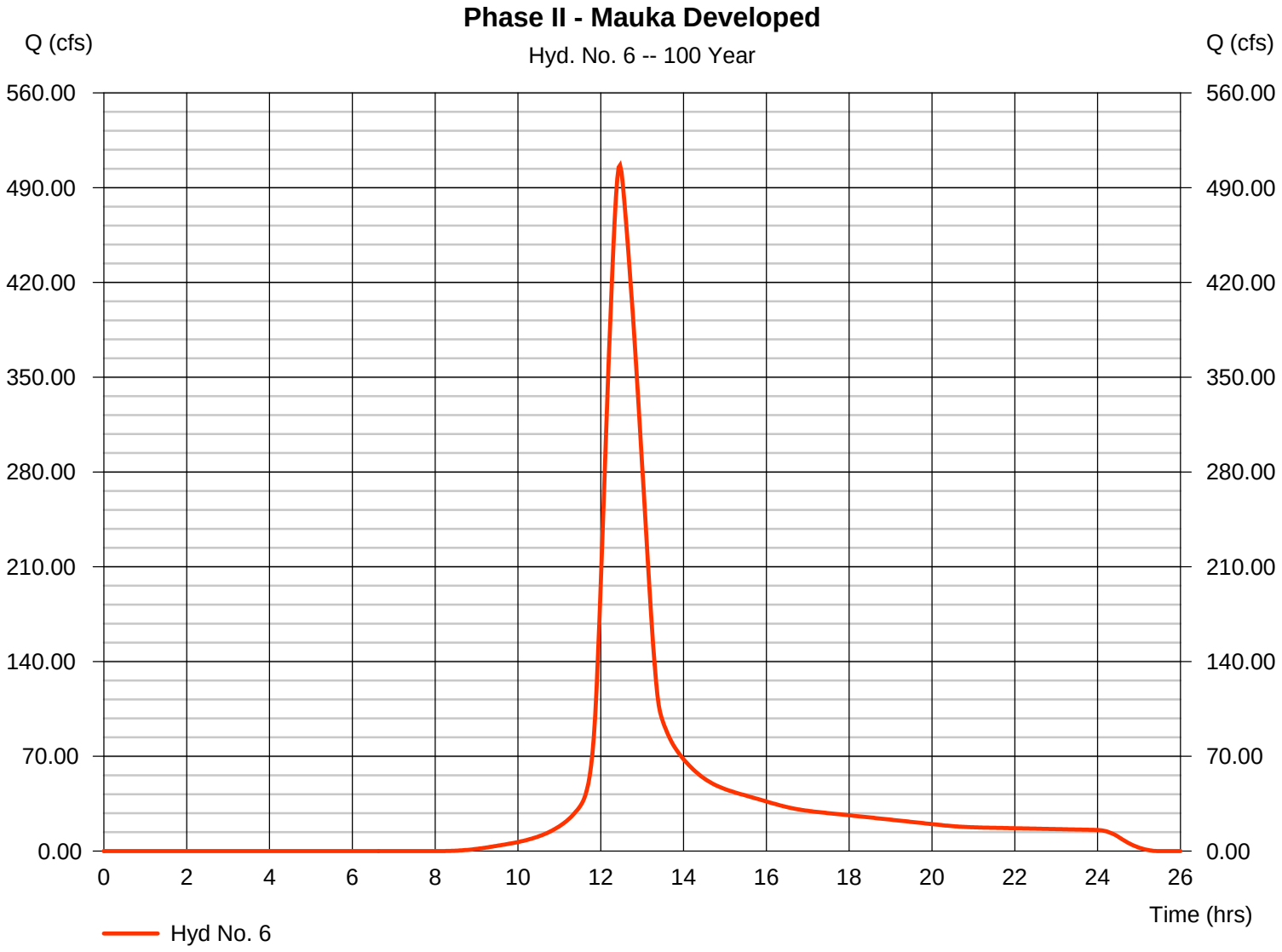
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Tuesday, 12 / 30 / 2014

Hyd. No. 6

Phase II - Mauka Developed

Hydrograph type	=	SCS Runoff	Peak discharge	=	506.56 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.47 hrs
Time interval	=	2 min	Hyd. volume	=	3,131,436 cuft
Drainage area	=	164.000 ac	Curve number	=	63
Basin Slope	=	8.0 %	Hydraulic length	=	4000 ft
Tc method	=	LAG	Time of conc. (Tc)	=	54.73 min
Total precip.	=	10.00 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

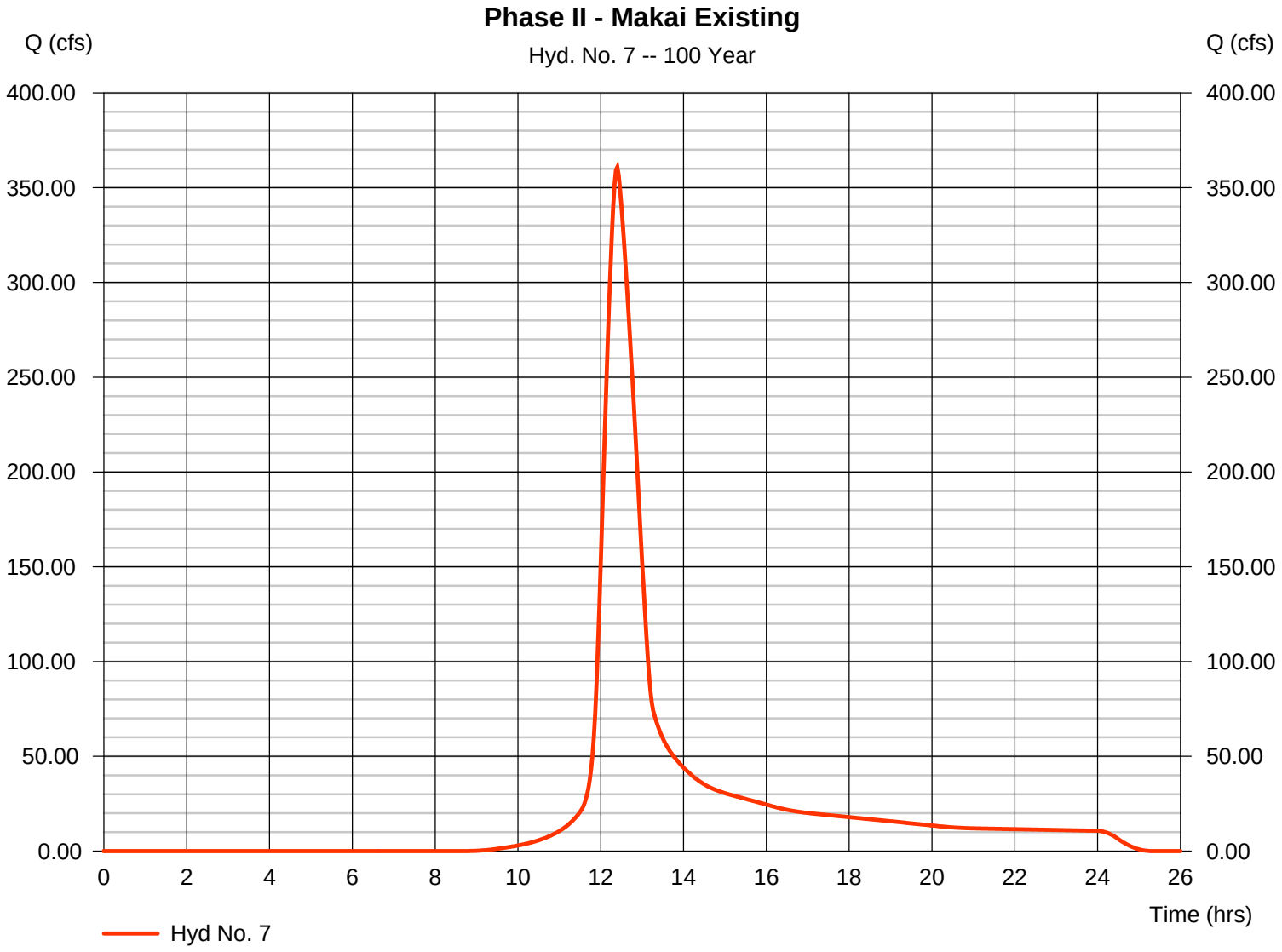


Hydrograph Report

Hyd. No. 7

Phase II - Makai Existing

Hydrograph type	=	SCS Runoff	Peak discharge	=	360.75 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.40 hrs
Time interval	=	2 min	Hyd. volume	=	2,062,681 cuft
Drainage area	=	116.000 ac	Curve number	=	60
Basin Slope	=	4.0 %	Hydraulic length	=	2000 ft
Tc method	=	LAG	Time of conc. (Tc)	=	47.99 min
Total precip.	=	10.00 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

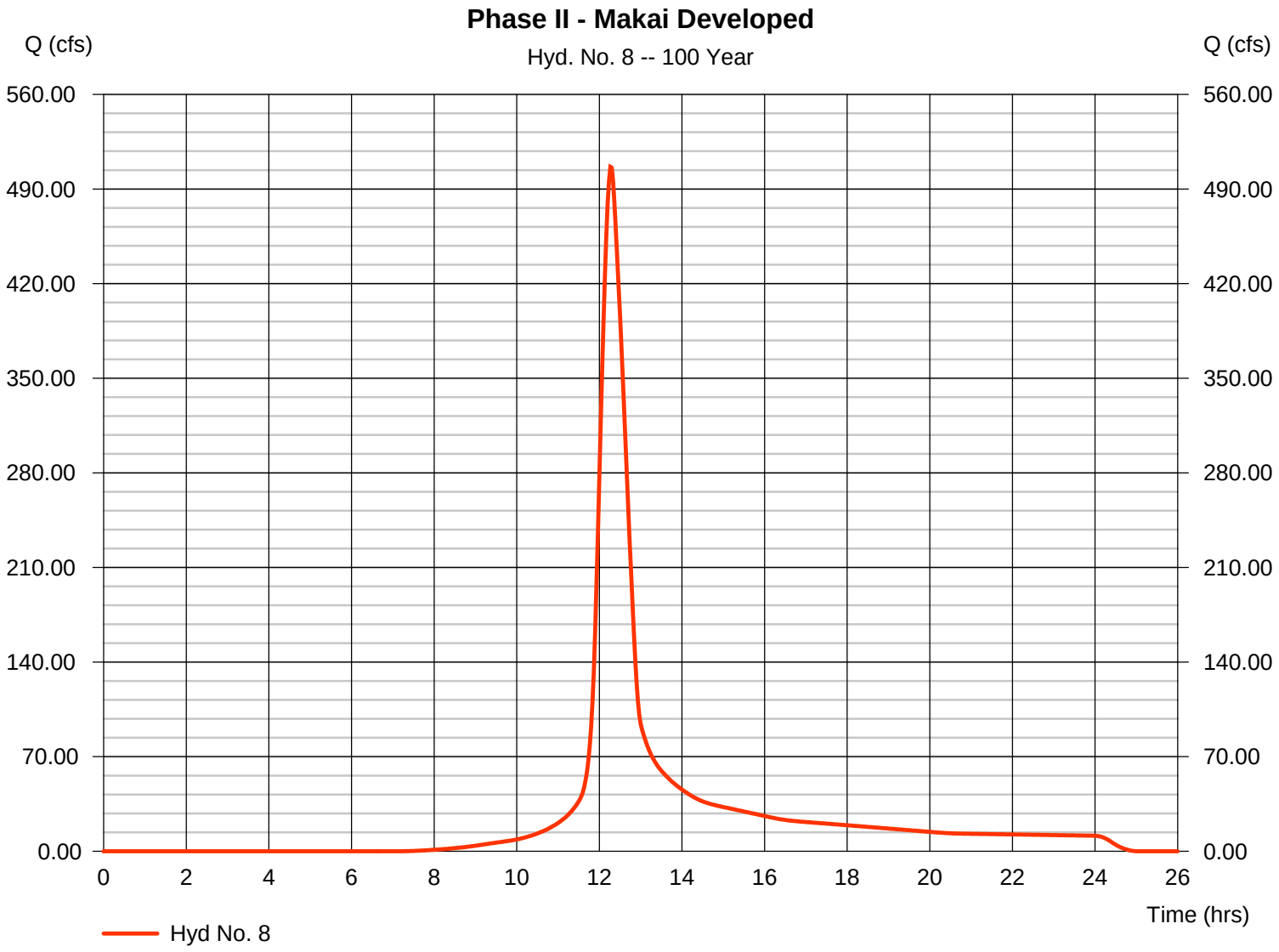


Hydrograph Report

Hyd. No. 8

Phase II - Makai Developed

Hydrograph type	= SCS Runoff	Peak discharge	= 506.32 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 2,454,805 cuft
Drainage area	= 116.000 ac	Curve number	= 67
Basin Slope	= 4.0 %	Hydraulic length	= 2000 ft
Tc method	= LAG	Time of conc. (Tc)	= 40.07 min
Total precip.	= 10.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



APPENDIX B

STORM WATER QUALITY CALCULATIONS

Storm Water Quality Calculations:

For the purpose of this preliminary study, it is assumed that 50% of the drainage area will be impervious.

Phase I Mauka Development

A. Determine the Runoff Coefficient (C):

C = 0.05 + (0.009 x IMP)

IMP = Impervious Area (%)
= 50.0%

C = 0.05 + (0.009 x 50.0)

= 0.50

B. Drainage Area (A) = 108Acres

C. Compute the Water Quality Design Volume (WQDV):

WQDV = C x 1" x A x 3630
= (0.50)(1.0)(108)(3630)
= **196,020 cubic feet**

Phase I Makai Development

A. Determine the Runoff Coefficient (C):

C = 0.05 + (0.009 x IMP)

IMP = Impervious Area (%)
= 50.0%

C = 0.05 + (0.009 x 50.0)

= 0.50

B. Drainage Area (A) = 120 Acres

C. Compute the Water Quality Design Volume (WQDV):

WQDV = C x 1" x A x 3630
= (0.50)(1.0)(120)(3630)
= **217,800 cubic feet**

Phase II Mauka Development

A. Determine the Runoff Coefficient (C):

C = 0.05 + (0.009 x IMP)

IMP = Impervious Area (%)
= 50.0%

C = 0.05 + (0.009 x 50.0)

= 0.50

B. Drainage Area (A) = 164 Acres

C. Compute the Water Quality Design Volume (WQDV):

WQDV = C x 1" x A x 3630
= (0.50)(1.0)(164)(3630)
= **297,660 cubic feet**

Phase II Makai Development

A. Determine the Runoff Coefficient (C):

C = 0.05 + (0.009 x IMP)

IMP = Impervious Area (%)
= 50.0%

C = 0.05 + (0.009 x 50.0)

= 0.50

B. Drainage Area (A) = 116 Acres

C. Compute the Water Quality Design Volume (WQDV):

WQDV = C x 1" x A x 3630
= (0.50)(1.0)(116)(3630)
= **210,540 cubic feet**

APPENDIX C
WATER DEMAND CALCULATIONS

PHASE I WATER DEMAND CALCULATIONS

Land Use	Area (Ac.) or Units	Average Unit Demand	Average Total Demand (gpd)
Single-Family	332 Units	400 gpd/unit	132,800
Rural Residential	15 Units	667 gpd/unit	10,005
Multi-Family	216 Units	373 gpd/unit	80,568
Country Town Mix-Use (Dwelling)	127 Units	373 gpd/unit	47,371
Ohanas	41 Units	200 gpd/unit	8,200
Country Town Mix-Use (Commercial)	58,475 s.f.	93 gpd/1,000 s.f.	5,438
Commercial/Employment	140,372 s.f.	93 gpd/1,000 s.f.	13,055
Parks & Open Space	26.66 ac.	0 gpd/ac.	0*
School	12 ac.	1,133 gpd/ac	51,000**
Total Average Day Demand **Maximum Daily Demand**			**348,437 gpd** **522,656 gpd**

**Per the DWSWSS, the average demand for a school is 13,596 gpd. However, the DOE is requiring an allocation based on 60 gallons per 850 person per day, so an average daily demand of 51,000 gpd will be used.

PHASE II WATER DEMAND CALCULATIONS

Land Use	Area (Ac.) or Units	Average Unit Demand	Average Total Demand (gpd)
Single-Family	638 Units	400 gpd/unit	255,200
Rural Residential	65 Units	667 gpd/unit	43,355
Multi-Family	40 Units	373 gpd/unit	14,920
Ohanas	105 Units	200 gpd/unit	21,000
Parks & Open Space	5.78 ac.	0 gpd/ac.	0*
Total Average Day Demand **Maximum Daily Demand**			**334,475 gpd** **501,713 gpd**

*Irrigation of parks and open space will be provided from the non-potable wells (Wells No. 4 and 5), therefore will have an average demand of 0.

Reservoir Capacity:

1. Meet the maximum day consumption. Reservoir full at the beginning of the 24-hour period with no source input into the reservoir.

   Maximum Daily Demand = 522,656 + 501,713 = 1,024,369 gallons

   Reservoir Capacity = 1,024,369 gallons (Use one 1.1 MG Reservoir or two 0.55 MG Reservoirs)

2. Meet the maximum day rate plus fire flow for duration of fire. Reservoir ¾ full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.

   Maximum Daily Demand = 968,263 gpd = 672 gpm

   Fire Flow = 2,000 gpm

   Total Required Demand = 2,672 gpm

   Fire Duration = 2 hours

   Incoming flow from pumps = 800 + 500 = 1,300 gpm (assume largest pump (1,000 gpm) is out of service)

   Required Reservoir Volume = 2,672 – 1,300 = 1,372 gpm

   Reservoir Volume = [(1,372 gpm) x (60 min/hr) x (2 hr)] / 0.75

   = 219,520 gallons

USE CRITERION 1, ONE 1.1 MILLION GALLON RESERVOIR OR TWO 0.55 MILLION GALLON RESERVOIRS.

APPENDIX D

WASTEWATER CALCULATIONS

WASTEWATER CALCULATIONS

Based on the *"Preliminary Wastewater Report",* prepared by Enviniti LLC, dated March 2013, the following were the determined average wastewater and design maximum flow rates for the project:

AVERAGE FLOW ESTIMATES*:

Phase I – 395,000 gpd
Phase II – 303,000 gpd
Total Project – 698,000 gpd

DESIGN MAXIMUM FLOW ESTIMATES*:

Phase I – 1,548,652 gpd
Phase II – 1,257,125 gpd
Total Project – 2,449,819 gpd

*Note-the estimated flow rates were calculated using the conceptual phasing plan. Assumptions were made on the use and development of land classifications. The flow rates will be refined as a more detailed development plan becomes available.

PHASE I WASTEWATER FLOW CALCULATIONS

Land Use	Area (Ac.) or Units	Average Unit Demand	Average Total Demand (gpd)
Single-Family	332 Units	350 gpd/unit	116,200
Rural Residential	15 Units	350 gpd/unit	5,250
Multi-Family	216 Units	255 gpd/unit	55,080
Country Town Mix-Use (Dwelling)	127 Units	350 gpd/unit	44,450
Ohanas	41 Units	180 gpd/unit	7,380
Country Town Mix-Use (Commercial)	58,475 s.f.	1 per 200 s.f. @ 20 gpd/unit	5,848
Commercial/Employment	140,372 s.f.	1 per 350 s.f. @ 20 gpd/unit	8,021
School (Elementary)	12 ac. (850 total students and staff)	25 gpd/unit	21,250
Average Daily Flow Rate			**263,479 gpd**

PHASE II WASTEWATER FLOW CALCULATIONS

Land Use	Area (Ac.) or Units	Average Unit Demand	Average Total Demand (gpd)
Single-Family	638 Units	350 gpd/unit	223,300
Rural Residential	65 Units	350 gpd/unit	22,750
Multi-Family	40 Units	255 gpd/unit	10,200
Ohanas	105 Units	180 gpd/unit	18,900
Total Average Day Demand			**275,150 gpd**

APPENDIX E

ORDER OF MAGNITUDE COST ESTIMATES

WAIKAPU COUNTRY TOWN
ORDER OF MAGNITUDE COST ESTIMATES

	PHASE I (MAUKA)	PHASE I (MAKAI)	PHASE II (MAUKA)	PHASE II (MAKAI)
GENERAL WORK	$ 4,200,000	$ 4,400,000	$ 3,075,000	$ 4,995,000
ROADWAY	$ 6,678,400	$ 8,129,000	$ 3,104,000	$ 9,200,000
OFFISTE ROADWAY	$ 1,900,000	-----	$ 400,000	-----
SEWER SYSTEM	$23,880,000**	$ 5,610,000	$12,409,000	$ 7,717,500**
POTABLE WATER SYSTEM	$14,228,000	$ 4,687,000	$10,785,000	$ 8,890,000
NON-POTABLE WATER SYSTEM	$ 3,345,000	$ 2,497,000	$ 2,140,000	$ 3,588,000
DRAINAGE SYSTEM	$11,980,000	$11,700,000	$10,832,000	$12,480,000
TOTAL COST	**$66,211,400***	**$37,023,000***	**$42,745,000***	**$46,870,500***

Total Estimated Cost-Phase I: $103,234,400*

Total Estimated Cost-Phase II: $89,615,500*

*Note-Cost estimate does not include underground electrical, telephone and cable TV

**Note-Cost estimate includes a private wastewater treatment plant servicing the Waikapu Country Town project only

APPENDIX I

Water Resource Associates Results of 10-Day Pumping Tests for Wells 1, 2, and 3

RESULTS OF 10-DAY PUMPING TEST
WCT WELLS 1, 2, and 3
IN THE WAIKAPU AQUIFER, MAUI

Prepared for:

Waikapu Properties, LLC

P.O. Box 1870

Manteca, CA 953367

Prepared by:

Water Resource Associates

1296 Kapiolani Blvd, #1704

Honolulu, Hawaii 96814

RESULTS OF 10-DAY PUMPING TEST
WCT WELLS 1, 2, and 3
IN THE WAIKAPU AQUIFER, MAUI

Prepared for:

Waikapu Properties, LLC

P.O. Box 1870

Manteca, CA 953367

Prepared by:

Water Resource Associates

1296 Kapiolani Blvd, #1704

Honolulu, Hawaii 96814

August 2016

CONTENTS

Executive Summary 1

Location of WCT Wells 3

Geohydrologic Setting 3
- Oblique View 3
- Geologic Cross Section 4
- Aquifers and Sustainable Yield 4

Solinst Data Loggers and Atmospheric Pressure 5

Pumping Test Protocol 5
- Purpose of Test 5
- Chlorides and Electrical Conductivity 6
- Water Levels 6
- Pumping 6
- Non-Pumping Monitor Wells 7

Results of Pumping Rate, Chlorides, and Electrical Conductivity 7
- Well 1 8
- Well 2 8
- Well 3 8

Results of Drawdown and Recovery 9
- Well 1 9
- Well 2 9
- Well 3 10

Time-Drawdown Analysis of Pumping Wells 10
- Well 1 10
- Well 2 10
- Well 3 11

Results of Water Levels in Non-Pumping Wells 11

Water Quality 11

FIGURES

1. WCT Well Location Map
2. Oblique View of Project Area
3. Interpretive Geologic Cross Section E-E
4. Sustainable Yield Map of Maui
5. Graph of Atmospheric Pressure in Well 2
6. Pumping Rate and Chlorides – Well 1
7. Pumping Rate and Chlorides – Well 2
8. Pumping Rate and Chlorides – Well 3
9. Linear Drawdown and Recovery Curve – Well 1
10. Linear Drawdown and Recovery Curve – Well 2
11. Linear Drawdown and Recovery Curve – Well 3
12. Semi-Log Drawdown Curve – Well 1
13. Semi-Log Drawdown Curve – Well 2
14. Semi-Log Drawdown Curve – Well 3
15. Water Levels – Well 4 (Monitor)
16. Water Levels – Well 5 (Monitor)
17. Water Levels – Well 6 (Monitor)

TABLES

1. Summary of Well Data
2. Solinst Data Logger Deployment

RESULTS OF 10-DAY PUMPING TEST
WCT WELLS 1, 2, and 3
IN THE WAIKAPU AQUIFER, MAUI

EXECUTIVE SUMMARY

The plan to perform a simultaneous constant-rate pumping test of Waikapu Country Town's (WCT) Wells 1, 2, and 3 for a 10-day period was to determine both their individual and aggregate sustainable capacities. Accordingly, the pumping rates of the three wells were set at 1.39 mgd, 1.03 mgd, and 1.07 mgd, respectively, for a total pumping rate of 3.49 mgd which compares with the sustainable yield of 3.0 mgd established for the Waikapu Aquifer System (in which the wells are located) by the State Commission on Water Resources Management. WCT has three more wells (4, 5, and 6) which have no pumps and which were used as observation wells to monitor water levels.

The area's contrasting geologic occurrence of interior permeable basalt lava flows which dip under a thick wedge of low-to-moderately permeable alluvial fan-type deposits that extend hundreds of feet below sea level plays an important role in the occurrence of high yield potable wells at the toe of interior basaltic slopes and lower yield potable wells on lower gentle slopes of alluvial deposits.

Non-vented data loggers were used to record water levels at two-minute intervals in six wells—three pumping and three non-pumping. Additional data was gathered and recorded for the pumping wells, including pumping rates, chlorides, and electrical conductivity of the pumped water. All data were compiled, analyzed, and presented graphically for easier understanding. Figures 6, 7, and 8 show that the pumping rates held steady in all three wells and that the chlorides in basalt Wells 1 and 2 were stable while the chlorides in alluvial Well 3 showed an increase from 25 to 109 mg/L. All three wells produced fresh potable water.

Figures 9, 10, and 11 graphically includes all Solinst recordings of drawdown and recovery of water levels in pumping Wells 1, 2, and 3. All graphs are typical of pumping tests in permeable aquifers in Hawaii.

Figures 12, 13, and 14 presents a semi-log plot and graphical analysis of the drawdown data for Wells 1, 2, and 3 to determine the transmissivity of the aquifer. The results indicate that basalt Wells 1 and 2 tap highly permeable aquifers and have sustainable capacities equal to or greater than their pumping rates and that alluvial Well 3 taps a moderately permeable aquifer.

Figures 15, 16, and 17, graphically presents the water level data recorded in the non-pumping Wells 4, 5, and 6. A cursory comparison of the water level graphs with the graph of atmospheric pressure in Figure 5, shows some possible relationship and the possibility that water levels in Well 4 were affected by the pumping test. However, no conclusions were possible with the cursory comparison.

Water samples were collected from the pumping wells and tested by Eurofins Analytical, an approved lab, for testing of water from new potable water sources as required by the Hawaii Department of Health. The overall results for the three wells showed no pesticides or other organic chemicals present, and all other contaminants tested were non-detectable or below maximum contaminant levels (MCL).

LOCATION OF WCT WELLS

A total of six deep wells have been drilled in the Waikapu Aquifer on a parcel of land situated immediately south of Waikapu Stream, which drains eastward out of the deeply eroded southern slopes of West Maui onto the isthmus of Central Maui (see Figure 1). Referred to as the Waikapu Country Town Development, this gently to moderately sloping parcel lies immediately south of old Waikapu Town. All six wells were drilled by Wailani Drilling Services of Maui and are numbered 1 through 6, in the order in which they were drilled.

Wells 1 and 2 lie at the toe of an outcrop of basaltic lava flows at 650 and 780 feet elevations, respectively; and they tap fresh basal water near sea level in permeable basaltic formations.

Well 3 lies directly down slope of Well 1 at an elevation of 520 feet on alluvial deposits called *slope wash* (deposits washed down by runoff water from deeply eroded interior slopes). Well 3 is cased to sea level and taps fresh basal water in slope wash deposits (based on moderate permeability). Only Wells 1, 2, and 3 have been outfitted with permanent pumps.

Wells 4 and 5 located northeast and further down slope of Well 3 at elevations of 460 and 480 feet, are also located on alluvial slope wash deposits and tap fresh basal water in slope wash deposits. Well 6, drilled at an elevation of 580 feet, lies northwest and slightly up slope of Wells 4 and 5 and near Waikapu Stream. Wells 4, 5, and 6 are yet to be completed with permanent casing.

A general summary of the hydrologic data for these six WCT wells are presented in Table 1.

GEOHYDROLOGIC SETTING

Oblique View. An oblique aerial photo (see Figure 2) of the Waikapu area clearly shows that there are two contrasting topographic environs, each of which reflect different types of geologic formations and groundwater occurrence. As can be seen in Figure 1, the toe of the deeply eroded basaltic slopes of West Maui Mountain delineate the approximate mauka boundary of the Waikapu Country Town Project. Abruptly down slope of the toe lie the gentle slopes of alluvial fan (slope wash) deposits transported by runoff from the mountainous interior. Based on Water Resource Associates' earlier investigations between Waikapu and

Waihee to the north, the slope wash deposits within the project area probably extend well below sea level and form "caprock" conditions that impede salt water intrusion and enhance the occurrence of the thick basaltic aquifers tapped by WCT Wells 1 and 2.

Geologic Cross Section. A thick, low-to-moderate permeability formation of slope wash deposits occurs within the project area, corroborated by hydro-geologic data from wells located north of Waikapu. In 1974, Well W2 (6-5130-02) situated approximately 2,500 feet north of Waikapu Stream (see Figure 1) was drilled in the hopes of tapping a basal aquifer in basaltic lava flows of the Wailuku volcanic series. Unexpectedly, however, no basalts were encountered—only alluvial (slope wash) deposits. Well W2 encountered fine to coarse sediments throughout its entire depth of 1,000 feet, a depth of 500 ft. below sea level (see geologic cross section in Figure 3). As expected, the slope wash formation has an overall low permeability and little salt water intrusion, based on the results of a constant-rate pumping test of the basal aquifer in Well 2 (500 gpm, 73 ft. drawdown, and 50 mg/L chlorides). Further to the north, another deep well, similarly positioned down slope of the contact between West Maui's basaltic slopes and associated slope wash deposits, also showed the occurrence of a thick alluvial formation that extends hundreds of feet below sea level. From other project investigations, it is postulated that slope wash deposits hundreds of feet thick below sea level occur down slope (east) of the West Maui basaltic toe from Malaaea to Waihee, acting as an impediment to salt water intrusion and enhancing the basal aquifer in basalts of the Wailuku volcanic series.

Aquifers and Sustainable Yield. Two types of aquifers occur within the project area based on the type of formations in which they occur: *basaltic aquifer* in permeable basaltic lava flows and *alluvial aquifer* in low-to-moderately permeable alluvial or slope wash deposits. Successful development of the basal aquifer in basaltic lava flows is confined to the *mauka* (interior) edge of the project area where the basalt formations can be encountered at or above sea level in order to tap the freshest part of the basal aquifer. Successful development of the basal aquifer in the alluvial slope wash deposits which occur throughout the project area is less predictable largely because of variations in permeability among the various sedimentary layers that comprise the slope wash formation which layers can range from clay to bouldery deposits.

The Commission on Water Resources Management (CWRM) regulates well drilling and groundwater resources in Hawaii and has established hydrologic units with sustainable yield values in million gallons per day (mgd) for the purpose of groundwater management throughout the state. The Waikapu Country Town Development lies within the Waikapu Aquifer System of the Wailuku Hydrologic Sector (see Figure 4). As shown in Figure 4, the *sustainable yield* (amount of groundwater that can be safely developed over the long term) of the Waikapu Aquifer System has been established as 3 mgd. When the CWRM officially *designates* a hydrologic sector or aquifer system for groundwater management, it has the responsibility to regulate the amount of groundwater use from wells within the designated area.

SOLINST DATA LOGGERS AND ATMOSPHERIC PRESSURE

The measurement of water levels in six wells (3 pumping and 3 non-pumping) for a total period of 18 days extending from April 25 to May 13, 2016 was accomplished with Solinst Model 3001 Levelogger Edge data loggers. These data loggers have an accuracy of 0.05% full scale and are based on non-vented pressure transducers which measure the absolute barometric pressure (atmospheric pressure and water pressure above the data logger). Therefore, a Model 3001 Barologger was also used to record the atmospheric pressure in Well 2 at a depth of 200 feet, which data was used to convert the absolute pressure readings into actual water levels above the data logger. A summary of the deployment data for the data loggers in each of the six wells are shown in Table 2.

It is well known that atmospheric pressure affects the water levels in wells in Hawaii to varying degrees, and the WCT wells are no exception as will be seen later in this report. A graph of the atmospheric pressure in the Waikapu area at the time of the pumping test, as recorded in Well 2 at a well depth of 200 feet, is shown Figure 5.

PUMPING TEST PROTOCOL

Purpose of Test. Aquifers are normally tested by two types of pumping tests—constant-rate and step-drawdown. The constant-rate test is used to obtain the specific capacity of a well and the transmissivity and storage values of the aquifer. Also, one or more observation wells are installed at appropriate distances from the

pumping well because accurate drawdown data are normally difficult to obtain. However, the non-pumping wells (Wells 4, 5, and 6) are not useful as observation wells for the purpose of the 10-day constant-test, primarily because they are in different aquifers (alluvial slope wash deposits) rather than the basalt aquifers of pumping Wells 1 and 2. Furthermore, Well 3 is believed to tap an alluvial aquifer. The step-drawdown test is normally used to show the reduction in specific capacity of a well at increasing rates of pumping, or efficiency of the well at increasing rates. No step drawdown tests were performed in this project.

The plan to perform a simultaneous constant-rate pumping test of Waikapu Country Town's Wells 1, 2, and 3 for a 10-day period was to determine the specific or sustainable capacity of each well. Also, with simultaneous pumping and nominal pump capacities of 900 gpm, 700 gpm and 700 gpm, respectively, for Wells 1, 2, and 3 and a total pump capacity of 2,300 gpm, or 3.3 mgd, the 10-day pumping test was designed to test the aquifer's established sustainable yield value of 3.0 mgd.

Chlorides and Electrical Conductivity. Because basal aquifers are always subject to salt water intrusion, monitoring the chloride content of the pumped water is a key to the sustainable pumping capacity of a well. Chloride content is accurately measured in the laboratory using the Mohr method of titration with a silver nitrate solution. In the field, measurements of chloride content is conveniently accomplished with a commercially available test kit; and although less accurate than laboratory analysis, such measurements are used to guide the course of a pumping test. The monitoring of chlorides during a pumping test can also be accomplished by measuring the electrical conductivity (EC) of the pumped water. However, the electrical conductivity of a water sample is affected by all electrolytes and, therefore, serves primarily as an additional, quick way to monitor changes in chlorides during a pumping test. The protocol for these two parameters were based on water samples collected 6 times a day for the first 2-3 days and 4 times a day thereafter.

Water Levels. With the use of data loggers in all six wells, the protocol for measurement of water levels did not require any constraints based on any limits of manpower. All data loggers were programmed to record at 2-minute intervals beginning at 1:00 pm on April 25th (one day before the start of pumping at 9:00 am, April 26th) and ending at 1:00 pm on May 13, 2016.

Pumping. The constant-rate pumping test began with Well 1 at 9:00 am on April 26, 2016. The start times of Wells 2 and 3 were staggered 3 hours apart with

Well 2 starting at 12:00 pm, and Well 3 starting at 3:00 pm. The staggered start times was at the request of others and was intended to assist in assessing any effects of pumping among the three wells.

The end of the 10-day pumping test was at 9:00 am on May 6, 2016. The water levels in all six wells continued to be monitored for seven days after the end of pumping, in accordance with pre-programmed Solinst data loggers and barologger.

Non-Pumping Monitor Wells. Alluvial Wells 4, 5, and 6, which have no pumps, were outfitted with data loggers and used as monitor wells to determine any possible effect on water levels due to the pumping of Wells 1, 2, and 3.

RESULTS OF PUMPING RATE, CHLORIDES, AND ELECTRICAL CONDUCTIVITY

The 10-day pumping test began with the start of Well 1 at 9 am, April 26th, followed three hours later by Well 2 at 12 pm and three additional hours later by Well 3 at 3 pm. At the staggered start of Wells 2 and 3, the pumping rates of each well had to be adjusted during the initial hours after starting because the wells were pumping downgradient in an interconnected network of pipes and valves to a downgradient point of discharge below all three wells, rather than to a common storage tank. However, the pumping rates of the wells were otherwise maintained at a constant rate throughout the 10 days of pumping as expected with electric-powered pumps. Throughout the test, three parameters were carefully monitored besides the automatic recording of water levels by Solinst data loggers—pumping rate, chlorides, and electrical conductivity.

The pumping rate of each well was monitored with new flow meters installed at each well and at the total discharge point into an open reservoir. The chloride content (an indicator of salt water intrusion) of each well's discharge water was monitored by collecting water samples and analyzing them with field test equipment. As an adjunct to chloride monitoring, the electrical conductivity of the pumped water was also monitored as a quick and easy indicator of any changes in chloride content. In addition to the field tests for purposes of field supervision of the pumping test, the grab water samples were later shipped to Honolulu for laboratory analyses and use in plotting the graphs shown in Figures 6, 7, and 8 discussed below.

Well 1. As shown in Figure 6, Well 1 was pumped at a constant rate of 972 gpm (1.39 mgd) for 10 days for a total pumpage of 13,600,000 gallons. During this period of time, Well 1's chloride content varied remarkably little—from an initial 41 mg/L to a final 47 mg/L (potable water limit is 250 mg/L). Correspondingly, the electrical conductivity of the pumped water increased little—from an initial 390 µS/cm (microSiemens per centimeter) to a final 400 µS/cm. Compared to other well tests in comparable basal aquifers, Well 1's chloride results are remarkable and suggest that Well 1 is capable of yielding 1.4 mgd, or more, of fresh water from a thick basal aquifer with a head (elevation of static water level above mean sea level) of 8.5 feet, in permeable basalts.

Well 2. As shown in Figure 7, Well 2 was pumped at a constant rate of 720 gpm (1.03 mgd) for 10 days, less three hours, for a total pumpage of 10,238,400 gallons. During this period of time, Well 2's chloride content decreased gradually from an initial 132 mg/L to 100 mg/L (potable water limit is 250 mg/L) and is corroborated by a similar decreasing trend in electrical conductivity from an initial 630 µS/cm to a final 540 µS/cm. This decreasing trend in chlorides is confirmed by a similar test performed in 2010 (10 days of pumping at an average rate 740 gpm). In this earlier test, Well 2 showed the same trend of decreasing chlorides over 10 days—from an initial 145 mg/L to 89 mg/L. While both unusual and difficult to explain without more data than is at hand, the occurrence of higher chloride water under static conditions than under pumping conditions in a well tapping a thick basal aquifer is plausibly not due to *upconing* of salt water from below, but rather from the uppermost layers of the aquifer. A salinity profile of the well might confirm this explanation.

Based on the chloride results, Well 2 is capable of yielding 1.0 mgd, or more, of fresh water from a thick basal aquifer with a head of 15.0 feet, in permeable basalts.

Well 3. As shown in Figure 8, Well 3 was pumped at a constant rate of 747 gpm (1.07 mgd) for 10 days, less 6 hours, for a total pumpage of 10,487,880 gallons. During this period of time, Well 3's chloride content increased from an initial 25 mg/L to a final 109 mg/L (potable water limit is 250 mg/L), while the well's electrical conductivity gradually increased from an initial 300 µS/cm to a final 600 µS/cm. Based on an observed linear rate of increase in chlorides of 8.4 mg/L chlorides per day, the projected salinity of Well 3 would rise to 250 mg/L

chlorides after 17 additional days, or 27 total, of pumping at an average rate of 747 gpm.

The upward trend in chlorides is probably due to *upconing* of salt water from overall deeper alluvial deposits, but conceivably due to random layers of coarser, more permeable sediments containing less fresh water. Well 3's sensitivity to increasing chlorides under pumping conditions occurs despite the aquifer's high head of 8.5 feet and the well's modestly shallow depth of 80 feet below mean sea level. A contributing factor to Well 3's upward trend in chlorides is the well's high drawdown of 12.2 feet, to a level 3.7 feet below mean sea level. The sustainable capacity of Well 3 apparently is less than 700 gpm, based on the chloride trend observed during the 10-day test. Further testing at lower pumping rates and drawdowns will be required to assess Well 3's sustainable pumping capacity with regard to chlorides.

RESULTS OF DRAWDOWN AND RECOVERY

As mentioned earlier in this report, the drawdown and recovery of water levels in the pumping Wells 1, 2, and 3 were recorded at 2-minute intervals by Solinst data loggers installed in each well. The Solinst data show that water levels in the WCT wells fluctuated daily between about 0.01 and 0.25 ft. under static conditions and as much as 0.80 ft. under pumping conditions (probably due largely to turbulence in the well). Because a plot of the water level data at 2-minute intervals would result in a mass of black ink (data points), the *Drawdown and Recovery Curves* in Figures 9, 10, and 11 are based on plots using one-hour and two-hour interval data arbitrarily selected to show both the trend and daily fluctuations of drawdown and recovery.

Well 1. Figure 9 graphically shows the record of water levels (drawdown and recovery) in Well 1 during an overall period of 18 days spanning before, during, and after the 10-day pumping period. As expected for a well in highly permeable basalts, the initial drawdown in Well 1 was small—only 2.52 ft., from a static level of 8.52 ft., msl, down to a level of 6.00 ft., msl. Thereafter, drawdown continued to increase at a declining rate with time toward an apparently equilibrium value. Drawdown in Well 1 reached a final 4.15 feet at the end of the test. Also as expected, water level in this well recovered rapidly (within a few hours) after pumping ended, recovering to within 87% of the beginning static water level.

Well 2. Figure 10 graphically shows the record of water levels (drawdown and recovery) in Well 2 during an overall period of 18 days spanning before, during, and after the 10-day pumping period. As expected for a well in highly permeable basalts, the initial drawdown in Well 2 was small—only 2.72 ft., from a static level of 15.03 ft., msl, down to a level of 12.31 ft., msl. Thereafter, drawdown continued to increase at a declining rate with time toward an apparently equilibrium value. Drawdown in Well 2 reached a final 10.67 ft. at the end of the

test. As expected, water level in this well recovered rapidly (within an hour) after pumping ended, recovering to within 88% of the beginning static water level.

Well 3. Figure 11 graphically shows the record of water levels (drawdown and recovery) in Well 3 during an overall period of 18 days spanning before, during, and after the 10-day pumping period. As expected for a well in low-to-moderately permeable formations (slope wash deposits), the initial drawdown in Well 3 was higher than in Wells1 and 2—a modest 6.73 ft., from a static level of 8.55 ft., msl, down to a level of -1.82 ft., msl. Thereafter, drawdown continued to increase at a declining rate with time toward an apparently equilibrium value. Drawdown in Well 3 reached a final -3.70 ft., msl, at the end of the test. Surprisingly, water level in the well recovered rapidly (within an hour) after pumping ended, recovering to within 84% of the beginning static water level.

TIME-DRAWDOWN ANALYSIS OF PUMPING WELLS

Semi-log plots of time-drawdown curves for a pumped well provide a graphical means of predicting future drawdown in the well. And when the slope of the time-drawdown curve changes during the period of continuous pumping, only graphical methods can be used to predict future drawdown in the pumped well.

Time-drawdown curves also provide a graphical means of determining, both, the coefficient of transmissivity (T) which indicates how much water will move through the aquifer and the coefficient of storage (S) which indicates how much water can be removed by pumping.

In using time-drawdown curves, $T=264Q/\Delta s$, where T is transmissivity in gpd/ft., Q is pumping rate in gpm, and Δs is drawdown in feet per log cycle.

Well 1. In Figure 12, Δs is graphically determined to be equal to 0.133, based on the first (in time) slope of the time-drawdown curve. Therefore, the coefficient of transmissivity for Well 1 = 264×972/0.147 = 1,929,000 gpd/ft, which is indicative of very permeable, high yield aquifer.

Assuming that the last interpreted slope of the time-drawdown curve does not change, drawdown in Well 1 is estimated to vary diurnally between 5.6 – 6.2 ft., after 1,000,000 minutes (694 days) of continuous pumping, non-stop, 24/7. Clearly, Well 1 has a sustainable capacity of 972 gpm (1.39 mgd), or more.

Well 2. In Figure 13, Δs is graphically determined to be equal to 0.133, based on the first (in time) slope of the time-drawdown curve. Therefore, the coefficient of transmissivity for Well 2 = 264×720/0.145 = 1,429,000 gpd/ft, which is indicative of a very permeable, high yield aquifer.

Assuming that the last interpreted slope of the time-drawdown curve does not change, drawdown in Well 2 is estimated to vary diurnally between 6.2 – 6.6 ft. after 1,000,000 minutes (694 days) of continuous pumping, non-stop, 24/7. Clearly Well 2 has a sustainable capacity of 720 gpm (1.03 mgd), or more.

Well 3. In Figure 14, Δs is graphically determined to be equal to 0.55, based on the first (in time) slope of the time-drawdown curve. Therefore, the coefficient of transmissivity for Well 3 = 264×747/0.522 = 358,600 gpd/ft, which is indicative of a low-to-moderate permeability, moderate yield aquifer.

Assuming that the last (third) interpreted slope of the time-drawdown curve does not change, drawdown in Well 3 is estimated to reach 15.9 ft. (7.4 ft below sea level) after 1,000,000 minutes (694 days) of continuous pumping, non-stop, 24/7. Well 2 has a sustainable capacity of less than 747 gpm (1.07 mgd).

RESULTS OF WATER LEVELS IN NON-PUMPING WELLS

Figures 15, 16, and 17 show graphs of the water levels in non-pumping Wells 4, 5, and 6 before, during, and after the 10-day test. Immediately noticeable are the diurnal fluctuations that seem to mirror to varying degrees the diurnal variations of the atmospheric pressure recorded in Well 2 (considered to be representative for the area). Only a cursory comparison could be made between the wells and atmospheric pressure, but only Well 4 showed a reasonable indication that its water levels might have declined as a result of the pumping test. No further study was made of the water levels in Wells 4, 5, and 6.

WATER QUALITY

The water quality parameter which is of most concern during a pumping test is chloride because it is an easily determined indicator of salt water intrusion. The potable water limit for chloride content is 250 mg/L, which indicates that Well 1 produces the freshest water at approximately 40 mg/L, followed close behind by basalt Well 2 at approximately 100 mg/L and alluvial Well 3 varying between 25 and 109 mg/L.

In addition to the frequent tests for chlorides, representative water samples were carefully collected from Wells 1, 2, and 3 for testing by Eurofins Analytical, an approved lab, in accordance with the requirements of the Hawaii Department of Health for new potable water sources. The results indicate that all three wells are capable of producing potable water of excellent quality. The chlorides are low and the tested inorganic constituents (see table below) are well within Federal maximum contaminant levels (MCL) of public water systems. Further, all volatile

and non-volatile organic contaminants and pesticides analyzed were non-detectable.

INORGANIC WATER QUALITY OF WELLS 1, 2, & 3
(Summary of Positive Data Only)

Analyte	MCL	Units	Well 1	Well 2	Well 3
Alkalinity in CAC03 units		mg/L	95	77	81
Barium Total ICAP/MS	2000	ug/L	6.6	4.5	7.6
Calcium Total ICAP		mg/L	18	27	17
Chloride	250	mg/L	47	100	89
Chromium Total ICAP/MS	100	ug/L	6.4	3.2	6.5
Copper Total ICAP/MS	1300	ug/L	2.5		6.8
Fluoride	4	mg/L	0.14	0.12	
Gross Beta (Subbed)		pCi/L		3.7	1.l6
Nitrate as Nitrogen by IC	10	mg/L	1.5	0.96	1.7
PH (H3=past HT not compliant)		units	7.8	8.0	7.8
Sodium Total ICAP		mg/L	40	46	53
Specific Conductance, 25 C		umho/cm	380	540	510
Sulflate	250	mg/L	14	16	24
Turbidity	5	NTU			0.13

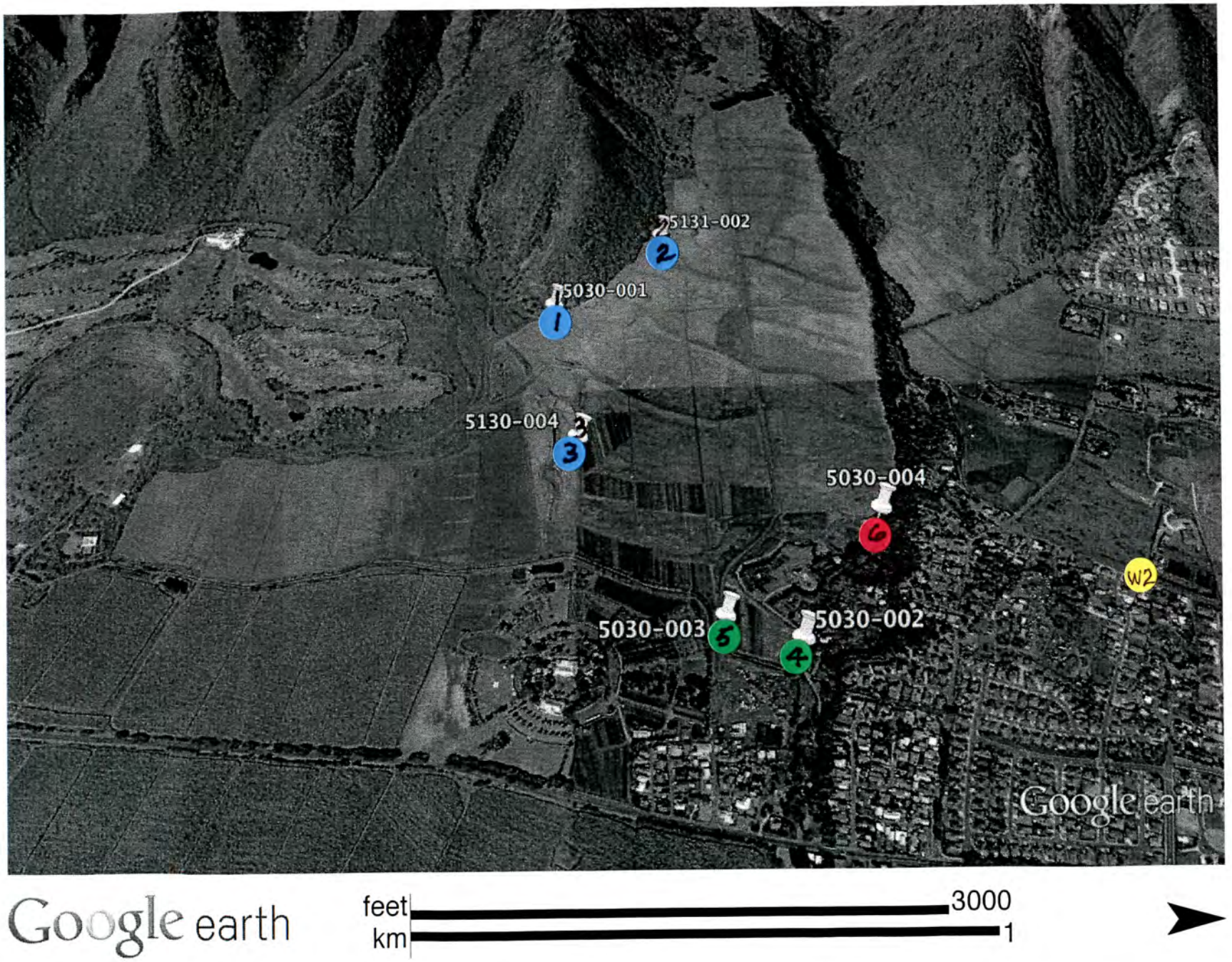


Figure 1. WCT WELLS LOCATION MAP

Figure 2. Oblique View of Project Area

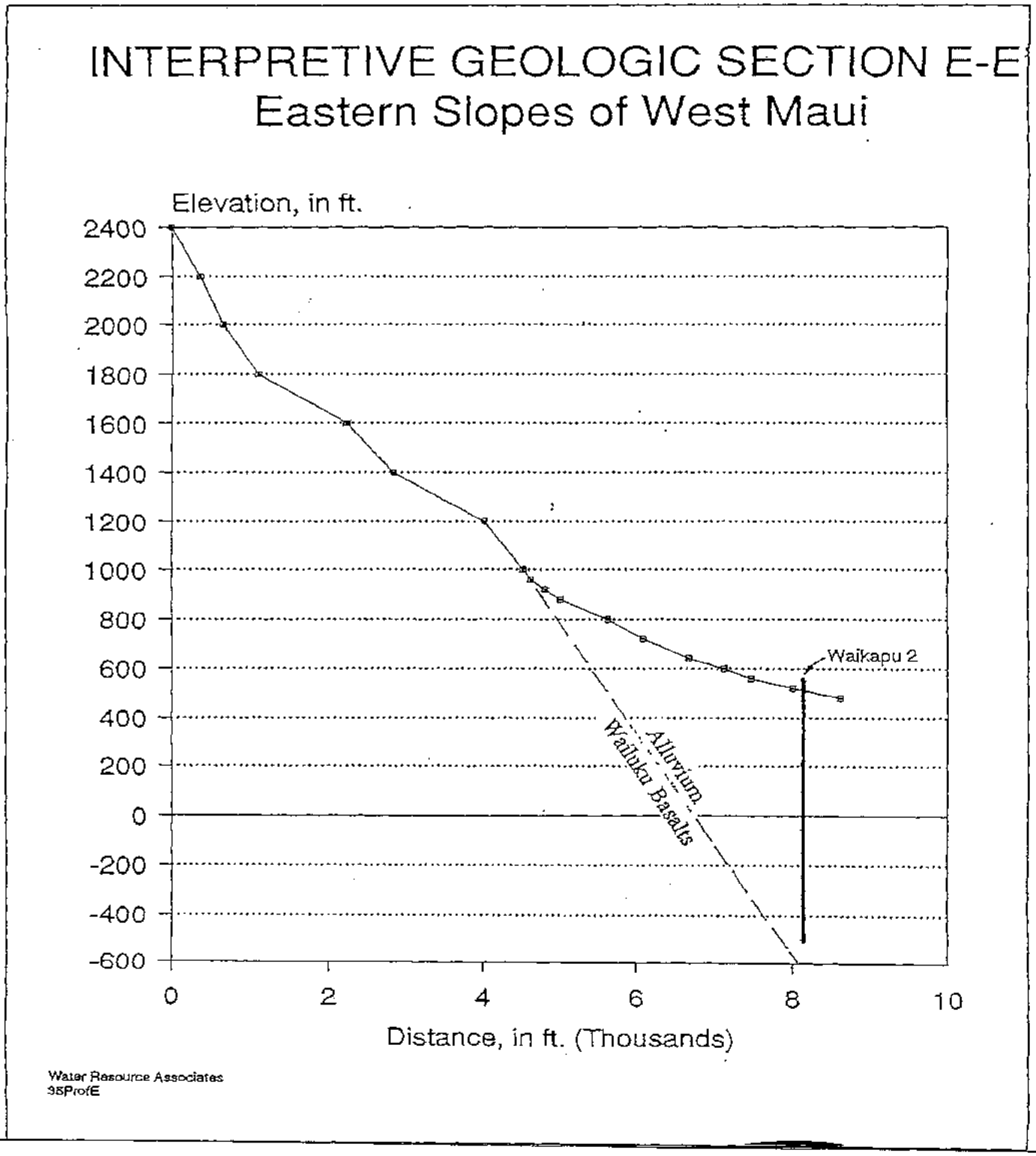


Figure 3. Interpretive Geologic Section E-E

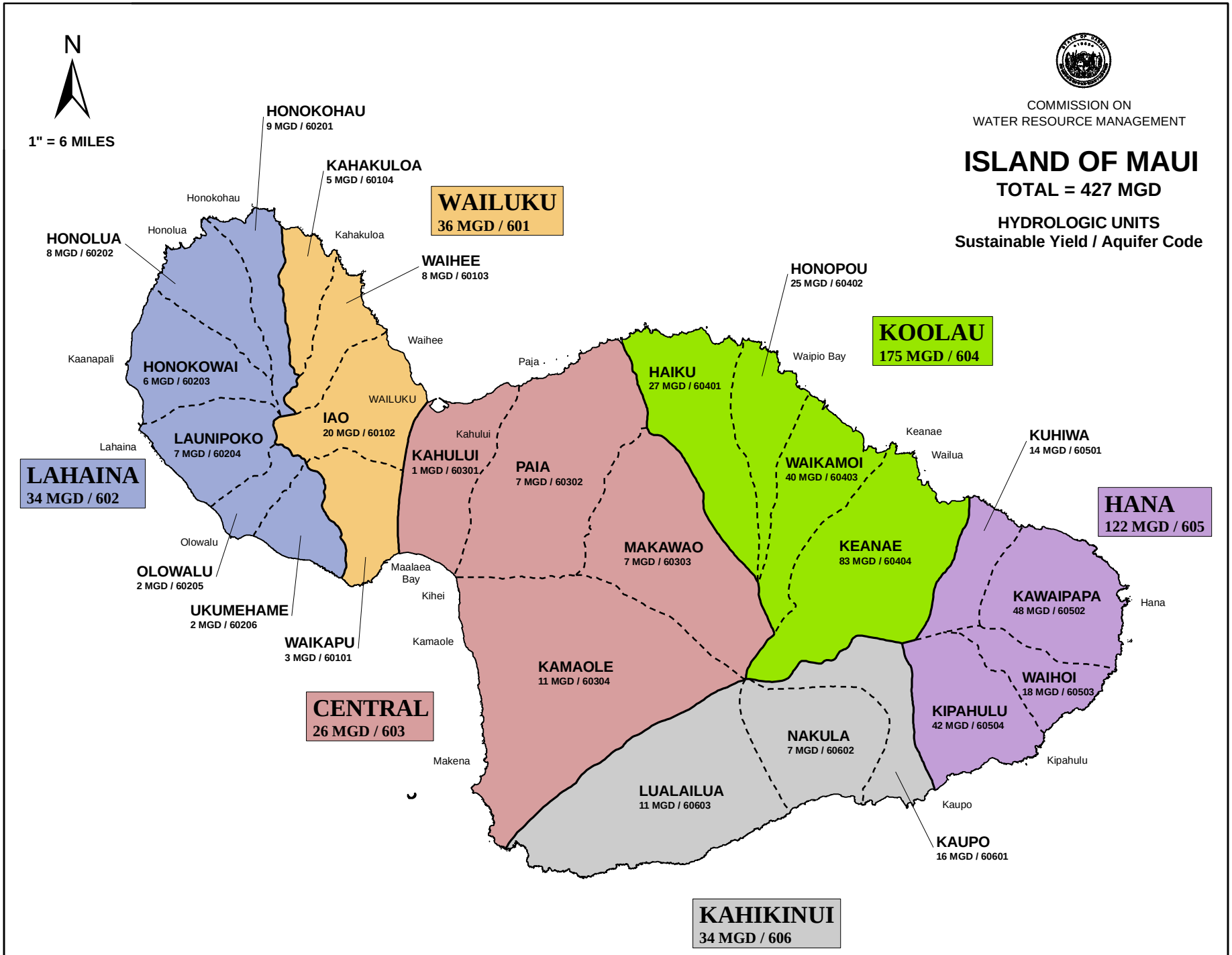


Fig. 4. SUSTAINABLE YIELD MAP OF MAUI

Map ID: 1019

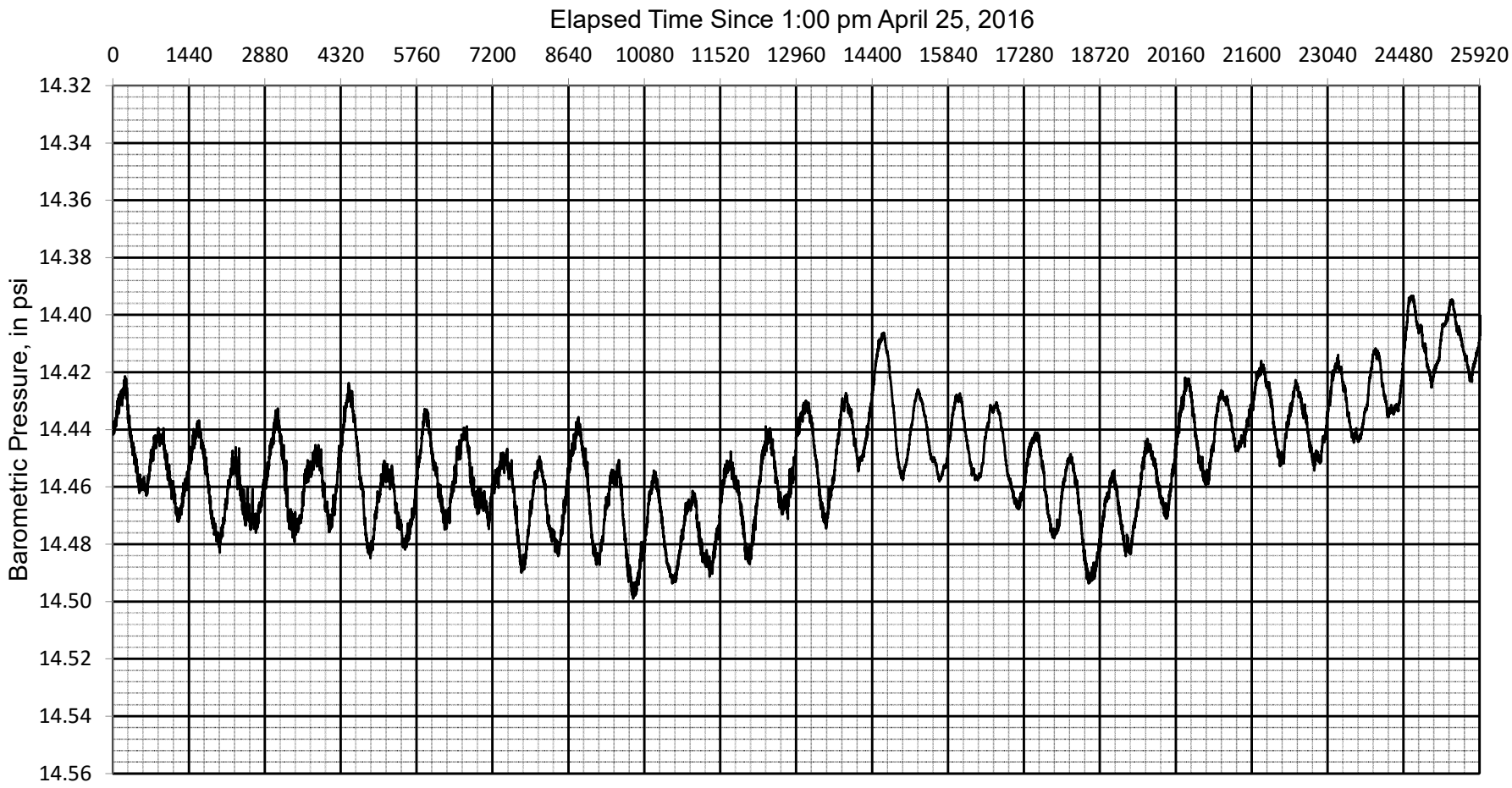
08/28/2008

Map Projection: Universal Transverse Mercator

Figure 5. GRAPH OF ATMOSPHERIC PRESSURE - WELL 2, 200 Ft. Depth

Solinst Barologger, 1pm April 25 - 3 pm May 13, 2016

Waikapu Country Town Development, Maui



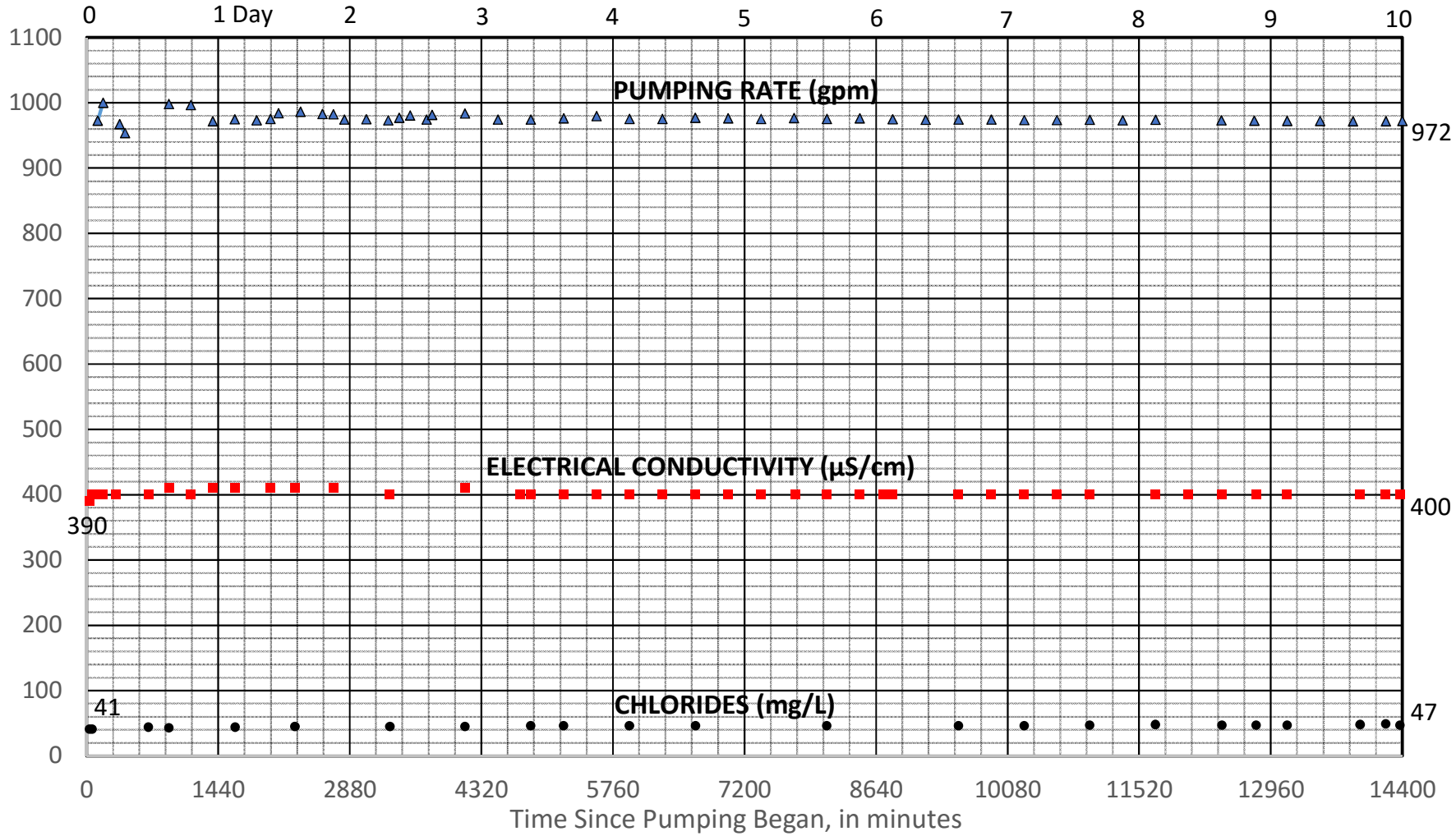
Daniel Lum
Geologist/Hydrologist
Water Resource Associates
Honolulu, Hawaii 96814

July 2016

Figure 6. PUMPING RATE AND CHLORIDES - WELL 1 (6-5030-01)

10-Day Pumping Test: 9 am April 26 to 9 am May 6, 2016

Waikapu Country Town Development, Maui



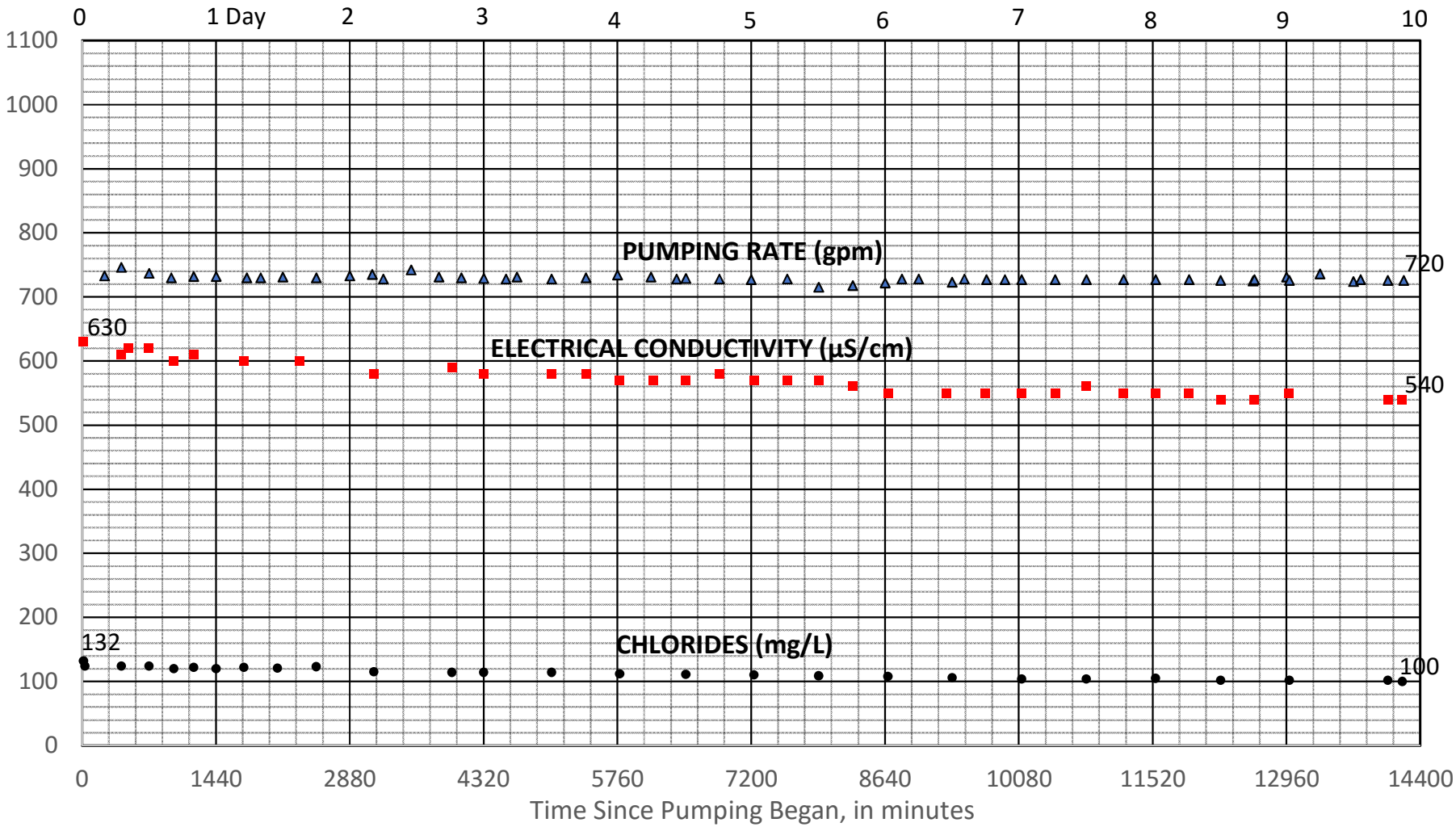
Daniel Lum, Geologist/Hydrologist
Water Resource Associates
Honolulu, Hawaii 96814

June 2016

Figure 7. PUMPING RATE AND CHLORIDES - WELL 2 (6-5131-02)

10-Day Pumping Test, 12 pm April 26 to 9 am May 6, 2016

Waikapu Country Town Develpment, Maui



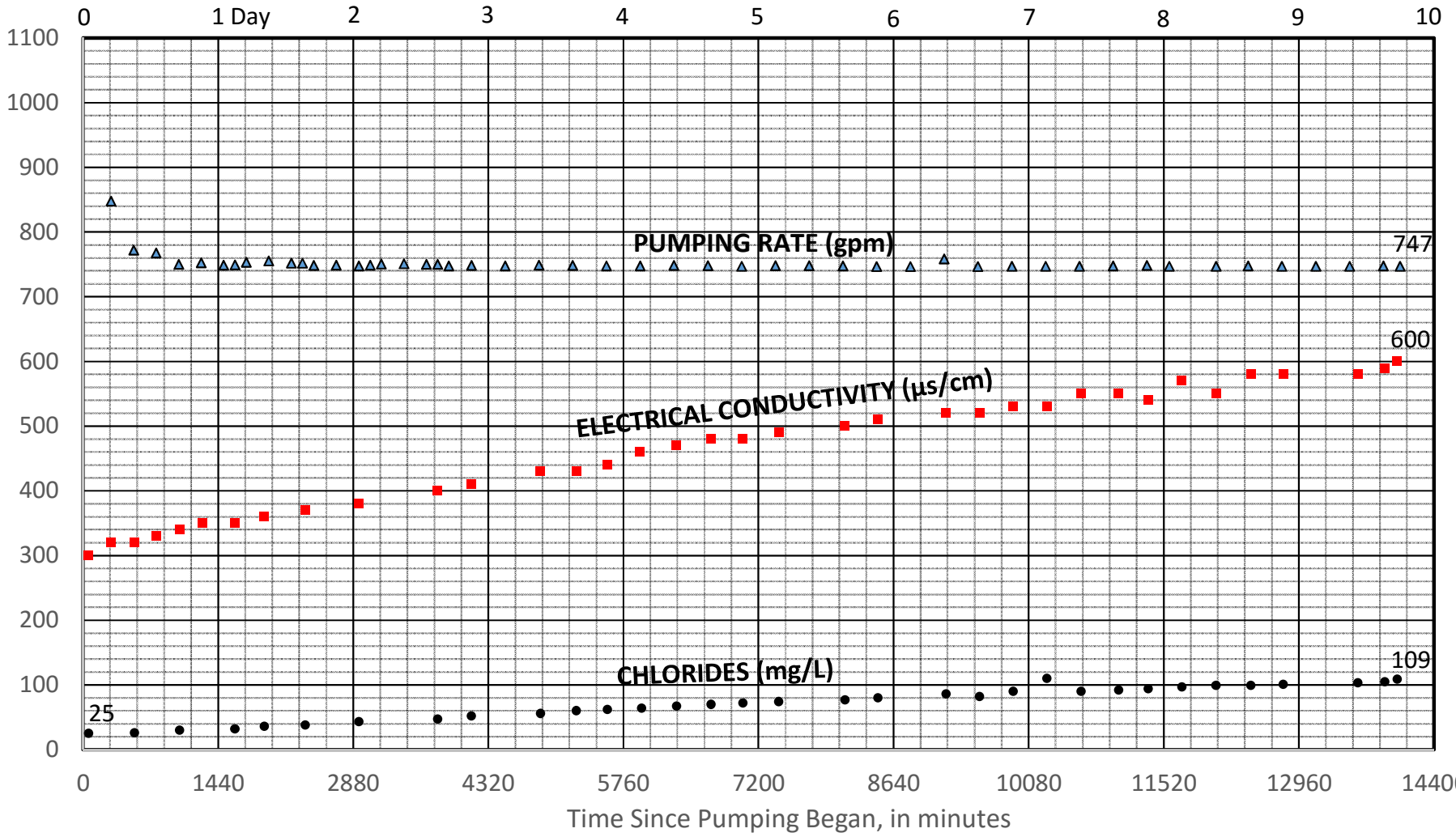
Daniel Lum, Geologist/Hydrologist
Water Resource Associates
Honolulu, Hawaii 96814

June 2016

Figure 8. PUMPING RATE and CHLORIDES - WELL 3 (6-5130-04)

10-Day Pumping Test: 3 pm April 26 to 9 am May 6, 2016

Waikapu Country Town Development, Maui



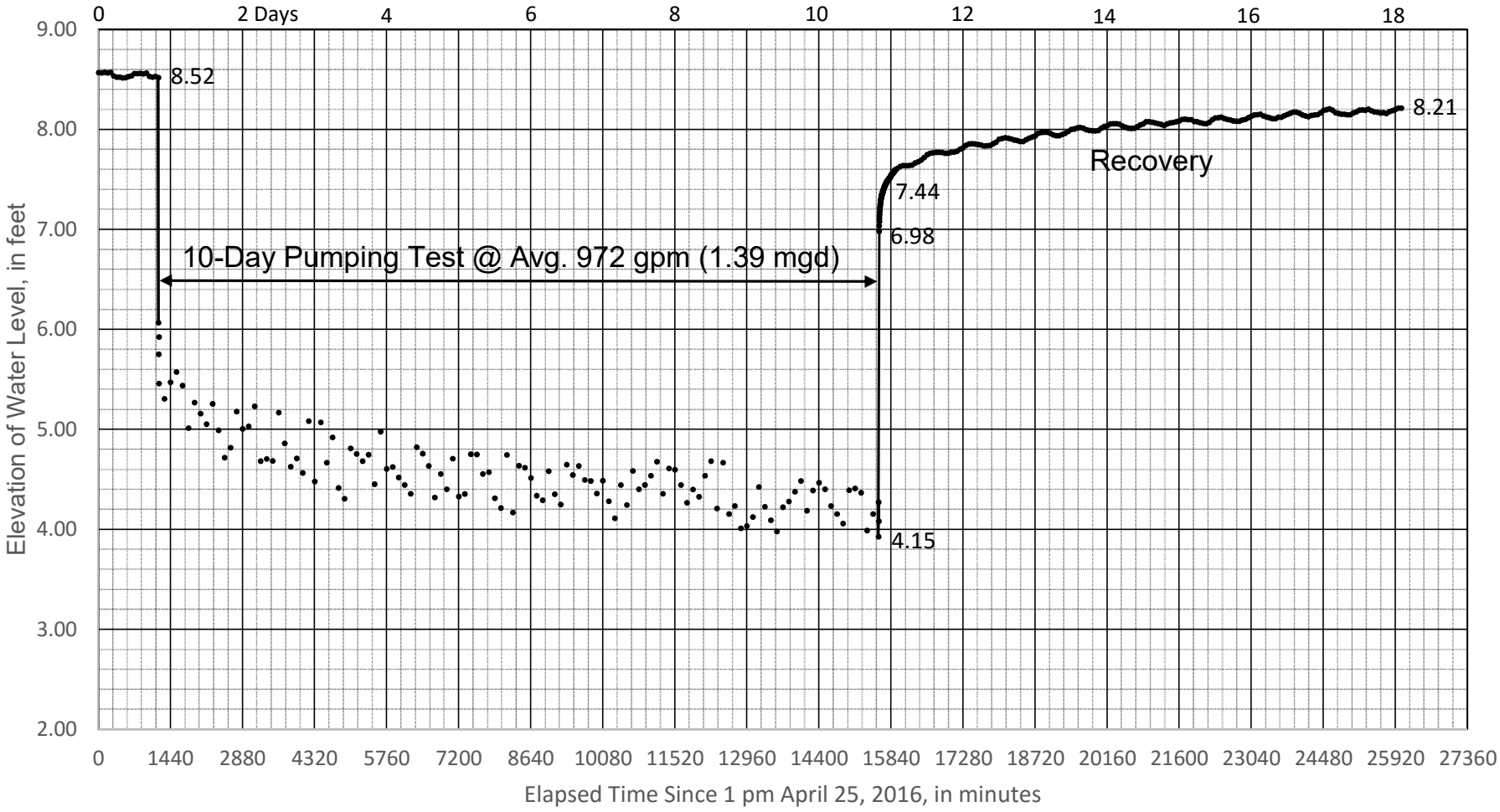
Daniel Lum, Geologist/Hydrologist
Water Resource Associates
Honolulu, Hawaii 96814

June 2016

Figure 9. LINEAR DRAWDOWN AND RECOVERY CURVE - WELL 1 (6-5030-04)

10-Day Pumping Test (9 am April 26 - 9 am May 6, 2016)

Waikapu Country Town Development, Maui



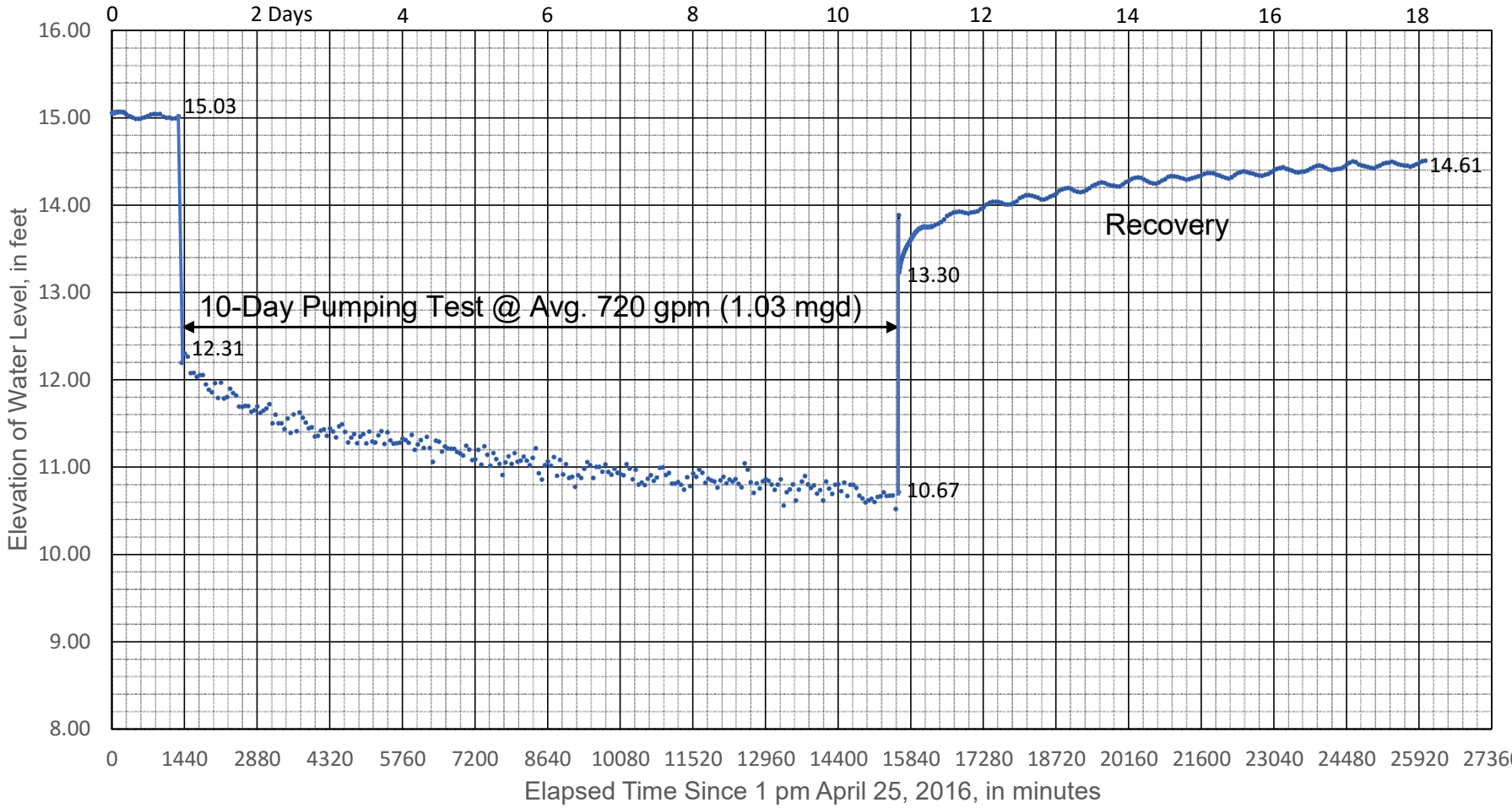
Daniel Lum, Geologist/Hydrologist
Water Resource Asssociates
Honolulu, Hawaii 96814

June 2016

Figure 10. LINEAR DRAWDOWN AND RECOVERY CURVE - WELL 2 (5131-02)

10-Day Pumping Test (12 pm April 26 - 9 am May 6, 2016)

Waikapu Country Town Development, Maui



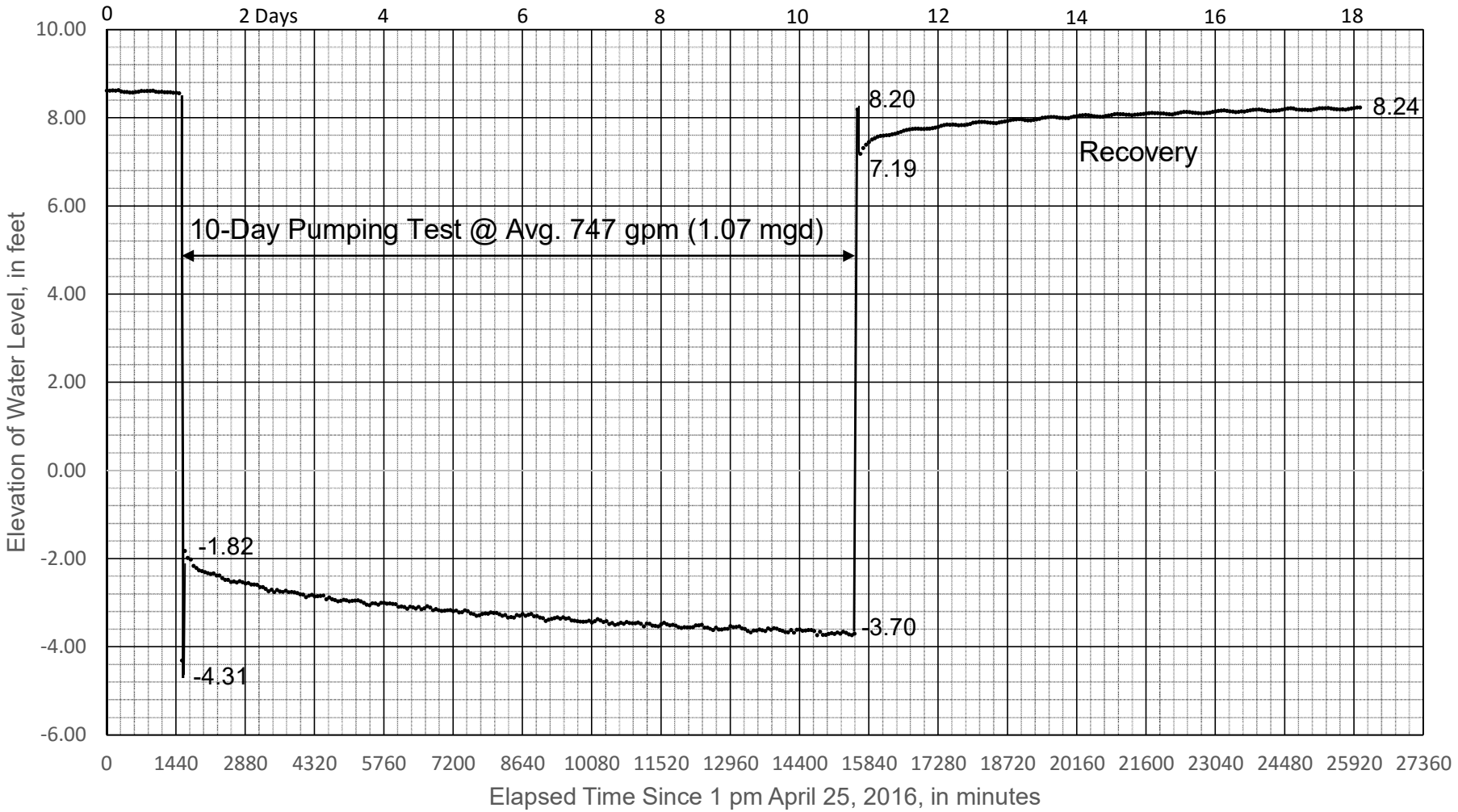
Daniel Lum, Geologist/Hydrologist
Water Resource Associates
Honolulu, Hawaii 96814

June 2016

Figure 11. LINEAR DRAWDOWN AND RECOVERY CURVE - WELL 3 (5130-04)

10-Day Pumping Test (3 pm April 26 - 9 am May 6, 2016)

Waikapu Country Town Development, Maui



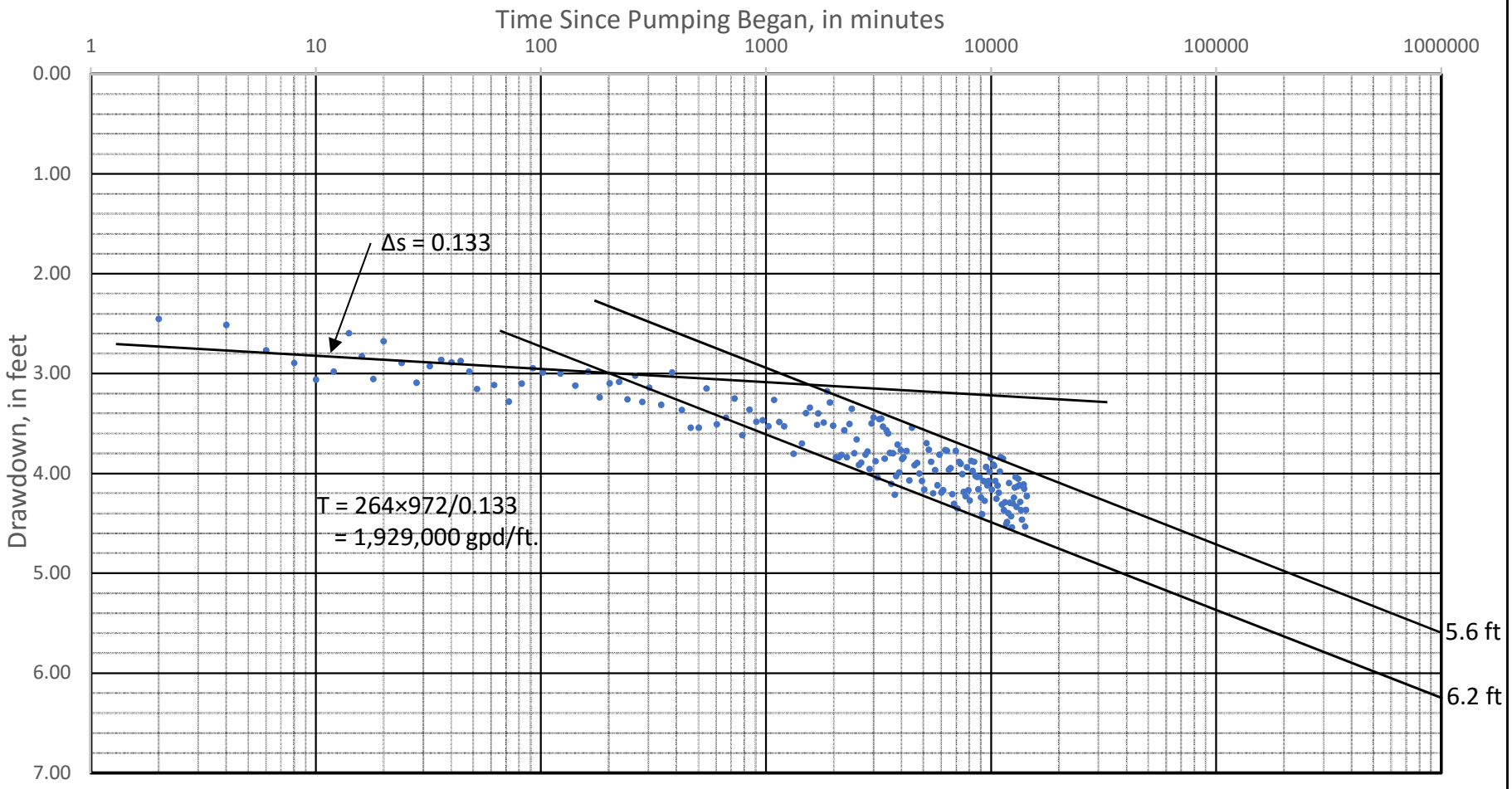
Daniel Lum, Geologist/Hydrologist
Water Resource Associates
Honolulu, Hawaii 96814

June 2016

Figure 12. SEMI-LOG DRAWDOWN CURVE - WELL 1 (6-5030-04)

10-Day Pumping Test @ Avg. 972 gpm (9 am April 26 - 9 am May 6, 2016)

Waikapu Country Town Development, Maui



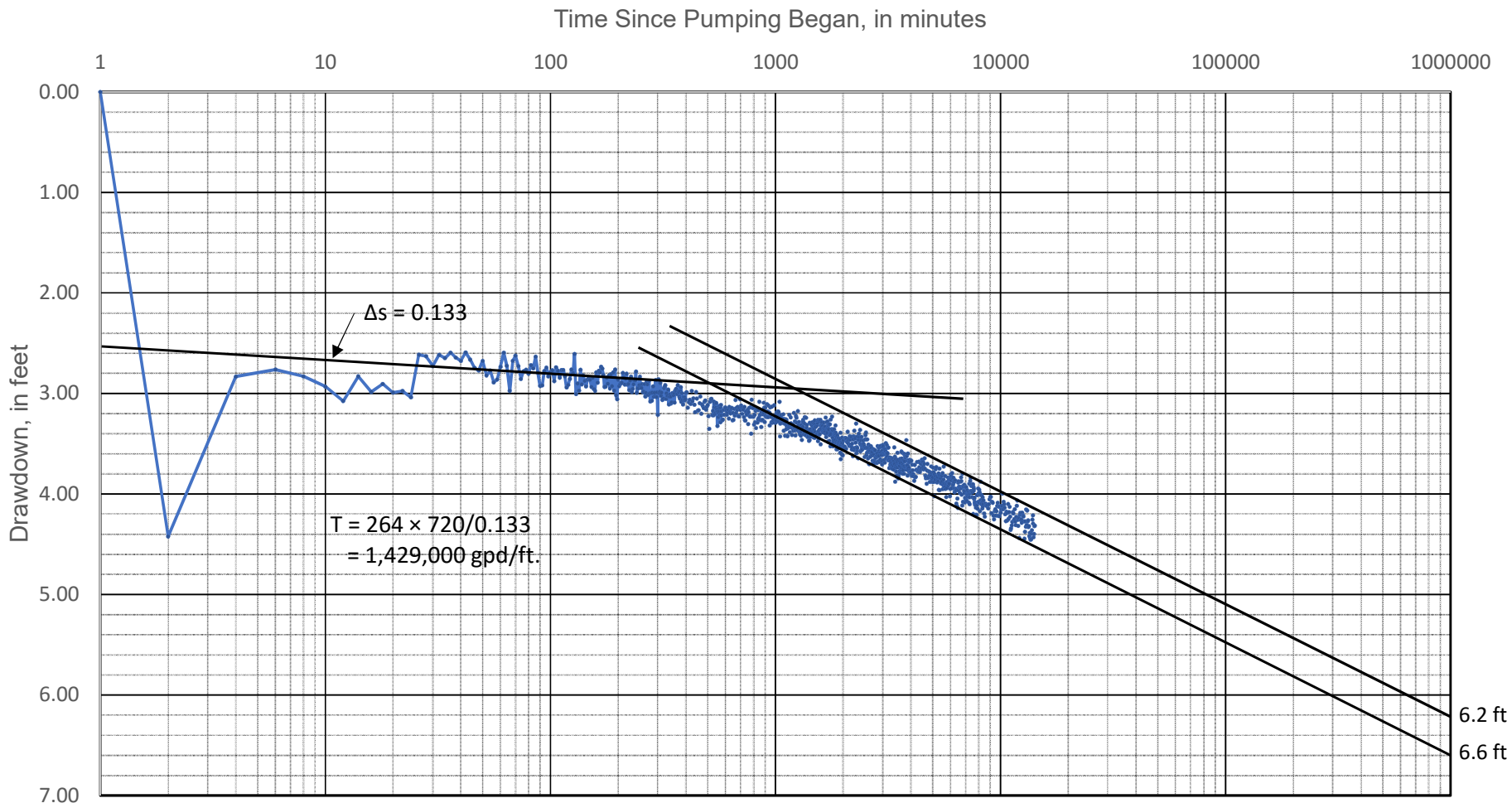
Daniel Lum, Geologist/Hydrologist
Water Resource Associates
Honolulu, Hawaii 96814

June 2016

Figure 13. SEMI-LOG DRAWDOWN CURVE - WELL 2 (6--5131-02)

10-Day Pumping Test @ Avg. 720 gpm (12 pm April 26 - 9 am May 6, 2016}

Waikapu Country Town Development, Maui



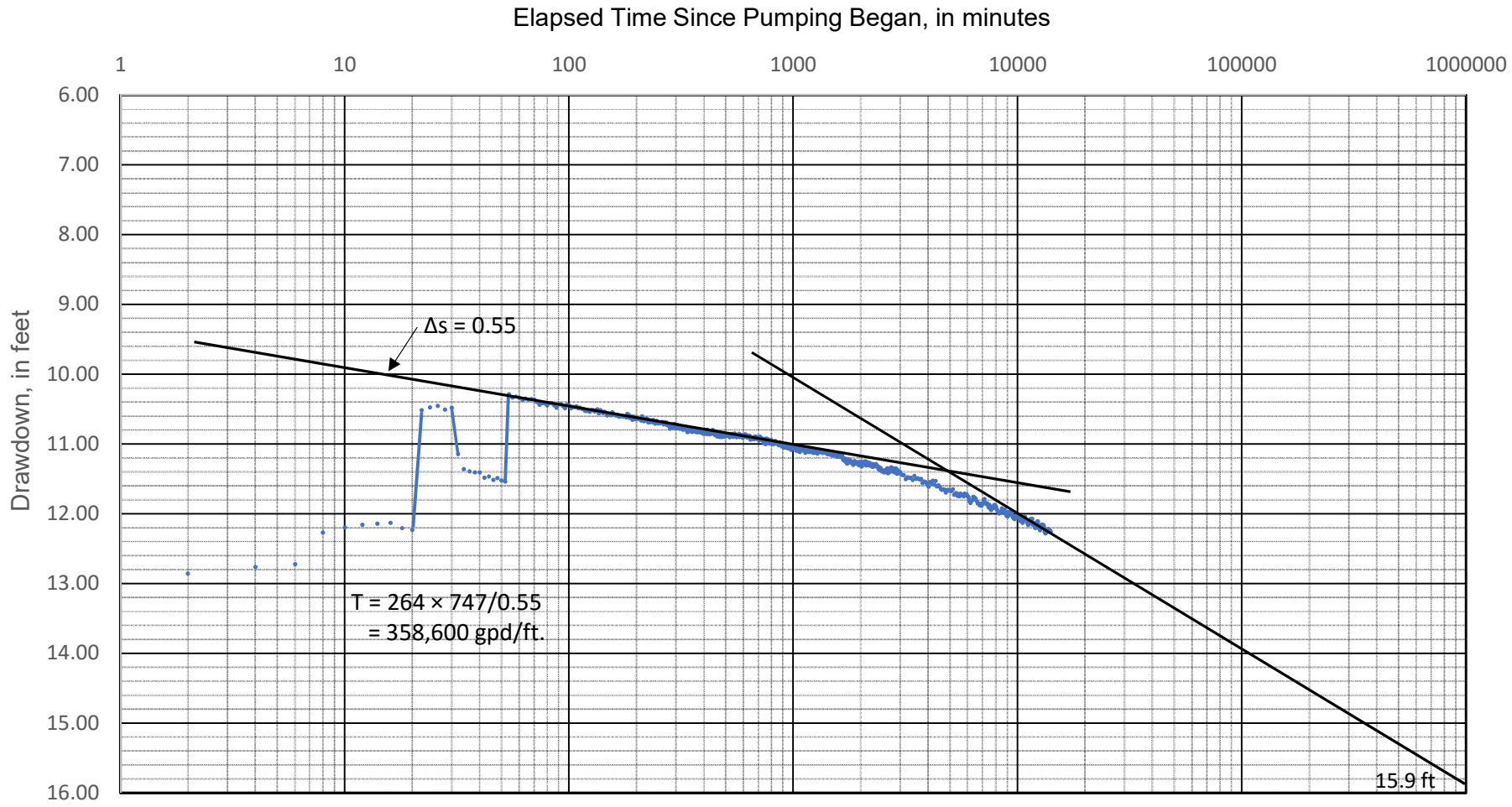
Daniel Lum, Geologist/Hydrologist
Water Resource Associates
Honolulu, Hawaii 96814

June 2016

Figure 14. SEMI-LOG DRAWDOWN CURVE - WELL 3 (5130-04)

10-Day Pumping Test @ Avg. 747 gpm (3 pm April 26 - 9 am May 6, 2016}

Waikapu Country Town Development, Maui



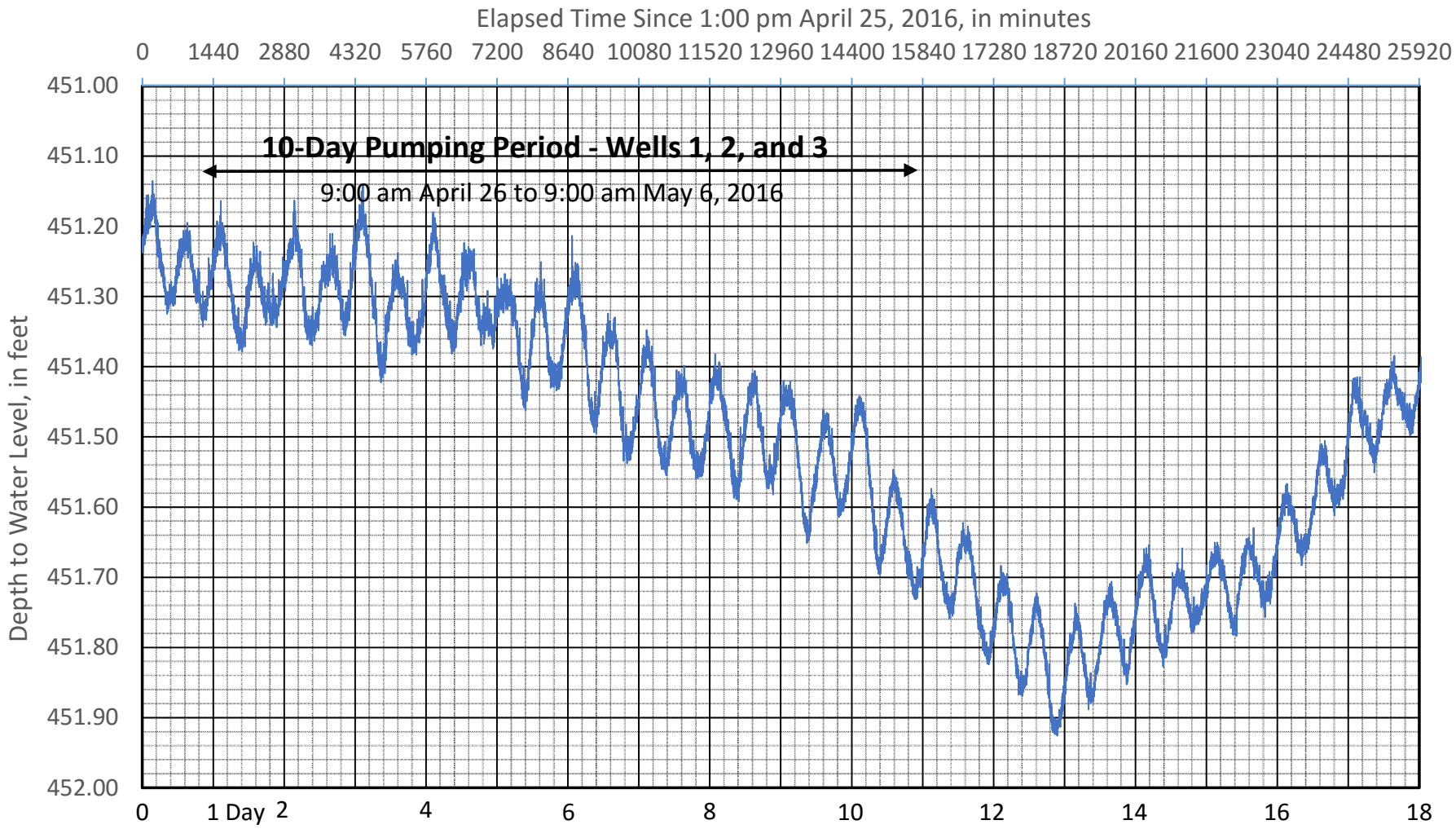
Daniel Lum, Geologist/Hydrologist
Water Resource Associates
Honolulu, Hawaii 96814

June 2016

Figure 15. WATER LEVELS - WELL 4 (MONITOR)

From 1:00 pm April 25 to 1:00 pm May 13, 2016

Waikapu Country Town Development, Maui



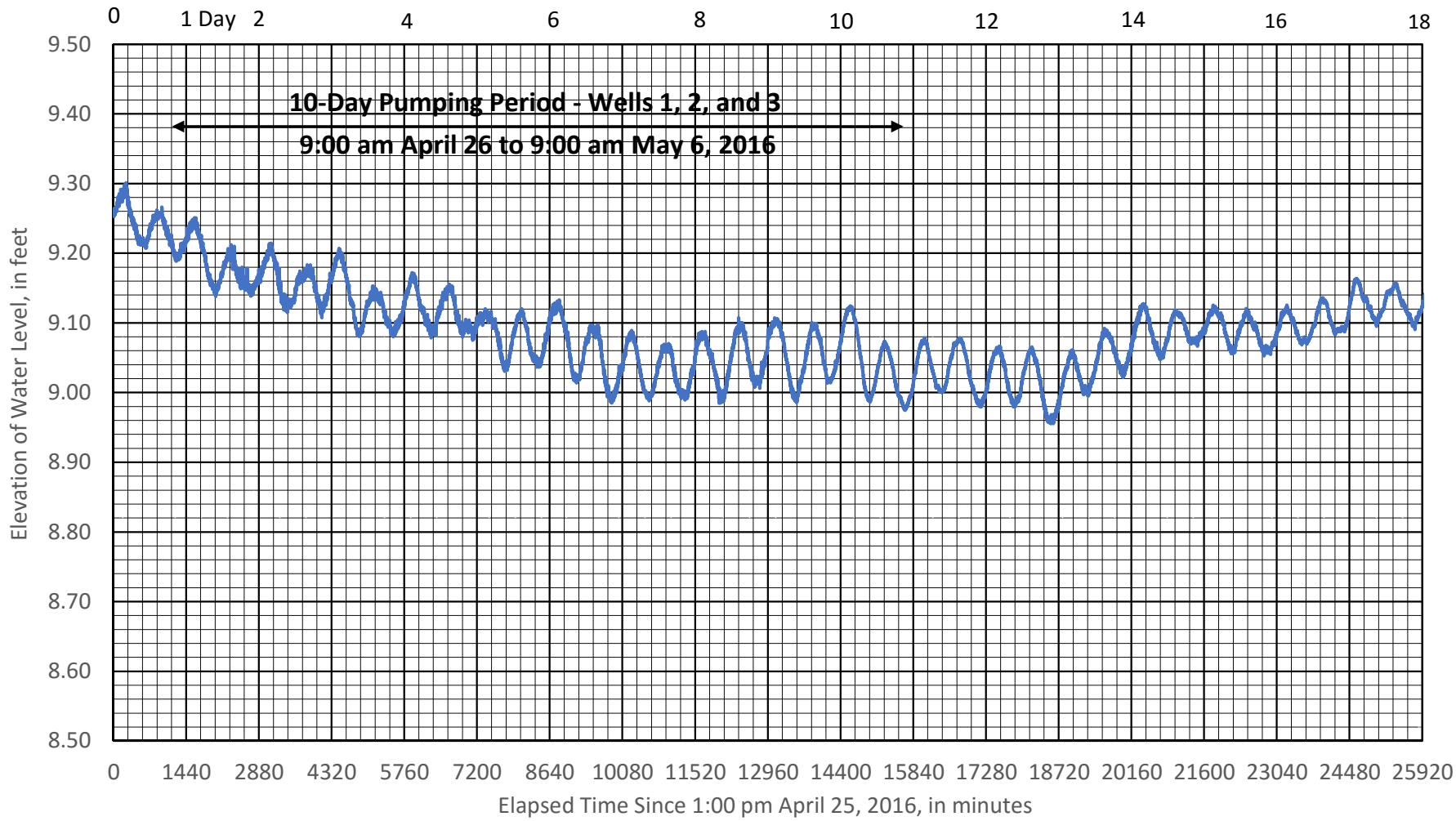
Daniel Lum, Geologist/Hydrologist
Water Resource Associates
Honolulu, Hawaii 96814

June 2016

Figure 16. WATER LEVELS - WELL 5 (MONITOR)

From 1:00 pm April 25 to 1:00 pm May 13, 2016

Waikapu Country Town Devopment, Maui



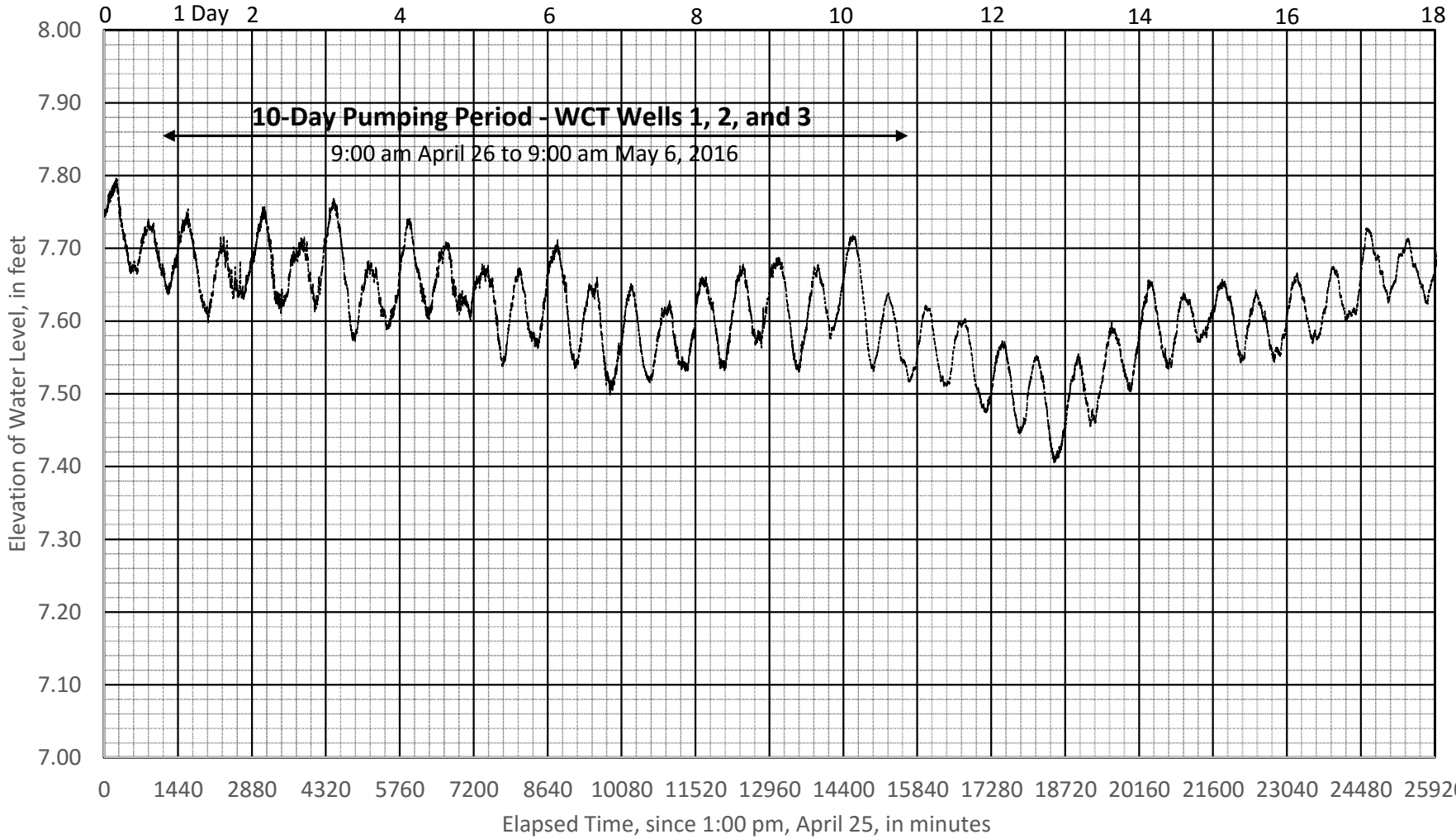
Daniel Lum, Geologist/Hydrologist
Water Resource Associates
Honolulu, Hawaii 96814

June 2016

Figure 17. WATER LEVELS - WELL 6 (MONITOR)

From 1:00 pm April 25 to 1:00 pm May 6, 2016

Waikapu Country Town Development, Maui



Daniel Lum, Geologist/Hydrologist
Water Resource Associates
Honolulu, Hawaii 96814

June 2016

Table 1. SUMMARY OF WELL DATA

Waikapu Country Town Wells, Maui

WCT WELL NAME	STATE WELL NO.	GRD ELEV. (ft.)	SURVEY ELEV. (ft.)	M.P. ELEV. (ft.)	DTW (ft.)	SWL (ft.)	YIELD (gpm)	DRAW DOWN (ft.)	CHLOR (mg/L)	TEMP	AQFR	CSG DIA. (in.)	SOL CSG DEPTH (ft.)	PERF CSG DEPTH (ft.)	TD (ft.)	TD (ft. msl)
1-DOM	5030-01	653.98	654.96	655.00	*646.42*	8.58	500	2.5 +/-	30	?	Basalt	12				
2-DOM	5131-02	778.17	780.21	780.40	*767.70*	12.70	740	3.66 - 4.11	140-85	71.1	Basalt	18	778	54	900	-120
3-DOM	5130-04	522.53	522.93	523.00	*514.21*	8.79	1008	25.2 - 21.9	120-15	75.5	Alluvial	18	522	582	602	-80
4-AG	5030-02	459.318	464.17	465.50	*452.65*	12.85	500	< 25			Alluvial	14	155	None	596	-131
5-AG	5030-03	482.283	450.12	450.12	*441.37*	8.75	500	25 +/-	20		Alluvial					
6-MON	5030-04	580.709	533.36	534.18	*527.58*	6.49					Alluvial					

2-DOM Pumping Test: 10 days @ 740 gpm, increasing drawdown from 3.66 to 4.11 ft. (Mink and Yuen Report, May 2010)

3-DOM Pumping Test: 4 days @ 1008 gpm, decreasing drawdown from 23.7 to 25.5 to 21.9 ft. (WCR, 09/5/14; per. comm, 10/6/15, Wailani Drlg)

GRD - Ground
M.P. - Measuring Point
ELEV - Elevation
DTW - Depth to Water
SWL - Static Water Level

CHLOR - Chlorides
AQFR - Aquifer
SOL CSG - Solid Casing
Perf CSG - Perforated Casing
TD - Total Depth

msl - Mean Sea Level

Date: 11/12/15

Daniel Lum, Geologist/Hydrologist
WATER RESOURCE ASSOCIATES
1296 Kapiolani Blvd., #1704
Honolulu, Hawaii 96814
Ph.: 808-291-4800

Table 2. SOLINST DATA LOGGER DEPLOYMENT
Waikapu Country Town Wells, Maui

Data Logger	Installed In Well	Orig. M.P. (ft.)	Orig. DTW (ft.)	Orig. SWL (ft.)	Wailani M.P. (ft.)	Wailani DTW (ft.)	Wailani SWL (ft.)	Logger Rdg. (ft.)	Obs'd DD (ft.)	Logger Range (ft.)	Max Cable Length	Custom Cable Length	Logger DD Range
F30	***1 - DOM***	655.00	*646.42*	***8.58***	*657.48*	*648.75*	***8.73***	***56.30***	2.5+/-	30.00	676	***670***	24
F30	***2 - DOM***	780.40	*767.70*	***12.70***	*782.71*	*767.48*	***15.23***	***57.84***	4.11	30.00	798	***790***	22
F65	***3 - DOM***	523.00	*514.21*	***8.79***	*524.06*	*515.14*	***8.92***	***89.81***	25.20	65.00	579	***570***	56
F65	***4 - AG***	465.50	*452.65*	***12.85***		*451.22*		***80.79***	<25	65.00	518	***500***	47
F65	***5 - AG***	450.12	*441.37*	***8.75***	*451.54*	*442.16*	***9.38***	***92.29***	25+/-	65.00	506	***500***	59
F30	***6 - MON***	534.18	*527.58*	***6.60***					n/a	30.00	558	***550***	22

NOTES:

1. Original M.P. (Measuring Point) Elevations and DTWs (Depths to Water) are based on Nance's 5/6/15 Memorandum.
2. Wailani M.P. = Elevation of Direct Read Cable Suspension Point, measured on 12/23/15.
3. Wailani DTW Measureements: Wells 1 -5 on 12/23/15. Well 6 on 1//1/16.
4. The "Install Cable Length" rounded to nearest ten feet for straight forward field measurement and installation.
5. Well 4 reported inaccessible because chase tube offset from hole in steel base plate (corrected as of 11/12/15).
6. The recommended data loggers have measurement range of either 30 ft. or 65 ft of water.
7. The Observed DD (Drawdown) in Wells 1, 4, and 5 based on Mike Robertson info.

Date: 1/3/16

Daniel Lum, Geologist/Hydrologist
Water Resource Associates
1296 Kaiolani Blvd., #1704
Honolulu, Hawaii 96814
Mobile: 808-291-4800

nas:\projects\192 Waikapu

APPENDIX J

Enviniti Prepared "Water Reclamation and Reuse Report"

Enviniti LLC
P.O. Box 1516
Honolulu, HI 96806
T: (808) 596-2378 ext. 1
www.enviniti.com

Preliminary Wastewater Report

(Revised Final)

Preliminary Planning – Private Wastewater Treatment Works

at

Project Site:	Waikapu Country Town, Maui, Hawaii
Project Addresses:	0 Honoapiilani Hwy., Wailuku, HI, 96793
	1670 Honoapiilani Hwy., Wailuku, HI, 96793
	2000 Honoapiilani Hwy., Wailuku, HI, 96793
Project TMKs:	(2) 3-6-002:003
	(2) 3-6-004:003
	(2) 3-6-004:006
	(2) 3-6-005:007

for

Waikapu Properties, LLC
P.O. Box 1870, Manteca, CA, 95336

Revised Final Submittal Date: November 2015

Enviniti LLC

Table of Contents

Table of Contents 2
1. Introduction 4
2. Abbreviations & Definitions 5
3. WCT Document References 7
4. Goal 8
5. Purpose 8
6. Objectives 8
7. Stakeholders / Points of Contact 9
8. Introduction of Project 11
9. General Private WWTW Description 15
10. Project Specific Private WWTW Description 26
11. Assumptions for Wastewater Flow Estimation 27
12. Preliminary Private WWTW Flow Estimates 36
13. Preliminary Private WWTW Cost Estimates 40
14. Future Tasks for Private WWTW 42
15. References 49
Appendix A – Priority Pollutants 50
Appendix B – Summary of Suitable Uses for Recycled Water 51

Table 1: Documents Provided by Client / Prime Consultants 7
Table 2: Drawing Provided by Client / Prime Consultants 7
Table 3: Phase 1 – Development Unit Type vs. Incremental Phasing Program 26
Table 4: Phase 2 – Development Unit Type vs. Incremental Phasing Program 26
Table 5: Project (Phases 1 & 2) – Development Unit Type vs. Conceptual Land Use Plan 26
Table 6: Summary of Development Unit Type vs. Incremental Phasing Program 36
Table 7: Summary of Residential Scenario vs. Flows Estimates 36
Table 8: Summary of Commercial Scenarios & Sub-Categories vs. Flow Estimates 36
Table 9: Summary of Civic Scenarios & Sub-Categories vs. Flow Estimates 37
Table 10: Summary of All Scenarios vs. Flow Estimates 37
Table 11: Summary of Estimate Types vs. Average Flow Estimates 37
Table 12: Population Estimates 38
Table 13: Summary of Estimate Types vs. Maximum Flow Estimates 38
Table 14: Dry Weather Infiltration/Inflow Flow Estimates 38
Table 15: Summary of Estimate Types vs. Design Average Flow Estimates 38
Table 16: Summary of Estimate Types vs. Design Maximum Flow Estimates 38
Table 17: Wet Weather Infiltration/Inflow Flow Estimates 39
Table 18: Summary of Estimate Types vs. Design Peak Flow Estimates 39
Table 19: Summary of Cost Estimate Range vs. WWTW Component 40
Table 20: Summary of Total Cost Estimate Range 40
Table 21: Estimate of WWTW Land Area Requirement 42
Table 22: Summary of Suitable Uses for Recycled Water 51
Table 23: Summary of Suitable Uses for Recycled Water (continued) 52

Figure 1: Hallstrom Absorption (Phase 1: 2017-2021 and Phase 2: 2022-2026) 12
Figure 2: Illustrative Land Plan 13
Figure 3: Illustrative Land Plan 14
Figure 4: DOH-SDWB UIC Areas 44
Figure 5: UIC Boundary Line for County of Maui 45
Figure 6: UIC Boundary Line for Island of Maui 46
Figure 7: UIC Boundary Line for Waikapu 47
Figure 8: UIC Boundary Line for WCT 48

Note: Updates, changes, and additions are written in blue.

1. Introduction

1.1. Authorization
- 1.1.1. This project was authorized by:
  - 1.1.1.1. Work Order & Agreement: 12-015
    - 1.1.1.1.1. Document dated: February 26, 2013
    - 1.1.1.1.2. Document signed and accepted: March 1, 2013
    - 1.1.1.1.3. Document approved by: Albert Boyce, Manager, Waikapu Properties, LLC
  - 1.1.1.2. Project Name: Preliminary Planning – Private Wastewater Treatment Works at Waikapu Country Town, Maui, Hawaii

1.2. Project Understanding
- 1.2.1. Property Owner and Client: Waikapu Properties, LLC
- 1.2.2. Project Management Companies and Prime Consultants:
  - 1.2.2.1. Planning Consultants Hawaii, LLC
  - 1.2.2.2. Hawaii Land Design LLC
- 1.2.3. Consultants:
  - 1.2.3.1. Civil Engineer: Otomo Engineering, Inc.
  - 1.2.3.2. Wastewater Engineer: Enviniti LLC
  - 1.2.3.3. Traffic Engineer: Fehr & Peers
  - 1.2.3.4. Market & Fiscal: The Hallstrom Group, Inc.
  - 1.2.3.5. Archaeology: Archaeological Services Hawaii, LLC
  - 1.2.3.6. Cultural: Hana Pono, LLC
  - 1.2.3.7. Flora & Fauna: Robert Hobdy
  - 1.2.3.8. Noise Quality: D.L. Adams & Associates, Ltd.
  - 1.2.3.9. Air Quality: B.D. Neal & Associates (dba Atmospheric Research &Technology, LLC)
  - 1.2.3.10. Surveying: Newcomer-Lee Land Surveying, Inc.
- 1.2.4. The project site is located at the following addresses and TMKs:
  - 1.2.4.1. Addresses:
    - 1.2.4.1.1. 0 Honoapiilani Hwy., Wailuku, HI, 96793
    - 1.2.4.1.2. 1670 Honoapiilani Hwy., Wailuku, HI, 96793
    - 1.2.4.1.3. 2000 Honoapiilani Hwy., Wailuku, HI, 96793
  - 1.2.4.2. TMKs:
    - 1.2.4.2.1. (2) 3-6-002:003
    - 1.2.4.2.2. (2) 3-6-004:003
    - 1.2.4.2.3. (2) 3-6-004:006
    - 1.2.4.2.4. (2) 3-6-005:007

2. Abbreviations & Definitions

2.1. 7-Day Average: The arithmetic mean of pollutant values of samples collected in a period of seven (7) consecutive days (EPA, 1984).
2.2. 30-Day Average: The arithmetic mean of pollutant values of samples collected in a period of thirty (30) consecutive days (EPA, 1984).
2.3. A_{BA}: Total horizontal area of all commercial buildings [SF]
2.4. ABS: Acrylonitrile Butadiene Styrene
2.5. ac: acres
2.6. A_{RA}: Total horizontal area of all commercial restaurants [SF]
2.7. A_{TAPA}: Total horizontal area of all active park-type lots [ac]
2.8. A_{TCA}: Total horizontal area of all commercial-type lots [SF], which includes Country Town Mixed-Use, Existing Commercial, and New Commercial/Emp.
2.9. A_{TESA}: Total horizontal area of all elementary school-type lot(s) [ac]
2.10. (Avg): Restaurant Customer Flow based on Average-type seating with NO bar-type seating
2.11. $(Avg + Bar)$: Restaurant Customer Flow based on Average-type seating with bar-type seating
2.12. BA: Building Area [SF]
  2.12.1. Total horizontal area of all commercial buildings (aka building footprint)
2.13. BOD: Biochemical Oxygen Demand [mg/L]
2.14. DOH-SDWB: State of Hawaii Department of Health Safe Drinking Water Branch
2.15. DOH-WWB: State of Hawaii Department of Health Wastewater Branch
2.16. Enviniti: Enviniti LLC
2.17. EPA: U.S. Environmental Protection Agency
2.18. (FF): Restaurant Customer Flow based on Fast Food-type seating with NO take-out meals
2.19. $(FF + TO)$: Restaurant Customer Flow based on Fast Food-type seating with take-out meals
2.20. Flow: Wastewater flow rate [gpd]
2.21. FOG: Fats, Oils, and Grease
2.22. ft^2: Square feet
2.23. GI: Grease Interceptor
2.24. gpd: Gallons per day
2.25. HAR: Hawaii Administrative Rule
2.26. $(H \times H)$: Permutation of “High Traffic” value and “High Vehicle Occupancy” value
2.27. $(H \times L)$: Permutation of “High Traffic” value and “Low Vehicle Occupancy” value
2.28. hr: Hour
2.29. IWS: Individual Wastewater System
2.30. L: Liter
2.31. LCC: Large-Capacity Cesspool
2.32. $(L \times H)$: Permutation of “Low Traffic” value and “High Vehicle Occupancy” value
2.33. $(L \times L)$: Permutation of “Low Traffic” value and “Low Vehicle Occupancy” value
2.34. Max.: Maximum
2.35. mg: milligrams
2.36. MGD: Million gallons per day
2.37. mg/L: Milligrams per liter
2.38. min: Minute
2.39. Min.: Minimum
2.40. NA: Not Applicable
2.41. NP: Not Provided
2.42. NPDES: National Pollutant Discharge Elimination System
2.43. O&M: Operation and Maintenance
2.44. OHA: Office of Hawaiian Affairs

2.45. Percent removal: A percentage expression of the removal efficiency across a treatment plant for a given pollutant parameter, as determined from the 30-day average values of the raw wastewater influent pollutant concentrations to the facility and the 30-day average values of the effluent pollutant concentrations for a given time period (EPA, 1984).
2.46. PL: Pre-Loader
2.47. POC: Point of Contact
2.48. PVC: Polyvinyl Chloride
2.49. Q: Wastewater flow rate [gpd]
2.50. RA: Restaurant Area [SF]
    2.50.1. Total horizontal area of all commercial restaurants
2.51. sec: Seconds
2.52. Secondary Treatment Standards: Quantifiable minimum level(s) of effluent quality attainable by secondary wastewater treatment.
2.53. SF: Square feet
2.54. SMH: Sewer Manhole
2.55. SS: Suspended Solids [mg/L]
    2.55.1. The pollutant parameter total suspended solids (EPA, 1984).
2.56. TAPA: Total Active Park Area [ac]
2.57. TCA: Total Commercial Area [SF]
    2.57.1. Total horizontal area of all commercial-type lots, which includes Country Town Mixed-Use, Existing Commercial, and New Commercial/Emp.
2.58. TESA: Total Elementary School Area [ac]
2.59. TSS: Total Suspended Solids (see SS)
2.60. $Meals_{(TO)}$: Take-Out Meals
2.61. UIC: Underground Injection Control
2.62. WCT: Waikapu Country Town
2.63. WFS: Wastewater Flow Standards
2.64. WP: Waikapu Properties, LLC
2.65. WRD: Wastewater Reclamation Division
2.66. WWTW: Wastewater Treatment Works (aka wastewater treatment plant)

3. WCT Document References

3.1. Documents provided by Client and/or Prime Consultants (see Table 1: Documents Provided by Client and Prime Consultants)

3.2. Drawings provided by Client and/or Prime Consultants (see Table 2: Drawing Provided by Client and Prime Consultants)

Table 1: Documents Provided by Client / Prime Consultants

#	Type of Document	Subject [Filename]	Dated	Qty. of Pages
1	Table	WCT Project Team	NP	1
2	Letter	WP LLC's response to objections of OHA to SWUPA-E no. 2356 [20090702Waikapu-OHA.pdf]	June 20, 2009	3
3	Spreadsheet	WCT – Conceptual Land Use Plan [WCT Land Use Plan_060513.pdf]	June 5, 2013	1
4	Letter	Waikapu – Tropical Plantation Development, Existing Sewer Availability [7-16-23 Wastewater Letter.pdf]	July 16, 2013	3
5	Spreadsheet	WCT Infrastructure Improvement Time and Cost [WCT Sewer.pdf]	August 22, 2013	1
6	Spreadsheet	WCT Phasing Plan [Incremental Phasing Program_102913.xlsx]	October 29, 2013	1
7	Spreadsheet	WCT, Conceptual Land Use Plan, Conceptual Plan with Maximum of 1433 Units per MIP WCT, Proposed Land Controls (Draft) [WCT Land Use Plan 1433 unit maximum_102913 _consultant draft.xlsx]	October 29, 2013	2
8	Narrative & Tables	Proposed Action Table 2: Phase I Conceptual Land Use Program for 2016 through 2026 Table 3: Phase II Conceptual Land Use Program for 2026 through 2036 Table 4: Conceptual Development Program for 2016 – 2036 [WCT Project Description_112613.docx]	November 26, 2013	4
9	Spreadsheet	Land Use Allocations [WCT Land Use Plan_092614_EISPN Insert.xlsx]	September 26, 2014	3
10	Spreadsheet	WCT Phasing Plan [Incremental Phasing Program_100114.xlsx]	October 1, 2014	1
11	Report	Preliminary Engineering Report for Waikapu Country Town, January 2015, Revised October 2015 [2013-06 Waikapu Country Town (10-15 Rev. Report).pdf]	October 7, 2015	74

Table 2: Drawing Provided by Client / Prime Consultants

#	Type of Document	Title [Filename]	Dated	Qty. of Pages
1	Plan	Waikapu, A Country Town, Waikapu, Maui, HI – Preliminary Draft Land Plan [12-027 Waikapu Preliminary Draft Land Plan 30X42 (02-06-13) (25%).jpg]	February 6, 2013	1
2	Plan	Waikapu, A Country Town, Waikapu, Maui, HI – Preliminary Draft Land Plan [12-027 Waikapu Preliminary Draft Land Plan 30X42 (02-06-13) (100%).jpg]	February 6, 2013	1
3	Plan	Waikapu, A Country Town, Waikapu, Maui, HI – Preliminary Draft Land Plan [12-027 Waikapu Preliminary Draft Land Plan 30X42 (02-06-13).pdf]	February 6, 2013	1
4	Plan	Concept Plan – Waikapu Country Town, Waikapu, Maui, HI [12-027 Waikapu Master Plan Overlay 11X17 (06-05-13).pdf]	June 5, 2013	1
5	Plan	Conceptual Phasing Plan (2016 – 2036) [Conceptual 20 year phasing plan_reduced_.pdf]	NP	1
6	Plan	Conceptual Phasing Plan (2016 – 2036) [Conceptual_phasing plan_102913.pdf]	NP	1
7	Plan	Hallstrom Absorption (Phase 1: 2017-2021, Phase 2: 2022-2026) [Absorption Diagram_100114__.pdf]	October 1, 2014	1
8	Plan	Waikapu Country Town – Illustrative Land Plan [12-027 Waikapu Illustrative Land Plan (2-23-2015).pdf]	February, 17, 2015	1
9	Plan	Waikapu Country Town – Illustrative Land Plan [Illustrative Inset 10-7-15.pdf]	October 7, 2015	1

4. Goal

4.1. The goal of this report is to assist the Client with future planning and development of a private WWTW for the subject project.

5. Purpose

5.1. The purpose of this report is to inform the Client of the general concepts and requirements for a private WWTW for the subject project.

6. Objectives

6.1. The objectives of this report are to discuss the following topics in order for the Client to identify the requirements and future tasks necessary for the Client to plan, design, construct, operate, and maintain a private WWTW for the subject project:

- 6.1.1. General Private WWTW Description
- 6.1.2. Project Specific Private WWTW Description
- 6.1.3. Assumptions for Wastewater Flow Estimation
- 6.1.4. Preliminary Private WWTW Flow Estimates
- 6.1.5. Preliminary Private WWTW Cost Estimates
- 6.1.6. Future Tasks for Private WWTW

7. Stakeholders / Points of Contact

- 7.1. Property Owner / Client
  - 7.1.1. Waikapu Properties, LLC
    - 7.1.1.1. P.O. Box 1870, Manteca, CA, 95336
    - 7.1.1.2. Michael Atherton, LLC Manager, Land Owner
      - 7.1.1.2.1. (209) 601-4187 (work)
      - 7.1.1.2.2. AthertonIsland@aol.com
    - 7.1.1.3. Albert Boyce, LLC Manager, Land Owner
      - 7.1.1.3.1. (209) 239-4014 (work)
      - 7.1.1.3.2. (209) 239-7886 (work fax)
      - 7.1.1.3.3. (209) 479-2896 (mobile)
      - 7.1.1.3.4. AlbertBoyce@gmail.com
    - 7.1.1.4. Larry Anderson, LLC Manager, Land Owner
    - 7.1.1.5. William Filios, LLC Manager
- 7.2. Project Management Companies / Prime Consultants
  - 7.2.1. Planning Consultants Hawaii, LLC
    - 7.2.1.1. 2331 W. Main Street, Wailuku, HI, 96793
    - 7.2.1.2. Land Use Planning, Sustainability Plan, Incremental Development Plan, Agricultural Impact Assessment
    - 7.2.1.3. Michael Summers, LLC Manager
      - 7.2.1.3.1. (808) 244-6231 (work)
      - 7.2.1.3.2. (808) 269-6220 (mobile)
      - 7.2.1.3.3. MSummers@PlanningConsultantsHawaii.com
  - 7.2.2. Hawaii Land Design LLC
    - 7.2.2.1. P.O. Box 880479, Pukalani, HI, 96788
    - 7.2.2.2. Landscape Architecture
    - 7.2.2.3. William (“Bill”) Mitchell, LLC Manager
      - 7.2.2.3.1. (808) 385-2859 (work)
      - 7.2.2.3.2. BMitchell@HawaiiLandDesign.com
- 7.3. Subconsultant / Report Author
  - 7.3.1. Enviniti LLC
    - 7.3.1.1. P.O. Box 256659, Honolulu, HI, 96825
    - 7.3.1.2. Wastewater Engineering
    - 7.3.1.3. Jonathan Nagato, PE, LLC Member, Principal
      - 7.3.1.3.1. (808) 368-8649 (mobile)
      - 7.3.1.3.2. Jon@enviniti.com
    - 7.3.1.4. Ross Tanimoto, PE, Chief Engineer
      - 7.3.1.4.1. Ross@enviniti.com
- 7.4. Other Subconsultants
  - 7.4.1. Otomo Engineering, Inc.
    - 7.4.1.1. 305 South High Street, Suite 102, Wailuku, HI, 96793
    - 7.4.1.2. Civil Engineering
    - 7.4.1.3. Stacy Otomo, PE, President
      - 7.4.1.3.1. (808) 242-0032 (office)
      - 7.4.1.3.2. stacy@OtomoEngineering.com
  - 7.4.2. Fehr & Peers
    - 7.4.2.1. 100 Pringle Avenue, Suite 600, Walnut Creek, CA, 94596
    - 7.4.2.2. Traffic Engineering
    - 7.4.2.3. Sohrab Rashid
      - 7.4.2.3.1. (619) 758-3002 (work)
      - 7.4.2.3.2. S.Rashid@FehrAndPeers.com

7.4.3. The Hallstrom Group, Inc.
- 7.4.3.1. 1003 Bishop Street, Suite 1350, Honolulu, HI, 96813
- 7.4.3.2. Market & Fiscal
- 7.4.3.3. Thomas Holiday
  - 7.4.3.3.1. (808) 526-0444 (work)
  - 7.4.3.3.2. tws@HallstromGroup.com

7.4.4. Archaeological Services Hawaii LLC
- 7.4.4.1. 1930 E. Vineyard Street, Wailuku, HI, 96793
- 7.4.4.2. Archaeology
- 7.4.4.3. Lisa Rotunno-Hazuka, LLC Member
  - 7.4.4.3.1. (808) 244-2012 (work)
  - 7.4.4.3.2. lisa@ashMaui.com

7.4.5. Hana Pono, LLC
- 7.4.5.1. P.O. Box 2039, Wailuku, HI, 96793
- 7.4.5.2. Cultural
- 7.4.5.3. Kainoa Horcajo
  - 7.4.5.3.1. (808) 283-9419 (work)
  - 7.4.5.3.2. KHorcajo@gmail.com

7.4.6. Robert Hobdy
- 7.4.6.1. 2560-B Pololei Place, Haiku, HI, 96708
- 7.4.6.2. Flora & Fauna
- 7.4.6.3. Robert Hobdy
  - 7.4.6.3.1. (808) 573-8029 (work)
  - 7.4.6.3.2. HobdyR001@hawaii.rr.com

7.4.7. D.L. Adams & Associates, Ltd.
- 7.4.7.1. 970 N. Kalaheo Avenue, Suite A-311, Kailua, HI, 96734
- 7.4.7.2. Noise Quality
- 7.4.7.3. Dana Dorsch
  - 7.4.7.3.1. (808) 254-3318 (office)
  - 7.4.7.3.2. ddorsch@dlaa.com

7.4.8. B.D. Neal & Associates (dba Atmospheric Research &Technology, LLC)
- 7.4.8.1. P.O. Box 1808, Kailua Kona, HI, 96745
- 7.4.8.2. Air Quality
- 7.4.8.3. Barry Neal, LLC Member
  - 7.4.8.3.1. (808) 329-1627 (office)
  - 7.4.8.3.2. BDNeal@BDneal.com

7.4.9. Newcomer-Lee Land Surveying, Inc.
- 7.4.9.1. 1498 Lower Main Street, Suite D, Wailuku, HI, 96793
- 7.4.9.2. Surveying
- 7.4.9.3. Bruce Lee, LPLS
  - 7.4.9.3.1. (808) 244-8889 (office)

8. Introduction of Project

8.1. The following is the project description from the Project Management Company and Lead Consultant, Planning Consultants Hawaii, LLC, per the document titled "WCT Project Description_112613.docx" and dated November 26, 2013. Updates, changes, and additions to the following project description are based on information from Otomo Engineering, Inc. per the document titled "Preliminary Engineering Report for Waikapu Country Town" and dated October 2015.

The WCT is situated in Central Maui, just south of the small plantation community of Waikapu, at the Maui Tropical Plantation (MTP). The property is identified as TMK Nos. (2) 3-6-5:007; 3-6-002:001 and 003; 3-6-004:003 and 006; and 3-6-006:036. The project area encompasses approximately 14 acres of State Urban District land and 1,562 acres of State Agricultural District land.

The existing MTP retail shops, restaurant, convention hall, tropical gardens and lagoon are on a portion of the State Land Use Urban designated land (TMK No. (2) 3-6-005:007). Approximately 488 acres of State Agricultural District land is proposed to be re-designated to the State Urban and Rural Districts. Approximately 1,074 acres will remain within the State Agricultural District. Much of this land, approximately 800 acres, will be protected in perpetuity through an agricultural easement, or similar mechanism.

WCT will be a "complete community," encompassing a mixture of single- and multi-family residential units, commercial, and civic uses. In accordance with the MIP's Directed Growth Area Guidelines, WCT includes [1,579] residential units together with neighborhood retail, commercial, a school, parks and open space. The town will be bound by agricultural land that will be preserved in perpetuity through a conservation easement. The utilization of conservation subdivision design (CSD) practices will preserve additional rural land for farming, open space, and open land recreation.

WCT will be built in two [five] year phases both mauka and makai of Honoapiilani Highway. Development mauka of the highway will focus inward onto a "village center," incorporating the existing buildings and grounds of the MTP. The Master Plan calls for a diverse mixture of affordable and market priced housing, along with commercial, entertainment, and civic uses within and around the village center.

Development makai of the highway will focus onto a pedestrian-oriented "main street," a nearby elementary school, and parks. The makai development is bound to the east by the planned extension of the Waiale Road, which will intersect with Honoapiilani Highway. A primary objective of the project is to develop a community where walking and biking are the preferred modes of transportation and recreation for short commutes. Therefore, in addition to proposing mixed-use and more compact development patterns, approximately eight miles of hiking, biking and walking trails will be incorporated into the project. Public transit will also be accommodated in strategic locations to facilitate the use of transit to job-rich areas in Wailuku/Kahului and South and West Maui. For the purpose of assessing the project's development impacts, the conceptual master plan and development program is consistent with the MIP's allocation of [1,579] units to the project. The MIP has an allowance for affordable housing and Ohana units. Affordable housing and Ohana units are not counted towards the total number of units allocated in the MIP.

The Applicant understands that local market conditions will ultimately determine the types of units sold and density of development within the project. It is intended that at full build-out the overall character of development, mix of uses and development pattern will be

consistent with the master plan vision, design guidelines, and zoning ordinances. However, should future market demand warrant additional residential units, and/or a higher density of development within the WCT Planned Growth Area, then a future amendment to the MIP may be required together with an analysis of the impact of the additional units upon infrastructure and public facility systems. The project will be implemented in two (2) [five-year] phases through [2026].

Figure 1: Hallstrom Absorption (Phase 1: 2017-2021 and Phase 2: 2022-2026)

[Enviniti was not provided with an updated Conceptual Phasing Plan (2016 – 2026). However, the Hallstrom Absorption diagram shows the two (2) five-year phases.]

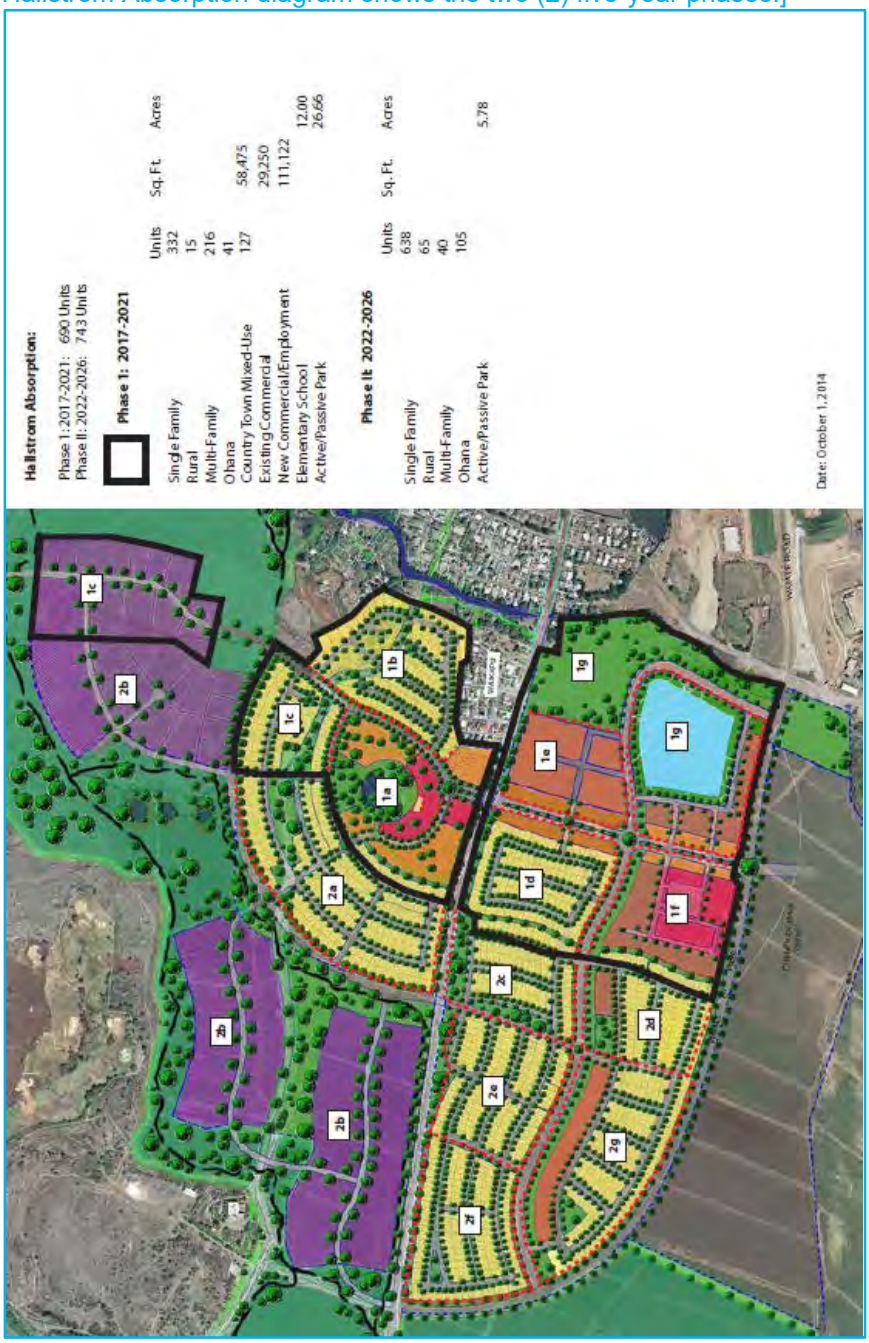
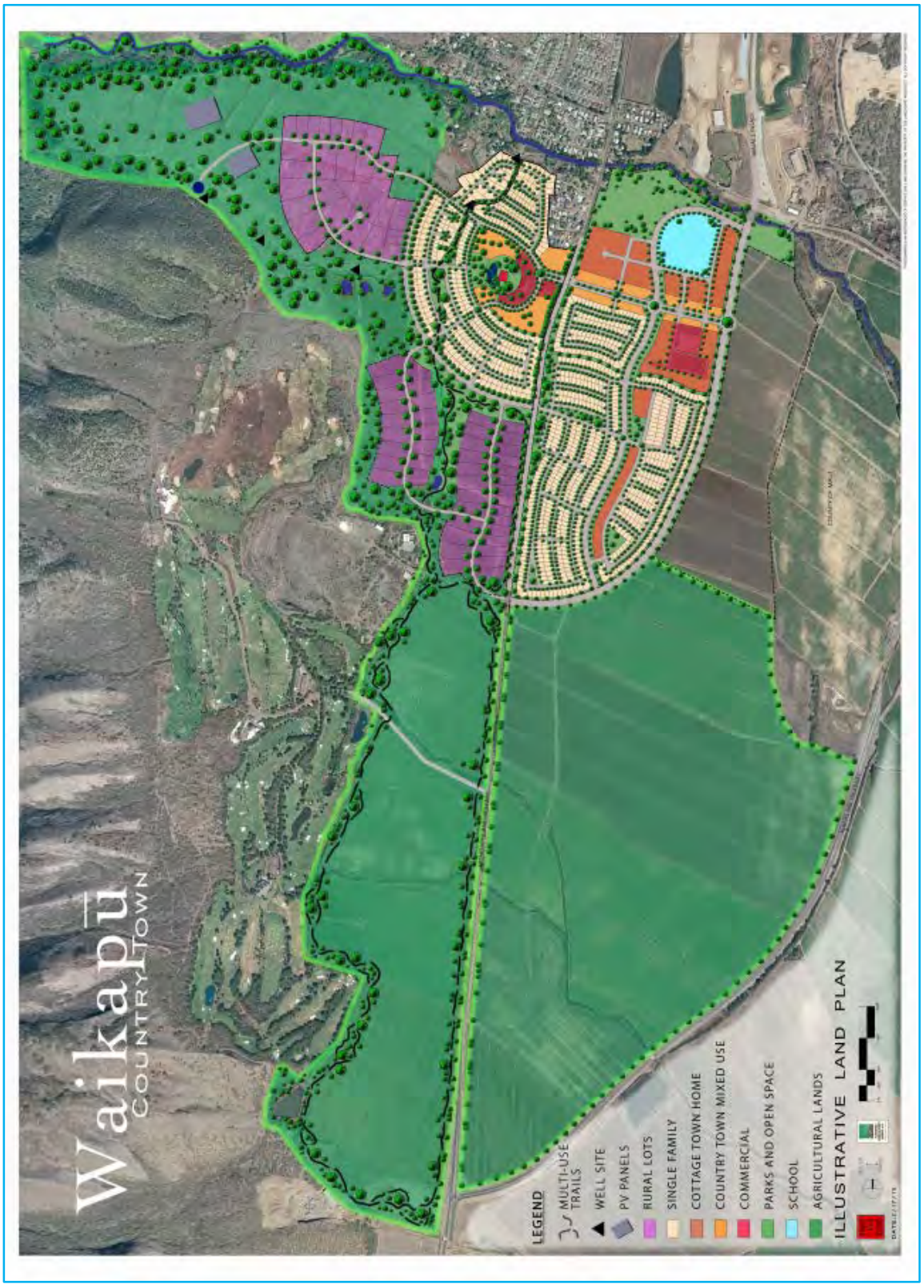


Figure 2: Illustrative Land Plan

Figure 3: Illustrative Land Plan



9. General Private WWTW Description

9.1. Wastewater Sources and Characteristics

9.1.1. Flow

9.1.1.1. The unit of measurement for the volumetric rate of movement of wastewater.

9.1.1.2. Most commonly expressed in gallons per day (“gpd”) or million gpd (“MGD”).

9.1.1.3. Domestic wastewater from the following types of establishments:

9.1.1.3.1. Residential:

9.1.1.3.1.1. Water closets (i.e. toilets)

9.1.1.3.1.2. Showers

9.1.1.3.1.3. Lavatories, sinks, and basins

9.1.1.3.2. Commercial:

9.1.1.3.2.1. Non-FOG Sources:

9.1.1.3.2.1.1 Water closets

9.1.1.3.2.1.2 Urinals

9.1.1.3.2.1.3 Lavatories, sinks, and basins

9.1.1.3.2.1.4 Floor drains

9.1.1.3.2.2. FOG Sources:

9.1.1.3.2.2.5 Dishwashers

9.1.1.3.2.2.6 Kitchen sinks (1-, 2-, and 3-compartment sinks)

9.1.1.3.2.2.7 Floor drains

9.1.1.3.2.2.8 Floor sinks

9.1.1.3.3. Civic:

9.1.1.3.3.1. Water closets

9.1.1.3.3.2. Urinals

9.1.1.3.3.3. Showers

9.1.1.3.3.4. Lavatories, sinks, and basins

9.1.1.3.3.5. Floor drains

9.1.2. BOD: Biochemical Oxygen Demand

9.1.2.1. A measure of the amount of dissolved oxygen required by aerobic biological bacteria and other microorganisms in water or wastewater to stabilize decomposable organic matter present in a given water sample at a specific temperature over a specific time period.

9.1.2.2. Most commonly expressed in milligrams per liter (“mg/L”)

9.1.2.3. BOD is not a measure of some specific pollutant (Vesilind and Morgan, 2004).

9.1.2.4. A very low rate of use would indicate:

9.1.2.4.1. The absence of contamination,

9.1.2.4.2. The available microorganisms are uninterested in consuming the available organics, or

9.1.2.4.3. The microorganisms are dead or dying (Vesilind and Morgan, 2004).

9.1.2.5. BOD_5: Five-day BOD. The standard BOD test is run in the dark at 20°C for five (5) days.

9.1.2.6. “BOD_5” means five (5) days BOD as measured by a standard test indicating the quantity of oxygen utilized by wastewater under controlled conditions of temperature and time (DOH-WWB, 2004).

9.1.2.7. The BOD_5 in the effluent from a treatment works shall not exceed 30 mg/L based on the arithmetic average of the results of the analyses of composite samples (DOH-WWB, 2004).
9.1.2.7.1. For wastewater treatment works with design flows greater than or equal to 100,000 gpd, the owner or operator shall perform composite sampling at least weekly (DOH-WWB, 2004).
9.1.2.8. The BOD_5 in the effluent from a treatment works shall not exceed 60 mg/L based on a grab sample (DOH-WWB, 2004).
9.1.2.8.1. For wastewater treatment works with design flows less than 100,000 gpd, the owner or operator shall perform grab sampling at least monthly (DOH-WWB, 2004).
9.1.2.9. Secondary Treatment Standards:
9.1.2.9.1. 7-Day Average $BOD_5 \leq 45$ mg/L (EPA, 1984)
9.1.2.9.2. 30-Day Average $BOD_5 \leq 30$ mg/L (EPA, 1984)
9.1.2.9.3. 30-Day Average BOD_5 Percent Removal ≥ 85% (EPA, 1984)

9.1.3. TSS: Total Suspended Solids (aka “SS”)
9.1.3.1. A measure of the amount material other than water or gas that is not dissolved into the water, but is able to be suspended in the water and does not settle to the bottom, which would be settleable solids.
9.1.3.2. Most commonly expressed in milligrams per liter (“mg/L”)
9.1.3.3. “SS” means suspended solids and indicates the characteristic state of solids in wastewater (DOH-WWB, 2004).
9.1.3.4. The SS in the effluent from a treatment works shall not exceed 30 mg/L based on the arithmetic average of the results of the analyses of composite samples (DOH-WWB, 2004).
9.1.3.4.1. For wastewater treatment works with design flows greater than or equal to 100,000 gpd, the owner or operator shall perform composite sampling at least weekly (DOH-WWB, 2004).
9.1.3.5. The SS in the effluent from a treatment works shall not exceed 60 mg/L based on a grab sample (DOH-WWB, 2004).
9.1.3.5.1. For wastewater treatment works with design flows less than 100,000 gpd, the owner or operator shall perform grab sampling at least monthly (DOH-WWB, 2004)
9.1.3.6. The pollutant parameter total suspended solids (EPA, 1984).
9.1.3.7. Secondary Treatment Standards:
9.1.3.7.1. 7-Day Average SS ≤ 45 mg/L (EPA, 1984)
9.1.3.7.2. 30-Day Average SS ≤ 30 mg/L (EPA, 1984)
9.1.3.7.3. 30-Day Average SS Percent Removal ≥ 85% (EPA, 1984)

9.1.4. pH
9.1.4.1. A measure of acidity or basicity of an aqueous solution.
9.1.4.2. “pH” means the logarithm of the reciprocal of the hydrogen ion concentration measured at 25°C or measured at another temperature and then converted to a n equivalent value at 25°C (DOH-WWB, 2004).
9.1.4.3. Secondary Treatment Standards:
9.1.4.3.1. 6.0 ≤ pH ≤ 9.0 (EPA, 1984)

9.1.5. Priority Pollutants
9.1.5.1. A set of organic and inorganic pollutants identified and regulated by the EPA based on their known or suspected carcinogenicity, mutagenicity, teratogenicity, or high acute toxicity, and for which analytical test methods have been developed (Tchobanoglous, Burton, and M&E, 1991).
9.1.5.2. The current list of Priority Pollutants can be found in Appendix A – Priority Pollutants.

9.1.6. O&G: Oils & Grease (aka FOG)
9.1.6.1. O&G consists of a group of related constituents that are of special concern in wastewater treatment due to their unique physical properties and highly concentrated energy content (Kiepper, 2013).
9.1.6.2. O&G constituents in wastewater can come from plants and animals (e.g. lard, butter, vegetable oils, and fats) as well as petroleum sources (e.g. kerosene, lubricating oils) (Kiepper, 2013).
9.1.6.3. O&G are generally hydrophobic (i.e. “water-hating”) and thus have low solubility in wastewater, resulting in relatively low biodegradability by microorganisms (Kiepper, 2013).
9.1.6.4. O&G becomes more soluble (i.e. more easily dissolved) in wastewater at high temperatures and will form emulsions (i.e. oil-water mixtures) that will often separate back out of wastewater as temperatures become cooler; thus, O&G are notorious for causing sewer collection system problems (e.g. blockages, pump failures) (Kiepper, 2013).
9.1.6.5. Pre-treatment equipment and systems installed as close to the wastewater source as possible and prior to entering the wastewater collection system is the best management practice to prevent long-term wastewater collection system and WWTW system problems.
9.1.6.6. Pre-treatment equipment and systems are typically utilized after commercial and civic establishment types (i.e. restaurants, public restrooms).
9.1.6.7. Examples of pre-treatment equipment and systems may include:
9.1.6.7.1. Grease interceptors (“GI”)
9.1.6.7.2. Pre-Loaders (“PL”, aka “trash tanks”)
9.1.6.7.3. Solids and FOG collection, handling, and disposal management plans and systems

9.2. Collection System: A system or network of underground pipes and sewer manholes (“SMH”) and underground and/or aboveground pump stations installed to convey wastewater (i.e. liquid and solids) from the wastewater sources to the WWTW.
9.2.1. Gravity Lines: The portion of the collection system, which typically includes underground pipes and fittings installed at specific downstream slopes, which conveys the wastewater by means of gravity.

9.2.1.1. Pipes and Fittings
9.2.1.1.1. Sizes and materials to be determined during the design phase of the project.
9.2.1.1.2. Typical diameters range from 4-inch to 48-inch.
9.2.1.1.3. Typical materials include:
9.2.1.1.3.1. ABS
9.2.1.1.3.2. PVC

9.2.1.2. Sewer Manholes ("SMH"): The access point from the existing grade to the gravity pipe, which is typically installed at the location of a change in direction of the pipe path, at the location of a junction of pipes, and/or after a specific horizontal length of pipe run according to applicable codes, standards, and regulations.
- 9.2.1.2.1. Sizes, types, and quantities to be determined during the design phase of the project.
- 9.2.1.2.2. Typical materials:
  - 9.2.1.2.2.1. Reinforced concrete (for base, walls or riser-sections, and cone-section)
  - 9.2.1.2.2.2. Cast-iron (for covers and frames)
  - 9.2.1.2.2.3. Wrought iron or stainless steel (for rungs)

9.2.1.3. O&M:
- 9.2.1.3.1. Periodic and continuous inspection, unclogging, cleaning, pumping, and repair shall be performed by WWTW Operator Service Provider.
- 9.2.1.3.2. Responsible party (i.e. WWTW Operator Service Provider) shall be identified by others.
- 9.2.1.3.3. WWTW Operator Service Provider shall have properly trained, certified, and managed personnel.

9.2.1.4. Odor
- 9.2.1.4.1. Odor from collection system is typical and inevitable.
- 9.2.1.4.2. Responsible party (i.e. WWTW Operator Service Provider) shall be capable of addressing.

9.2.1.5. Spill Prevention and Response
- 9.2.1.5.1. Responsible party (i.e. WWTW Operator Service Provider) shall be capable of preventing and responding to spills.
- 9.2.1.5.2. Responsible party (i.e. WWTW Operator Service Provider) shall be well aware and updated of current and applicable Federal, State, and local laws, regulations, protocols, and procedures.

9.2.1.6. Contingencies
- 9.2.1.6.1. Responsible party (i.e. WWTW Operator Service Provider) shall prepare and implement proper safety, O&M, odor, and emergency response plans.
- 9.2.1.6.2. Responsible party (i.e. WWTW Operator Service Provider) shall have proper equipment (e.g. tools, vehicles, pump trucks), systems (e.g. 24-7 call-center), and personnel in order to operate and maintain collection system in a timely manner.
- 9.2.1.6.3. Responsible party (i.e. WWTW Operator Service Provider) shall have in-stock necessary surplus materials (e.g. pipes, covers, fittings, SMHs, etc.) in order to repair collection system in a timely manner.

9.2.2. Pump Station (aka “force main” or “lift station”): A facility, which typically includes a secured building, storage well, and system of pipes, valves, pumps, and other equipment, to convey raw wastewater from a low-point of an upstream gravity line to a higher-point of a downstream gravity line.

9.2.2.1. O&M
- 9.2.2.1.1. Periodic and continuous inspection, unclogging, cleaning, pumping, and repair shall be performed by WWTW Operator Service Provider.
- 9.2.2.1.2. Responsible party (i.e. WWTW Operator Service Provider) shall be identified by others.
- 9.2.2.1.3. WWTW Operator Service Provider shall have properly trained, certified, and managed personnel.

9.2.2.2. Odor
- 9.2.2.2.1. Odor from pump station is typical and inevitable.
- 9.2.2.2.2. Responsible party (i.e. WWTW Operator Service Provider) shall be capable of addressing.

9.2.2.3. Spill Prevention and Response
- 9.2.2.3.1. Responsible party (i.e. WWTW Operator Service Provider) shall be capable of preventing and responding to spills.
- 9.2.2.3.2. Responsible party (i.e. WWTW Operator Service Provider) shall be well aware and updated of current and applicable Federal, State, and local laws, regulations, protocols, and procedures.

9.2.2.4. Contingencies
- 9.2.2.4.1. Responsible party (i.e. WWTW Operator Service Provider) shall prepare and implement proper safety, O&M, odor, and emergency response plans.
- 9.2.2.4.2. Responsible party (i.e. WWTW Operator Service Provider) shall have proper equipment (e.g. tools, vehicles, pump trucks), systems (e.g. 24-7 call-center), and personnel in order to operate and maintain pump station in a timely manner.
- 9.2.2.4.3. Responsible party (i.e. WWTW Operator Service Provider) shall have in-stock necessary surplus materials (e.g. pipes, covers, fittings, SMHs, etc.) in order to repair pump station in a timely manner.

9.2.2.5. Instrumentation
- 9.2.2.5.1. Sizes, types, and quantities to be determined during the design phase of the project.

9.2.2.6. Valving
- 9.2.2.6.1. Sizes, types, and quantities to be determined during the design phase of the project.

9.2.2.7. Backup Power
- 9.2.2.7.1. Sizes, types, and quantities to be determined during the design phase of the project.
- 9.2.2.7.2. 100% backup power will be required for all pump stations.

9.3. Treatment (liquids and solids): A facility, which typically includes a secured and fenced lot or property, buildings, aboveground and underground tanks, and systems of pipes, valves, pumps, and other equipment, to physically and biologically treat the raw wastewater to acceptable effluent according to the project goals and/or current and applicable Federal, State, and/or local laws, regulations, and standards.

9.3.1. If a private WWTW is utilized, then:
- 9.3.1.1. A WWTW design must be completed by a Civil Engineer
- 9.3.1.2. The WWTW design must be in compliance with the DOH-WWB HAR 11-62
- 9.3.1.3. A WWTW Application must be completed by the Owners or their Engineer
- 9.3.1.4. The WWTW Application and related document and procedural requirements must be in compliance with the DOH-WWB HAR 11-62

9.3.2. Sizes, types, and materials to be determined during the design phase of the project.

9.3.3. The following are a general overview of typical, but not all, types of treatment systems.

9.3.4. Liquids Treatment

9.3.4.1. Preliminary Treatment
- 9.3.4.1.1. Bar screens and/or grit channels remove materials that are able to be easily collected from the influent raw wastewater entering the WWTW in order to prevent damaging or clogging the pumps and lines of the primary clarifier(s).
- 9.3.4.1.2. Typical material removed may include trash, leaves, branches, cans, rages, plastic, etc.

9.3.4.2. Flow Equalization
- 9.3.4.2.1. Equalization basins temporarily store the influent raw wastewater after preliminary treatment in order to efficiently and uniformly discharge the influent raw wastewater into the primary clarifiers.
- 9.3.4.2.2. Equalization basins temporarily store the influent raw wastewater after preliminary treatment in order to allow for maintenance of downstream equipment.
- 9.3.4.2.3. Equalization basins serve as a dilution, distribution, and/or discharge point for high-strength wastewater (e.g. from portable toilet or septic tank pump trucks), which may disrupt the biological processes downstream.

9.3.4.3. Primary Sedimentation Treatment (aka “Primary Sedimentation” or “Primary Treatment”)
- 9.3.4.3.1. Primary clarifiers or settling tanks allow the influent raw wastewater after flow equalization to physically settle as sludge to the bottom or float as scum to the top.
- 9.3.4.3.2. The objective of primary treatment is to remove solids.

9.3.4.4. Secondary Biological Treatment (Step 1 of 2)
- 9.3.4.4.1. The process in which the primary treated wastewater is allowed to biologically degrade.
- 9.3.4.4.2. The primary treatment has removed much of the suspended organic matter, but the primary treated wastewater still contains a high demand form oxygen due to the dissolved biodegradable organics (i.e. BOD).
- 9.3.4.4.3. The objective of secondary treatment is to remove BOD by allowing the microorganisms to be brought into contact with oxygen and the dissolved biodegradable organics (i.e. “food”) in order to digest the wastewater.
- 9.3.4.4.4. Typical methods of secondary treatment achieved using aerobic biological processes may include, but are not limited to:
  - 9.3.4.4.4.1. Suspended-growth (e.g. activated sludge)
  - 9.3.4.4.4.2. Fixed-film or attached growth (e.g. trickling filters, rotating biological contactors, or bio-towers)

9.3.4.5. Secondary Sedimentation Treatment (Step 2 of 2)
- 9.3.4.5.1. After the microorganisms have aerobically digested the wastewater, the microorganisms are separated from the liquid in a second clarifier or settling tank.

9.3.4.6. Disinfection
- 9.3.4.6.1. If required per the project goals and/or current and applicable Federal, State, and local laws, regulations, and standards, then disinfection may be performed.
- 9.3.4.6.2. Disinfection destroys and/or sterilizes pathogenic organisms in order to reduce or eliminate the possibility of disease transmission.
- 9.3.4.6.3. Typical methods of disinfection may include, but are not limited to:
  - 9.3.4.6.3.1. Chlorine
  - 9.3.4.6.3.2. Ultraviolet (“UV”) light
  - 9.3.4.6.3.3. Ozone
  - 9.3.4.6.3.4. Sodium hydrochloride

9.3.5. Solids Treatment

9.3.5.1. Stabilization
- 9.3.5.1.1. The objective of solids (or sludge) stabilization is to reduce the following problems:
  - 9.3.5.1.1.1. Solids (or sludge) odor and putrescence (i.e. aesthetically displeasing).
  - 9.3.5.1.1.2. Presences of pathogenic organisms (i.e. potentially harmful to humans and environment).
- 9.3.5.1.2. Typical methods of solids (or sludge) stabilization may include, but are not limited to:
  - 9.3.5.1.2.1. Lime stabilization
  - 9.3.5.1.2.2. Aerobic digestion

9.3.5.1.2.3. Anaerobic digestion, which may include the following methods, but is not limited to:
9.3.5.1.2.3.9 Primary and secondary anaerobic digesters (e.g. two-stage anaerobic digestion)
9.3.5.1.2.3.10 Egg-shaped anaerobic digester(s)

9.3.5.2. Dewatering
9.3.5.2.1. The objective of solids (or sludge) dewatering is to reduce the quantity of water contained in the solids (or sludge).
9.3.5.2.2. Typical methods of solids (or sludge) dewatering may include, but are not limited to:
9.3.5.2.2.1. Sand drying bed
9.3.5.2.2.2. Belt filter
9.3.5.2.2.3. Solid bowl decanter centrifuge

9.3.6. Backup power
9.3.6.1. Sizes, types, and quantities to be determined during the design phase of the project.
9.3.6.2. 100% backup power will be required for all WWTW equipment and systems.

9.3.7. Reuse (or Recycled) Water
9.3.7.1. In Hawaii, reuse (or recycled) water is governed by the document titled "Guidelines for the Treatment and Use of Recycled Water" (DOH-WWB, 2002).
9.3.7.2. The classifications of recycled water (from least to most treated) is as follows:
9.3.7.2.1. R-3
9.3.7.2.2. R-2
9.3.7.2.3. R-1
9.3.7.3. A summary of suitable uses for recycled water is enclosed in Appendix B – Summary of Suitable Uses for Recycled Water.

9.4. Disposal (liquids and solids): Treated wastewater liquids and solids may be disposed on-site or off-site.
9.4.1. Sizes, types, and materials to be determined during the design phase of the project.
9.4.2. The following are a general overview of typical, but not all, types of disposal systems.

9.4.3. Liquids (i.e. Treated Effluent)

9.4.3.1. Injection Well (aka “Seepage Pit”)

9.4.3.1.1. “Injection well” has the same meaning as defined in chapter 11-23 (DOH-WWB, 2004).

9.4.3.1.2. “Injection well” means a will into which subsurface disposal of fluid or fluids occurs or is intended to occur by means of injection (DOH-SDWB, 2000).

9.4.3.1.3. “Seepage pit” means an excavation in the ground whose depth is greater than its widest surface dimension and which receives the discharge from treatment units and permits the effluent to seep through its bottom or sides to gain access to the underground formation (DOH-WWB, 2004).

9.4.3.1.4. Typical materials:

9.4.3.1.4.1. Pre-cast reinforced concrete (for base, walls or riser-sections, and cone-section)

9.4.3.1.4.1.11 Injection sections are perforated to allow injection, seepage, or discharge into the underground soil and lined with geotextile fabric material to reduce clogging of the perforation by soil.

9.4.3.1.4.1.12 Non-injection sections are not perforated.

9.4.3.1.4.2. Cast-iron (for covers and frames)

9.4.3.1.4.3. Wrought iron or stainless steel (for rungs)

9.4.3.1.5. The utilization and allowed use of injection wells or seepage pits are determined by the DOH-SDWB in accordance with HAR 11-23.

9.4.3.1.6. Typically, any injection well, defined by class V subclass A in HAR 11-23 section 11-23-06, above the Underground Injection Control (“UIC”) boundary line is prohibited.

9.4.3.1.7. Typically, any injection well, defined by class V subclass A in HAR 11-23 section 11-23-06, below the UIC boundary line is allowed per the requirements of HAR 11-23.

9.4.3.1.8. If injection well(s) are allowed to be utilized, then a the design and construction of the injection well(s) must be in compliance with DOH-SDWB HAR 11-23 and a UIC Permit Application must be:

9.4.3.1.8.1. In compliance with DOH-SDWB HAR 11-23

9.4.3.1.8.2. Completed by the Owners or their Engineer

9.4.3.1.8.3. Submitted to the DOH-SDWB

9.4.3.1.8.4. Approved by the DOH-SDWB prior to construction and installation

9.4.3.1.8.5. Maintained via annual monitoring and reporting

9.4.3.2. Absorption Beds
9.4.3.2.1. Absorption beds are another method of treated effluent disposal. However, due to their horizontal configuration, the wastewater capacity of this project, and the available land area, absorption beds would most likely take-up too much land area to be efficient and/or effective.

9.4.3.3. Percolation
9.4.3.3.1. Percolation Rate:
9.4.3.3.1.1. The unit of measurement for the time duration per vertical length of the movement of liquid through porous material.
9.4.3.3.1.2. Most commonly expressed in minutes per inch ("mpi").
9.4.3.3.1.3. In Hawaii, the percolation rate is cross-referenced to Table 3 in the DOH-WWB HAR 11-62 Appendix F to obtain the corresponding required absorption area per 200 gpd.
9.4.3.3.2. Percolation Test:
9.4.3.3.2.1. A procedural test to determine the percolation rate.

9.4.3.4. Reuse (or Recycled) Water
9.4.3.4.1. See Section 9.3.7.

9.4.4. Solids

9.4.4.1. Biosolids Reuse
9.4.4.1.1. See Section 9.3.7.

9.4.4.2. Off-Site Transport and Disposal of Treated and Dewatered Sludge
9.4.4.2.1. If the local County accepts treated and dewatered sludge, then the treated and dewatered sludge, testing of the sludge, and transport equipment, methods, and procedures must meet the current and applicable Federal, State, and/or local laws, regulations, and standards.
9.4.4.2.2. Feasibility, applicability, and all other components of off-site transport and disposal of treated and dewatered sludge to be determined during the design phase of the project.

9.5. Associated issues
9.5.1. Odor:
9.5.1.1. Odors in domestic wastewater usually are caused by gases produced by the decomposition of organic matter or by substances added to the wastewater (Tchobanoglous, Burton, and M&E, 1991).
9.5.1.2. The importance of odors at low concentrations in human terms is related primarily to the psychological stress they produce rather than to the harm they do to the body. In extreme situations, offensive odors can lead to the deterioration of person and community pride, interfere with human relations, discourage capital investment, lower socio-

economic status, and deter growth (Tchobanoglous, Burton, and M&E, 1991).

9.5.1.3. Odors can be measured by sensory methods (i.e. often a panel of human subjects are exposed to odors) or instrumental methods (i.e. specific odorant concentrations are measured) (Tchobanoglous, Burton, and M&E, 1991).

9.5.1.4. Proximity of residential areas and direction of prevailing winds shall be considered by during the design phase of the project.

9.5.2. Supervisory Control and Data Acquisition ("SCADA"): At type of computer-based industrial control system with coded signals to provide 24-hour monitoring, remote control, and process control for wastewater pump stations, WWTW facilities, and reuse systems.

9.5.3. Reporting: Monitoring, testing and reporting shall be based on all current and applicable Federal, State, and local laws, regulations, and standards.

9.5.4. Training: All WWTW Operator Service Provider staff shall be properly trained and certified. Continuous and updated training shall be provided to all staff of the WWTW. Training certification shall include, but is not limited to the following:

9.5.4.1. Hazardous Waste Operations and Emergency Response

9.5.4.2. OSHA Hazard Recognition Training for the Construction Industry

9.5.4.3. First Aid, CPR, Adult AED

9.5.5. Safety: All WWTW Operator Service Provider staff shall understand that safety and health of the public and themselves is priority. Safety plans and practices may include, but are not limited to the following:

9.5.5.1. OSHA 29 Code of Federal Regulation 1910

9.5.5.2. OSHA 29 Code of Federal Regulation 1926

10. Project Specific Private WWTW Description

10.1. Information and Description Provided By Client

10.1.1. WCT intends to be a "complete community", encompassing a mixture of single- and multi-family residential units, commercial, and civic uses.

10.1.2. WCT intends to be built in two (2) phases of five (5) years each both mauka and makai of Honoapiilani Highway.

10.1.3. WCT intends to be a low-volume commercial community, which encourages more pedestrian and bicycle traffic.

Updates, changes, and additions into the following tables are shown in pink cells.

Table 3: Phase 1 – Development Unit Type vs. Incremental Phasing Program

Type		Subtype	Phase 1									
			1 A	1 B	1 C	1 D	1 E	1 F	1 G	1 H	Subtotal	Unit
1	Residential	Single Family	15.00	113.00	60.00	125.00	0.00	19.00	0.00	0.00	332.00	units
		Rural	0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	15.00	
		Multi-Family	0.00	0.00	0.00	0.00	90.00	54.00	72.00	0.00	216.00	
		Ohana	2.00	11.00	21.00	6.00	0.00	1.00	0.00	0.00	41.00	
		Country Town Mixed-Use (MF Residential)	86.00	0.00	0.00	11.00	14.00	8.00	7.00	0.00	126.00	
2	Commercial	Country Town Mixed-Use (Commerical)	29,621.00	0.00	0.00	7,806.00	10,106.00	4,251.00	6,691.00	0.00	58,475.00	SF
		Existing Commercial	29,250.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29,250.00	
		New Commercial/Emp.	24,438.00	0.00	0.00	0.00	0.00	86,684.00	0.00	0.00	111,122.00	
3	Civic	Elementary School	0.00	0.00	0.00	0.00	0.00	0.00	15.76	0.00	15.76	ac
		"Active" Park	2.28	0.00	0.00	0.00	0.00	2.70	0.43	18.16	23.57	

Table 4: Phase 2 – Development Unit Type vs. Incremental Phasing Program

Type		Subtype	Phase 2								
			2 A	2 B	2 C	2 D	2 E	2 F	2 G	Subtotal	Unit
1	Residential	Single Family	156.00	0.00	64.00	60.00	117.00	125.00	116.00	638.00	units
		Rural	0.00	65.00	0.00	0.00	0.00	0.00	0.00	65.00	
		Multi-Family	0.00	0.00	0.00	13.00	0.00	0.00	27.00	40.00	
		Ohana	16.00	65.00	3.00	3.00	6.00	6.00	6.00	105.00	
		Country Town Mixed-Use (MF Residential)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	Commercial	Country Town Mixed-Use (Commerical)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	SF
		Existing Commercial	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
		New Commercial/Emp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3	Civic	Elementary School	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ac
		"Active" Park	0.00	0.00	0.00	2.22	0.00	0.00	5.56	7.78	

Table 5: Project (Phases 1 & 2) – Development Unit Type vs. Conceptual Land Use Plan

Type		Subtype	Project		
			Subtotal	Total	Unit
1	Residential	Single Family	970.00	1,578.0	units
		Rural	80.00		
		Multi-Family	256.00		
		Ohana	146.00		
		Country Town Mixed-Use (MF Residential)	126.00		
2	Commercial	Country Town Mixed-Use (Commerical)	58,475.00	198,847.0	SF
		Existing Commercial	29,250.00		
		New Commercial/Emp.	111,122.00		
3	Civic	Elementary School	15.76	47.1	ac
		"Active" Park	31.35		

11. Assumptions for Wastewater Flow Estimation

11.1. Beyond the development unit types and quantities provided in Table 3, Table 4, and Table 5 limited information was provided regarding the description, types and subtypes, mix, quantities, sizes, etc. of the various residential, commercial, and civic establishments.

11.2. Therefore, the following rationales were used for the wastewater flow estimation of the various residential, commercial, and civic establishments.

11.3. Residential (i.e. Single Family, Rural, Multi-Family, and Ohana)

11.3.1. *This value is for information only.* Min. Flow per Apartment or Condo = 255 gpd/unit (County of Maui, WRD, WFS, 02-Feb-2000)

11.3.2. *This value is for information only.* Max. Occupancy per Apartment or Condo = 2.5 persons/unit

11.3.3. *This value is for information only.* Max. Occupancy per Residence = 4 persons/unit (County of Maui, WRD, WFS, 02-Feb-2000)

11.3.4. *This value is for information only.* Min. Dwelling Flow per Person = 100 gpd/person (DOH-WWB, HAR 11-62, Appendix F, Table 1, 15-Apr-1997)

11.3.5. *This value is for information only.* Min. Dwelling Occupancy per Bedroom = 2 persons/bedroom (DOH-WWB, HAR 11-62, Appendix F, Table 1, 15-Apr-1997)

11.3.6. Min. Flow per Residence = 350 gpd/unit (County of Maui, WRD, WFS, 02-Feb-2000)

11.3.7. Residential Scenario A: Min. Flow per Residence = 350 gpd/unit

11.4. Commercial (i.e. Country Town Mixed-Use, Existing Commercial, and New Commercial/Emp.)

11.4.1. For all Commercial type lots, only horizontal areas in square feet were provided. It was assumed that these horizontal areas were total area, NOT building area. Therefore, the following assumptions were used in order to calculate estimated flow scenarios, but need to be verified by the Owner, their Architect, or other Consultants or project specific data needs to be provided by the Owner and/or other Consultants:

11.4.1.1. Max. Percentage of Commercial Building Coverage = 25%

$$A_{BA} = A_{TCA} \times (Max.\ \%\ Commercial\ Building\ \ Coverage) = A_{TCA} \times 25\% = 0.25A_{TCA}$$

11.4.2. Building Area ("BA"): Total horizontal area of all commercial buildings.

11.4.3. Total Commercial Area ("TCA"): Total horizontal area of all commercial-type lots, which includes:

11.4.3.1. Country Town Mixed-Use

11.4.3.2. Existing Commercial

11.4.3.3. New Commercial/Emp.

11.4.4. For Commercial Employee Flow per TCA:

11.4.4.1. Min. Retail Flow per Employee = 15 gpd/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.4.2. Min. Office Flow per Employee = 20 gpd/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.4.3. Min. Industrial Flow per Employee = 25 gpd/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.4.4. Min. Factory Flow per Employee = 30 gpd/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.4.5. Max. Occupancy per Office = 200 SF/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.4.6. Max. Occupancy per Retail Warehouse = 350 SF/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.4.7. Max. Occupancy per Storage or Industrial = 500 SF/person (County of Maui, WRD, WFS, 02-Feb-2000)

$$\frac{Q_{Min.\ Retail\ Warehouse}}{A_{BA}} = \frac{1\ person}{350\ ft^2} \times \frac{15\ gpd}{person} = 0.043\frac{gpd}{ft^2} = \frac{Q_{Min.\ Retail\ Warehouse}}{0.25A_{TCA}}$$
$$\frac{Q_{Min.\ Retail\ Warehouse}}{A_{TCA}} = 0.043\frac{gpd}{ft^2} \times 0.25 = 0.011\frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Industrial}}{A_{BA}} = \frac{1\ person}{500\ ft^2} \times \frac{25\ gpd}{person} = 0.050\frac{gpd}{ft^2} = \frac{Q_{Min.\ Industrial}}{0.25A_{TCA}}$$
$$\frac{Q_{Min.\ Industrial}}{A_{TCA}} = 0.050\frac{gpd}{ft^2} \times 0.25 = 0.013\frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Factory}}{A_{BA}} = \frac{1\ person}{500\ ft^2} \times \frac{30\ gpd}{person} = 0.060\frac{gpd}{ft^2} = \frac{Q_{Min.\ Factory}}{0.25A_{TCA}}$$
$$\frac{Q_{Min.\ Storage}}{A_{TCA}} = 0.060\frac{gpd}{ft^2} \times 0.25 = 0.015\frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Office}}{A_{BA}} = \frac{1\ person}{200\ ft^2} \times \frac{20\ gpd}{person} = 0.100\frac{gpd}{ft^2} = \frac{Q_{Min.\ Office}}{0.25A_{TCA}}$$
$$\frac{Q_{Min.\ Office}}{A_{TCA}} = 0.100\frac{gpd}{ft^2} \times 0.25 = 0.025\frac{gpd}{ft^2}$$

11.4.4.8. Commercial Employee Scenario B: Min. Retail Employee Flow per TCA = 0.011 gpd/SF
11.4.4.9. Commercial Employee Scenario C: Min. Industrial Employee Flow per TCA = 0.013 gpd/SF
11.4.4.10. Commercial Employee Scenario D: Min. Factory Employee Flow per TCA = 0.015 gpd/SF
11.4.4.11. Commercial Employee Scenario E: Min. Office Employee Flow per TCA = 0.025 gpd/SF

11.4.5. For Commercial Non-Restaurant Customer Flow per TCA:

11.4.5.1. Min. Retail Flow per Customer = 5 gpd/person (County of Maui, WRD, WFS, 02-Feb-2000)

11.4.5.2. The following traffic data was assumed in order to calculate estimated flow scenarios, but need to be verified by the Owner or Traffic Engineer or project specific data needs to be provided by the Owner and/or other Consultants:

11.4.5.2.1. Low Traffic = 5% vehicles/SF

11.4.5.2.2. High Traffic = 15% vehicles/SF

11.4.5.2.3. Low Vehicle Occupancy = 2 persons/vehicle

11.4.5.2.4. High Vehicle Occupancy = 4 persons/vehicle

$$\frac{Q_{Min.\ Retail\ Customer\ (L\times L)}}{A_{BA}} = \frac{5\ gpd}{person} \times \frac{5\%\ vehicles}{ft^2} \times \frac{2\ persons}{vehicle} = 0.50\frac{gpd}{ft^2} = \frac{Q_{Retail\ Customer\ (L\times L)}}{0.25A_{TCA}}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (L\times L)}}{A_{TCA}} = 0.50\frac{gpd}{ft^2} \times 0.25 = 0.13\frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (L\times H)}}{A_{BA}} = \frac{5\ gpd}{person} \times \frac{5\%\ vehicles}{ft^2} \times \frac{4\ persons}{vehicle} = 1.00\frac{gpd}{ft^2} = \frac{Q_{Retail\ Customer\ (L\times H)}}{0.25A_{TCA}}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (L\times H)}}{A_{TCA}} = 1.00\frac{gpd}{ft^2} \times 0.25 = 0.25\frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (H\times L)}}{A_{BA}} = \frac{5\ gpd}{person} \times \frac{15\%\ vehicles}{ft^2} \times \frac{2\ persons}{vehicle} = 1.50\frac{gpd}{ft^2} = \frac{Q_{Retail\ Customer\ (H\times L)}}{0.25A_{TCA}}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (H\times L)}}{A_{TCA}} = 1.50\frac{gpd}{ft^2} \times 0.25 = 0.38\frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (H\times H)}}{A_{BA}} = \frac{5\ gpd}{person} \times \frac{15\%\ vehicles}{ft^2} \times \frac{4\ persons}{vehicle} = 3.00\frac{gpd}{ft^2} = \frac{Q_{Retail\ Customer\ (H\times H)}}{0.25A_{TCA}}$$

$$\frac{Q_{Min.\ Retail\ Customer\ (H\times H)}}{A_{TCA}} = 3.00\frac{gpd}{ft^2} \times 0.25 = 0.75\frac{gpd}{ft^2}$$

11.4.5.3. Commercial Non-Restaurant Customer Scenario B: Min. Retail Customer Flow (Low x Low) per TCA = 0.13 gpd/SF

11.4.5.4. Commercial Non-Restaurant Customer Scenario C: Min. Retail Customer Flow (Low x High) per TCA = 0.25 gpd/SF

11.4.5.5. Commercial Non-Restaurant Customer Scenario D: Min. Retail Customer Flow (High x Low) per TCA = 0.38 gpd/SF

11.4.5.6. Commercial Non-Restaurant Customer Scenario E: Min. Retail Customer Flow (High x High) per TCA = 0.75 gpd/SF

11.4.6. For Commercial Restaurant Customer Flow per TCA:

11.4.6.1. For Restaurants, NO information was provided. Therefore, the following assumptions were used in order to calculate estimated flow scenarios, but need to be verified by the Owner, their Architect, or other Consultants or project specific data needs to be provided by the Owner and/or other Consultants:

11.4.6.1.1. Restaurant Area ("RA"): Total horizontal area of all commercial restaurants

11.4.6.1.2. Min. RA per Seat = 15 SF/seat

11.4.6.1.3. Percentage of RA of BA = 15%

$$A_{RA} = A_{BA} \times (\%\ RA\ of\ BA) = A_{BA} \times 15\% = 0.25A_{TCA} \times 0.15 = 0.0375A_{TCA}$$

11.4.6.2. Min. Flow per Take-Out Meal = 3 gpd/meal (DOH-WWB, HAR 11-62, Appendix F, Table 1, 15-Apr-1997). The following assumptions were made, but need to be verified by the Owner, other Consultants, or the site specific restaurant:

11.4.6.2.1. BA of Take-Out Restaurant = 3,000 SF

11.4.6.2.2. Time Duration per Take-Out Meal = 60 sec/meal

11.4.6.2.3. Quantity of Take-Out Meals per Minute = 1 meals/min

11.4.6.2.4. Quantity of Take-Out Meals per Hour = 60 meals/hr

11.4.6.2.5. Time Duration of Take-Out Operations = 12 hours

11.4.6.3. Min. Flow per Bar Seat = 15 gpd/seat (DOH-WWB, HAR 11-62, Appendix F, Table 1, 15-Apr-1997)

11.4.6.4. Min. Flow per Average Seat = 80 gpd/seat (DOH-WWB, HAR 11-62, Appendix F, Table 1, 15-Apr-1997 and County of Maui, WRD, WFS, 02-Feb-2000)

11.4.6.5. Min. Flow per Fast Food Seat = 100 gpd/seat (DOH-WWB, HAR 11-62, Appendix F, Table 1, 15-Apr-1997 and County of Maui, WRD, WFS, 02-Feb-2000)

$$\frac{Q_{Min.\ Restaurant\ Customer(Avg)}}{A_{RA}} = \frac{80\ gpd}{seat} \times \frac{seat}{15\ ft^2} = \frac{16\ gpd}{3\ ft^2} = \frac{Q_{Min.\ Restaurant\ Customer(Avg)}}{0.0375 A_{TCA}}$$
$$\frac{Q_{Min.\ Restaurant\ Customer\ Flow\ (Avg)}}{A_{TCA}} = \frac{16\ gpd}{3\ ft^2} \times 0.0375 = 0.2 \frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Restaurant\ Customer(Avg+Bar)}}{A_{RA}} = \frac{(15+80) gpd}{seat} \times \frac{seat}{15\ ft^2} = \frac{19\ gpd}{3\ ft^2} = \frac{Q_{Min.\ Restaurant\ Customer(Avg+Bar)}}{0.0375 A_{TCA}}$$
$$\frac{Q_{Min.\ Restaurant\ Customer(Avg+Bar)}}{A_{TCA}} = \frac{19\ gpd}{3\ ft^2} \times 0.0375 = 0.238 \frac{gpd}{ft^2}$$

$$\frac{Q_{Min.\ Restaurant\ Customer(FF)}}{A_{RA}} = \frac{100\ gpd}{seat} \times \frac{seat}{15\ ft^2} = \frac{20\ gpd}{3\ ft^2} = \frac{Q_{Min.\ Restaurant\ Customer(FF)}}{0.0375 A_{TCA}}$$
$$\frac{Q_{Min.\ Restaurant\ Customer(FF)}}{A_{TCA}} = \frac{20\ gpd}{3\ ft^2} \times 0.0375 = 0.250 \frac{gpd}{ft^2}$$

$$\frac{Meals_{TO}}{A_{RA}} = \frac{60\ meals}{hour} \times \frac{12\ hours}{3{,}000 ft^2} = 0.24 \frac{meals}{ft^2}$$
$$\frac{Q_{Min.\ Restaurant\ Customer(FF+TO)}}{A_{RA}} = \left(\frac{100\ gpd}{seat} \times \frac{seat}{15\ ft^2}\right) + \left(\frac{3\ gpd}{meal} \times \frac{0.24\ meals}{ft^2}\right) = \frac{554\ gpd}{75\ ft^2}$$
$$\frac{Q_{Min.\ Restaurant\ Customer(FF+TO)}}{A_{RA}} = \frac{Q_{Min.\ Restaurant\ Customer(FF+TO)}}{0.0375 A_{TCA}}$$
$$\frac{Q_{Min.\ Restaurant\ Customer(FF+TO)}}{A_{TCA}} = \frac{554\ gpd}{75\ ft^2} \times 0.0375 = 0.227 \frac{gpd}{ft^2}$$

11.4.6.6. Commercial Restaurant Customer Scenario B: Min. Restaurant Customer Flow (average seating with NO bar) per TCA = 0.200 gpd/SF

11.4.6.7. Commercial Restaurant Customer Scenario C: Min. Restaurant Customer Flow (average seating with bar) per TCA = 0.238 gpd/SF

11.4.6.8. Commercial Restaurant Customer Scenario D: Min. Restaurant Customer Flow (fast food seating with NO take-out meals) per TCA = 0.250 gpd/SF

11.4.6.9. Commercial Restaurant Customer Scenario E: Min. Restaurant Customer Flow (fast food seating with take-out meals) per TCA = 0.227 gpd/SF

11.5. Civic (i.e. Elementary School and "Active" Park)

11.5.1. For all Elementary School type lots, only horizontal area in acres was provided. It was assumed that the horizontal area for Elementary School was total area, NOT building area. No further information for Elementary School type lots was provided; therefore, the above assumption and following data were used in order to calculate estimated flow scenarios, but these assumptions and data need to be verified by the Owner and/or other Consultants or project specific data needs to be provided by the Owner and/or other Consultants:

11.5.1.1. Lihikai Elementary School:

11.5.1.1.1. Land Area = 16.9618 acres

11.5.1.1.2. Quantity of Students = 1,011 students

11.5.1.1.3. Quantity of Employees = 72 employees

11.5.1.1.3.1. Quantity of Teachers = 46 persons

11.5.1.1.3.2. Quantity of Staff = 26 persons

11.5.1.2. Pomaikai Elementary School:

11.5.1.2.1. Land Area = 13.494 acres

11.5.1.2.2. Quantity of Students = 593 students

11.5.1.2.3. Quantity of Employees = 78 employees

11.5.1.2.3.1. Quantity of Teachers = 31 persons

11.5.1.2.3.2. Quantity of Staff = 47 persons

11.5.1.3. Wailuku Elementary School:

11.5.1.3.1. Land Area = 4.15103 acres

11.5.1.3.2. Quantity of Students = 881 students

11.5.1.3.3. Quantity of Employees = 58 employees

11.5.1.3.3.1. Quantity of Teachers = 41 persons

11.5.1.3.3.2. Quantity of Staff = 17 persons

11.5.1.4. Kihei Elementary School:

11.5.1.4.1. Land Area = 24.778 acres

11.5.1.4.2. Quantity of Students = 876 students

11.5.1.4.3. Quantity of Employees = 79 employees

11.5.1.4.3.1. Quantity of Teachers = 61 persons

11.5.1.4.3.2. Quantity of Staff = 18 persons

11.5.1.5. For Elementary School Flow per TCA:

11.5.1.5.1. Min. Flow per Elementary Student = 15 gpd/student (County of Maui, WRD, WFS, 02-Feb-2000)

11.5.1.5.2. *This value is for information only.* Min. Flow per High-School Student = 25 gpd/student (County of Maui, WRD, WFS, 02-Feb-2000)

$$\frac{Q_{Min.\ Student}}{A_{TESA}} = \frac{15\ gpd}{student} \times \frac{876\ students}{24.778\ acres} = 530\frac{gpd}{acre}$$

$$\frac{Q_{Min.\ Student}}{A_{TESA}} = \frac{15\ gpd}{student} \times \frac{593\ students}{13.494\ acres} = 659\frac{gpd}{acre}$$

$$\frac{Q_{Min.\ Student}}{A_{TESA}} = \frac{15\ gpd}{student} \times \frac{1{,}011\ students}{16.9618\ acres} = 894\frac{gpd}{acre}$$

$$\frac{Q_{Min.\ Student}}{A_{TESA}} = \frac{15\ gpd}{student} \times \frac{881\ students}{4.15103\ acres} = 3{,}184\frac{gpd}{acre}$$

11.5.1.6. Civic Elementary School Scenario F: Min. Elementary School Student Flow per TESA = 530 gpd/ac
11.5.1.7. Civic Elementary School Scenario G: Min. Elementary School Student Flow per TESA = 659 gpd/ac
11.5.1.8. Civic Elementary School Scenario H: Min. Elementary School Student Flow per TESA = 894 gpd/ac
11.5.1.9. Civic Elementary School Scenario I: Min. Elementary School Student Flow per TESA = 3,184 gpd/ac

$$\frac{Q_{Min.\ Employee}}{A_{TESA}} = \frac{20\ gpd}{employee} \times \frac{61\ employees}{24.778\ acres} = 64\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Employee}}{A_{TESA}} = \frac{20\ gpd}{employee} \times \frac{72\ employees}{16.9618\ acres} = 85\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Employee}}{A_{TESA}} = \frac{20\ gpd}{employee} \times \frac{78\ employees}{13.494\ acres} = 116\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Employee}}{A_{TESA}} = \frac{20\ gpd}{employee} \times \frac{58\ employees}{4.15103\ acres} = 279\frac{gpd}{acre}$$

11.5.1.10. Civic Elementary School Scenario F: Min. Elementary School Employee Flow per TESA = 64 gpd/ac
11.5.1.11. Civic Elementary School Scenario G: Min. Elementary School Employee Flow per TESA = 85 gpd/ac
11.5.1.12. Civic Elementary School Scenario H: Min. Elementary School Employee Flow per TESA = 116 gpd/ac
11.5.1.13. Civic Elementary School Scenario I: Min. Elementary School Employee Flow per TESA = 279 gpd/ac

11.6. For all Active Park type lots, only horizontal areas in acres were provided. It was assumed that restroom facilities will be provided. It was assumed that the horizontal areas for Active Parks were total areas, NOT building areas. No further information for Active Park type lots was provided; therefore, the above assumptions and following data were used in order to calculate estimated flow scenarios, but these assumptions and data need to be verified by the Owner and/or other Consultants or project specific data needs to be provided by the Owner and/or other Consultants:

11.6.1. Makapuu Beach North Comfort Station
11.6.1.1. Approximate Wastewater Flow = 3,000 gpd
11.6.1.2. Land Area = 20.59 acres

11.6.2. Barbers Point Beach Park Comfort Station
11.6.2.1. Approximate Wastewater Flow = 2,000 gpd
11.6.2.2. Land Area = 7.39 acres

11.6.3. Kahana Valley State Park Comfort Station
11.6.3.1. Approximate Wastewater Flow = 3,000 gpd
11.6.3.2. Land Area = 8.364 acres

11.6.4. Wailua River State Park Comfort Station
11.6.4.1. Approximate Wastewater Flow = 5,000 gpd
11.6.4.2. Land Area = 3.446 acres

$$\frac{Q_{Min.\ Park}}{A_{TAPA}} = \frac{3{,}000\ gpd}{20.59\ acres} = 146\,\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Park}}{A_{TAPA}} = \frac{2{,}000\ gpd}{7.39\ acres} = 271\,\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Park}}{A_{TAPA}} = \frac{3{,}000\ gpd}{8.364\ acres} = 359\,\frac{gpd}{acre}$$
$$\frac{Q_{Min.\ Park}}{A_{TAPA}} = \frac{5{,}000\ gpd}{3.446\ acres} = 1{,}415\,\frac{gpd}{acre}$$

11.6.5. Civic Active Park Scenario F: Min. Active Park Flow per TAPA = 146 gpd/ac
11.6.6. Civic Active Park Scenario G: Min. Active Park Flow per TAPA = 271 gpd/ac
11.6.7. Civic Active Park Scenario H: Min. Active Park Flow per TAPA = 359 gpd/ac
11.6.8. Civic Active Park Scenario I: Min. Active Park Flow per TAPA = 1,415 gpd/ac

12. Preliminary Private WWTW Flow Estimates

Updates, changes, and additions into the following tables are shown in pink cells.

Table 6: Summary of Development Unit Type vs. Incremental Phasing Program

Type		Subtype	Unit	Phase 1 Subtype Total	Phase 2 Subtype Total	Project Subtype Total	Phase 1 Type Total	Phase 2 Type Total	Project Type Total
1	Residential	Single Family	units	332	638	970	730	848	1,578
		Rural		15	65	80			
		Multi-Family		216	40	256			
		Ohana		41	105	146			
		Country Town Mixed-Use (MF Residential)		126	0	126			
2	Commerical	Country Town Mixed-Use (Commerical)	SF	58,475	0	58,475	198,847	0	198,847
		Existing Commercial		29,250	0	29,250			
		New Commercial/Emp.		111,122	0	111,122			
3	Civic	Elementary School	ac	15.76	0.00	15.76	39.33	7.78	47.11
		"Active" Park		23.57	7.78	31.35			

Table 7: Summary of Residential Scenario vs. Flows Estimates

Type		Scenario	Dwelling Flow/Unit	Phase 1 Flow	Phase 2 Flow	Project Flow	Unit
1	Residential	A	350 gpd/unit	255,500	296,800	552,300	gpd

Table 8: Summary of Commercial Scenarios & Sub-Categories vs. Flow Estimates

Type		Scenario	Employee Flow/Unit	Phase 1 Flow	Phase 2 Flow	Project Flow	Unit
2	Commerical	B	0.011 gpd/SF	2,200	0	2,200	gpd
		C	0.013 gpd/SF	2,600	0	2,600	
		D	0.015 gpd/SF	3,000	0	3,000	
		E	0.025 gpd/SF	5,000	0	5,000	
		Scenario	**Non-Restaurant Customer Flow/Unit**	**Phase 1 Flow**	**Phase 2 Flow**	**Project Flow**	
		B	0.130 gpd/SF	25,900	0	25,900	
		C	0.250 gpd/SF	49,700	0	49,700	
		D	0.380 gpd/SF	75,600	0	75,600	
		E	0.750 gpd/SF	149,100	0	149,100	
		Scenario	**Restaurant Customer Flow/Unit**	**Phase 1 Flow**	**Phase 2 Flow**	**Project Flow**	
		B	0.200 gpd/SF	39,800	0	39,800	
		C	0.238 gpd/SF	47,300	0	47,300	
		D	0.250 gpd/SF	49,700	0	49,700	
		E	0.227 gpd/SF	45,100	0	45,100	

Table 9: Summary of Civic Scenarios & Sub-Categories vs. Flow Estimates

Type		Scenario	Elementary School Student Flow/Unit	Phase 1 Flow	Phase 2 Flow	Project Flow	Unit
3	Civic	F	530 gpd/ac	8,400	0	8,400	gpd
		G	659 gpd/ac	10,400	0	10,400	
		H	894 gpd/ac	14,100	0	14,100	
		I	3,184 gpd/ac	50,200	0	50,200	
		Scenario	**lementary School Employe Flow/Unit**	**Phase 1 Flow**	**Phase 2 Flow**	**Project Flow**	
		F	64 gpd/ac	1,000	0	1,000	
		G	85 gpd/ac	1,300	0	1,300	
		H	116 gpd/ac	1,800	0	1,800	
		I	279 gpd/ac	4,400	0	4,400	
		Scenario	**Active Park Flow/Unit**	**Phase 1 Flow**	**Phase 2 Flow**	**Project Flow**	
		F	146 gpd/ac	3,400	1,100	4,600	
		G	271 gpd/ac	6,400	2,100	8,500	
		H	359 gpd/ac	8,500	2,800	11,300	
		I	1,415 gpd/ac	33,400	11,000	44,400	

Table 10: Summary of All Scenarios vs. Flow Estimates

Type		Scenario	Phase 1 Flow	Phase 2 Flow	Project Flow	Unit
1	Residential	A	255,500	296,800	552,300	gpd
2	Commerical	B	67,900	0	67,900	
		C	99,600	0	99,600	
		D	128,300	0	128,300	
		E	199,200	0	199,200	
3	Civic	F	12,800	1,100	14,000	
		G	18,100	2,100	20,200	
		H	24,400	2,800	27,200	
		I	88,000	11,000	99,000	

Table 11: Summary of Estimate Types vs. Average Flow Estimates

Estimate Type	Phase 1	Phase 2	Project	Unit
	Q(avg)			
Aggressive	336,000	298,000	634,000	gpd
Average	415,000	301,000	716,000	
Conservative	543,000	308,000	851,000	

Table 12: Population Estimates

Population		Qty/unit	Phase 1	Phase 2	Project	Unit
			Qty (persons)			
1	Residential	4	2,920.0	3,392.0	6,312.0	capita
2	Commercial	40	183.0	0.0	183.0	
3	Civic	NA	NA	NA	NA	
Totals			3,103.0	3,392.0	6,495.0	

Table 13: Summary of Estimate Types vs. Maximum Flow Estimates

Babbit Peaking Factor	Phase 1	Phase 2	Project	
	3.99	3.92	3.44	
Estimate Type	**Phase 1**	**Phase 2**	**Project**	**Unit**
	Q(max)			
Aggressive	1,339,531	1,167,065	2,180,436	gpd
Average	1,654,481	1,178,814	2,462,449	
Conservative	2,164,779	1,206,228	2,926,737	

Table 14: Dry Weather Infiltration/Inflow Flow Estimates

Q(dry i/i)/capita	5.00	gpd/capita		
Estimate Type	**Phase 1**	**Phase 2**	**Project**	**Unit**
	Q(dry i/i)			
Average	15,515	16,960	32,475	gpd

Table 15: Summary of Estimate Types vs. Design Average Flow Estimates

Estimate Type	Phase 1	Phase 2	Project	Unit
	Q(des avg)			
Aggressive	351,515	314,960	666,475	gpd
Average	430,515	317,960	748,475	
Conservative	558,515	324,960	883,475	

Table 16: Summary of Estimate Types vs. Design Maximum Flow Estimates

Estimate Type	Phase 1	Phase 2	Project	Unit
	Q(des max)			
Aggressive	1,355,046	1,184,025	2,212,911	gpd
Average	1,669,996	1,195,774	2,494,924	
Conservative	2,180,294	1,223,188	2,959,212	

Table 17: Wet Weather Infiltration/Inflow Flow Estimates

Pre-Development Land Type	Acres	
State Urban	14	
State Agricultural	1562	1576

Post-Development Land Type	Acres	
State Urban & Rural	488	
State Agricultural	1074	
Unaccounted	14	1576

Q(wet i/i)/A	1,250.00	gpd/acre
Estimate Type	Project Q(wet i/i)	Unit
Average	627,500	gpd

Table 18: Summary of Estimate Types vs. Design Peak Flow Estimates

Estimate Type	Phase 1	Phase 2	Project	Unit
	Q(des peak)			
Aggressive	1,982,546	1,811,525	2,840,411	gpd
Average	2,297,496	1,823,274	3,122,424	
Conservative	2,807,794	1,850,688	3,586,712	

13. Preliminary Private WWTW Cost Estimates

13.1. Based on the historical data provided August 23, 2013, the following information was used for preliminary cost estimate purposes:

13.1.1. Engineering Cost Estimate Range per Flow
8% – 12% of Construction Costs

13.1.2. Construction Cost Estimate Range for Secondary Treatment per Flow
$23.00/gpd – $35.00/gpd

13.1.3. Construction Cost Estimate Range for R-1 Recycle Treatment per Flow
$17.00/gpd – $26.00/gpd

13.1.4. Construction Cost Estimate Range for Sludge Off-Site Disposal per Flow
$8.00/gpd – $12.00/gpd

Table 19: Summary of Cost Estimate Range vs. WWTW Component

Phase 1					
Estimate Type	Engineering 8% - 12%	Secondary $ 23/gpd - $ 35/gpd	R-1 Recycled $ 17/gpd - $ 26/gpd	Sludge Off-Site Disp. $ 8/gpd - $ 12/gpd	Total Cost Estimate Range
Aggressive	$ 1.29 M - $ 2.94 M	$ 7.73 M - $ 11.76 M	$ 5.71 M - $ 8.74 M	$ 2.69 M - $ 4.03 M	$ 17.42 M - $ 27.47 M
Average	$ 1.59 M - $ 3.64 M	$ 9.55 M - $ 14.53 M	$ 7.06 M - $ 10.79 M	$ 3.32 M - $ 4.98 M	$ 21.52 M - $ 33.94 M
Conservative	$ 2.08 M - $ 4.76 M	$ 12.49 M - $ 19.01 M	$ 9.23 M - $ 14.12 M	$ 4.34 M - $ 6.52 M	$ 28.14 M - $ 44.41 M

Phase 2					
Estimate Type	Engineering 8% - 12%	Secondary $ 23/gpd - $ 35/gpd	R-1 Recycled $ 17/gpd - $ 26/gpd	Sludge Off-Site Disp. $ 8/gpd - $ 12/gpd	Total Cost Estimate Range
Aggressive	$ 1.14 M - $ 2.61 M	$ 6.85 M - $ 10.43 M	$ 5.07 M - $ 7.75 M	$ 2.38 M - $ 3.58 M	$ 15.44 M - $ 24.37 M
Average	$ 1.16 M - $ 2.64 M	$ 6.92 M - $ 10.54 M	$ 5.12 M - $ 7.83 M	$ 2.41 M - $ 3.61 M	$ 15.61 M - $ 24.62 M
Conservative	$ 1.18 M - $ 2.70 M	$ 7.08 M - $ 10.78 M	$ 5.24 M - $ 8.01 M	$ 2.46 M - $ 3.70 M	$ 15.96 M - $ 25.19 M

Project					
Estimate Type	Engineering 8% - 12%	Secondary $ 23/gpd - $ 35/gpd	R-1 Recycled $ 17/gpd - $ 26/gpd	Sludge Off-Site Disp. $ 8/gpd - $ 12/gpd	Total Cost Estimate Range
Aggressive	$ 2.43 M - $ 5.55 M	$ 14.58 M - $ 22.19 M	$ 10.78 M - $ 16.48 M	$ 5.07 M - $ 7.61 M	$ 32.86 M - $ 51.83 M
Average	$ 2.75 M - $ 6.27 M	$ 16.47 M - $ 25.06 M	$ 12.17 M - $ 18.62 M	$ 5.73 M - $ 8.59 M	$ 37.12 M - $ 58.54 M
Conservative	$ 3.27 M - $ 7.46 M	$ 19.57 M - $ 29.79 M	$ 14.47 M - $ 22.13 M	$ 6.81 M - $ 10.21 M	$ 44.12 M - $ 69.59 M

Table 20: Summary of Total Cost Estimate Range

Estimate Type	Phase 1	Phase 2	Project
	Total Cost Estimate Range		
Aggressive	$ 17.42 M - $ 27.47 M	$ 15.44 M - $ 24.37 M	$ 32.86 M - $ 51.83 M
Average	$ 21.52 M - $ 33.94 M	$ 15.61 M - $ 24.62 M	$ 37.12 M - $ 58.54 M
Conservative	$ 28.14 M - $ 44.41 M	$ 15.96 M - $ 25.19 M	$ 44.12 M - $ 69.59 M

13.2. These preliminary cost estimates do NOT include the following:
- 13.2.1. Construction Cost Estimates for:
  - 13.2.1.1. Treated Effluent On-Site Disposal System
  - 13.2.1.2. Collection System
  - 13.2.1.3. Sludge On-Site Treatment & Disposal System
  - 13.2.1.4. Reuse/Recycled Water Distribution System
- 13.2.2. O&M Cost Estimates for:
  - 13.2.2.1. WWTWs
  - 13.2.2.2. Effluent On-Site Disposal
  - 13.2.2.3. Sludge Off-Site Disposal
  - 13.2.2.4. Collection System
  - 13.2.2.5. Sludge On-Site Treatment & Disposal System
  - 13.2.2.6. Reuse/Recycled Water Distribution System

14. Future Tasks for Private WWTW

14.1. Identification of Alternative Private WWTW Site

14.1.1. From a preliminary review of the preferred site for the private WWTW (see Table 21), an alternative site may need to be considered. Considering the Average Wastewater Flows for Phase 1 and Phase 2, the approximate available area of 6.33 acres may NOT be feasible.

14.1.2. An alternative site with a larger area for the private WWTW must be considered.

14.1.3. The approximate area needed for the private WWTW for the entire Project may range from 10.40 acres to 13.96 acres.

Table 21: Estimate of WWTW Land Area Requirement

Approx. WWTW Area per Q(avg)		0.0000164 acres/gpd		
Estimate Type	Phase 1	Phase 2	Project	Unit
	WWTW Area			
Aggressive	5.52	4.89	10.40	acres
Average	6.81	4.94	11.75	
Conservative	8.91	5.06	13.96	
Preferred Site for WWTW per Owners	Area	275,570 SF		
		6.33 acres		
	Perimeter	2,152 ft		

14.2. Identification of Allowed and Feasible Treated Effluent Disposal System

14.2.1. From a preliminary review of the UIC map and boundary line for the island of Maui, it appears that the portion of the WCT subdivision property that is east of (or makai of) Honoapiilani Hwy. is below the UIC boundary line. Therefore, injection wells may be considered in this portion of the subdivision property. Further review and analysis must be performed prior to and during the design phase of the project. See the following figures:

14.2.1.1. Figure 4: DOH-SDWB UIC Areas

14.2.1.2. Figure 5: UIC Boundary Line for County of Maui

14.2.1.3. Figure 6: UIC Boundary Line for Island of Maui

14.2.1.4. Figure 7: UIC Boundary Line for Waikapu

14.2.1.5. Figure 8: UIC Boundary Line for WCT

14.2.2. If on-site disposal of treated effluent by means of injection well is not allowed, then horizontal absorption beds may not be feasible due to the available land area. On-site disposal may be allowed by means of reuse/recycled water. Further review and analysis must be performed prior to and during the design phase of the project.

14.2.3. If on-site disposal of treated effluent is not allowed and/or on-site disposal by means of reuse/recycled water is not allowed, not feasible, and/or it is not feasible to dispose all reuse/recycled water on-site, then off-site disposal may be required. Off-site disposal may be reuse/recycled water distribution to user(s) of reuse/recycled water.

14.2.3.1. Owner must determine the user(s) of reuse/recycled water and all associated and applicable agreements, contracts, responsibilities, fees, etc.

14.2.3.2. Further review and analysis must be performed prior to and during the design phase of the project.

14.3. Identification of Approved Disposal Site Treated and Dewatered Sludge
- 14.3.1. Further discussion with the County of Maui must be conducted to determine the allowed quantity of treated and dewatered sludge to be accepted at their facility(ies).
- 14.3.2. If the County of Maui does not allow or accept any or all of the treated and dewatered sludge from the WCT private WWTW, then further sludge treatment and processing equipment and facilities must be considered.
- 14.3.3. Further review and analysis must be performed prior to and during the design phase of the project.

14.4. Identification of the Private Collection System
- 14.4.1. Whether the WCT project decides to utilize a private WWTW or connection to the County of Maui collection system, the following items will need to be developed:
  - 14.4.1.1. The internal collection system within the boundaries of the WCT project.
  - 14.4.1.2. The quantity, types, and sizes of pump stations within the boundaries of the WCT project.
- 14.4.2. Development of the internal collection system for the WCT project was not in the Scope of Work for this Preliminary Planning Report by Enviniti and, therefore, was not discussed.
- 14.4.3. Further review and analysis must be performed during the design phase of the project.

14.5. Detailed Information Required for Design
- 14.5.1. Client shall provide further subdivision and development use information to the wastewater engineer to calculate more accurate wastewater flows, particularly for the Commercial and Civic uses.

Figure 4: DOH-SDWB UIC Areas

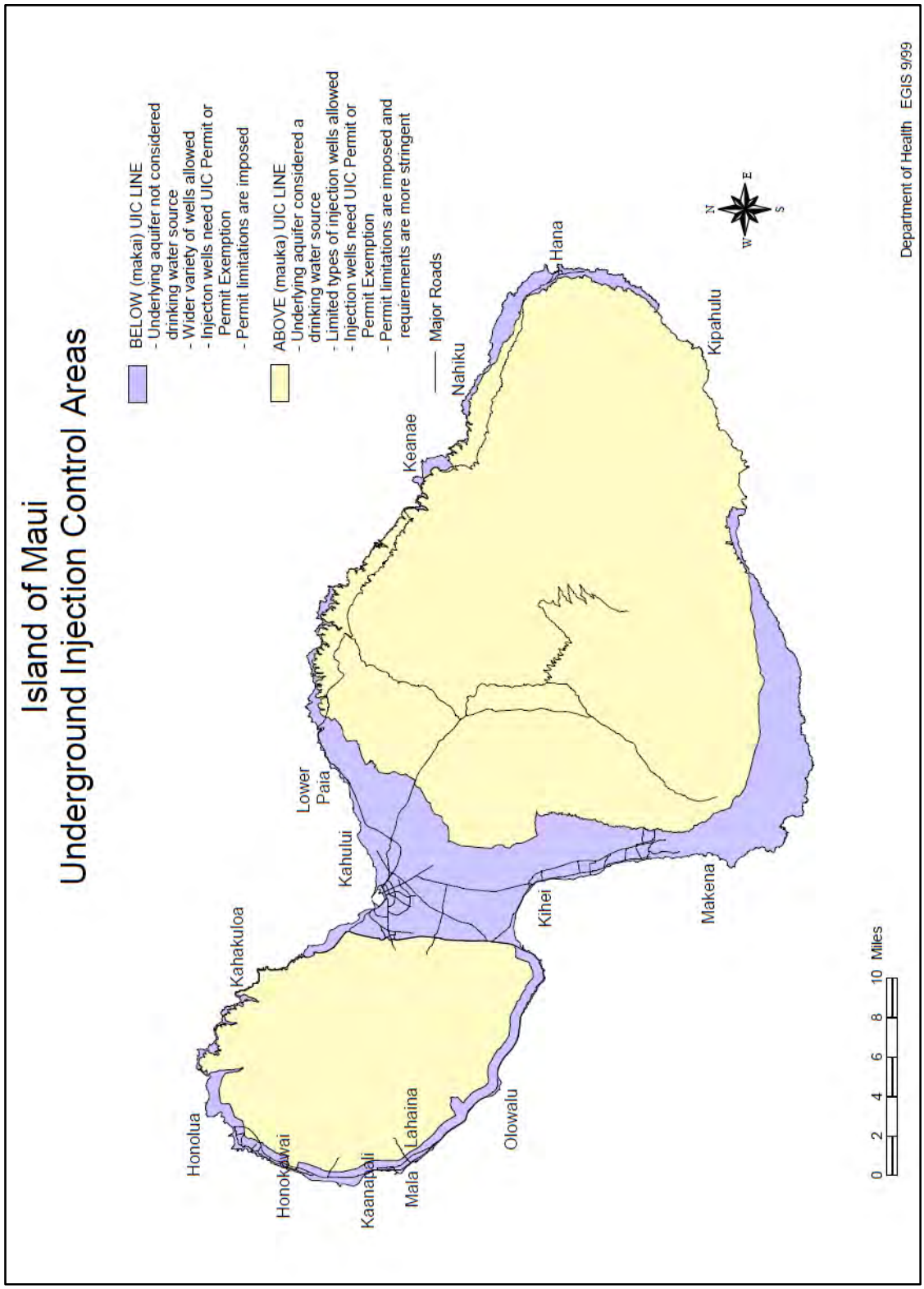


Figure 5: UIC Boundary Line for County of Maui

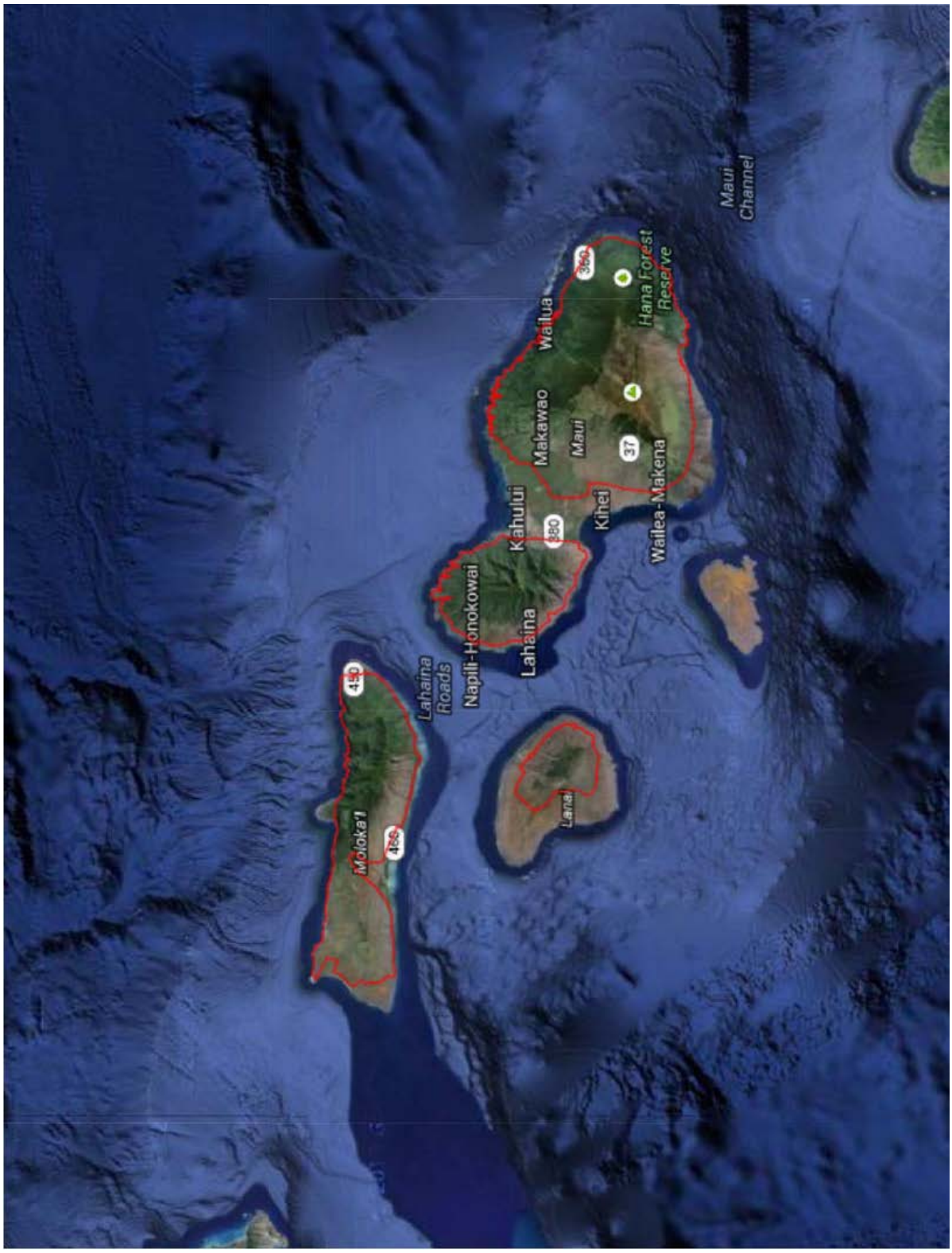


Figure 6: UIC Boundary Line for Island of Maui

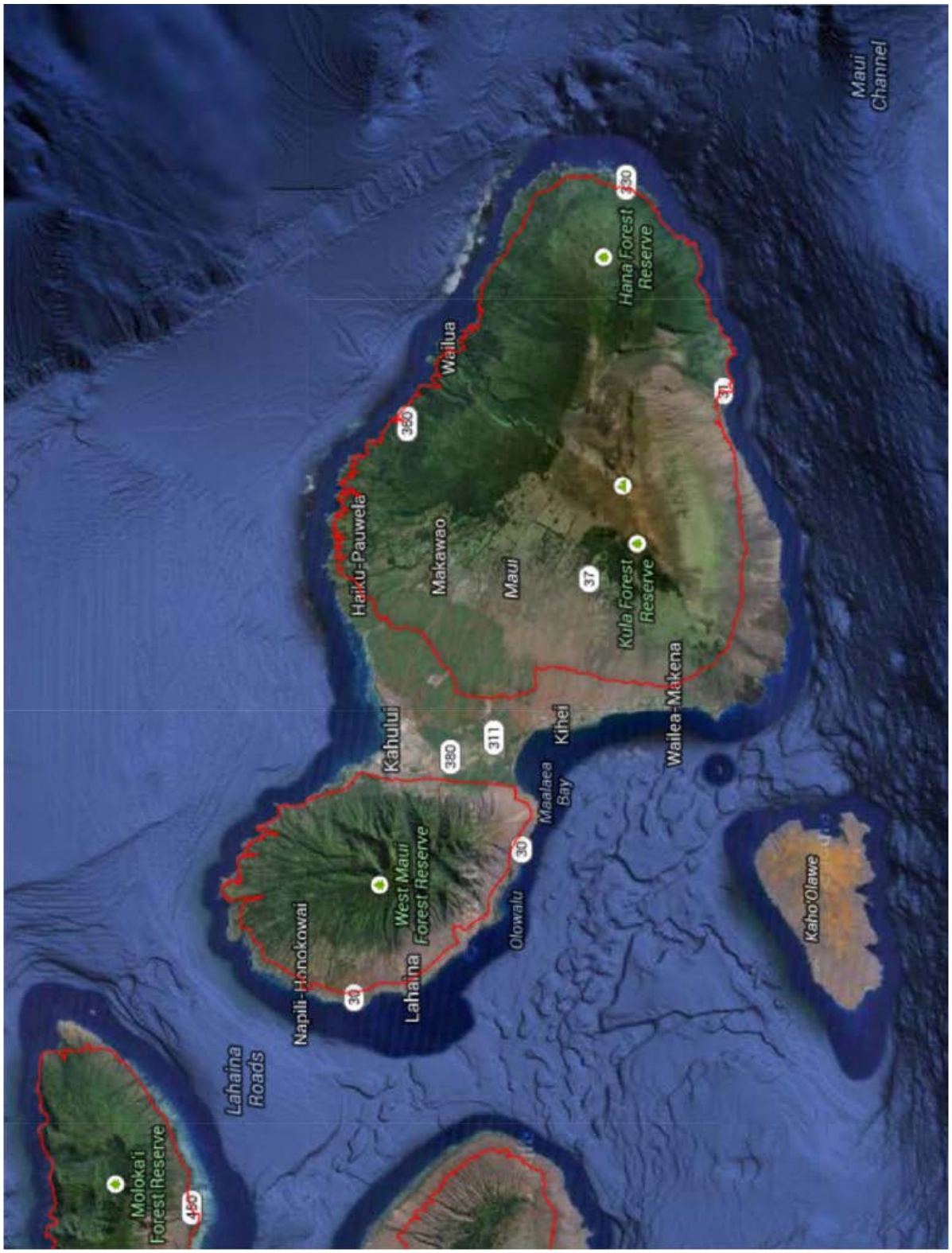


Figure 7: UIC Boundary Line for Waikapu

Figure 8: UIC Boundary Line for WCT

15. References

City and County of Honolulu Department of Wastewater Management (1993). *Design Standards Volume 1*. Available from the City and County of Honolulu website: http://www1.honolulu.gov/csd/mrc/onlinesources.htm.

City and County of Honolulu Department of Wastewater Management (1984). *Design Standards Volume 2*. Available from the City and County of Honolulu website: http://www1.honolulu.gov/csd/mrc/onlinesources.htm.

Kiepper, B. H. (2013). *Understanding Laboratory Wastewater Tests: I. Organics (BOD, COD, TOC, O&G)*. Available from The University of Georgia College of Agricultural & Environmental Sciences website: http://www.caes.uga.edu/publications/pubDetail.cfm?pk_id=7895#OG

State of Hawaii Department of Health Safe Drinking Water Branch (2000). *Hawaii Administrative Rules Title 11 Department of Health Chapter 23 Underground Injection Control* (revised October 11, 2000). Available from DOH-WWB website: http://health.hawaii.gov/sdwb/uicprogram/

State of Hawaii Department of Health Wastewater Branch (2002). *Guidelines for the Treatment and Use of Recycled Water* (revised May 15, 2002). Available from DOH-WWB website: http://health.hawaii.gov/wastewater/home/forms/

State of Hawaii Department of Health Wastewater Branch (2004). *Hawaii Administrative Rules Title 11 Department of Health Chapter 62 Wastewater Systems* (revised January 14, 2004). Available from DOH-WWB website: http://health.hawaii.gov/wastewater/home/forms/

Tchobanoglous, G., Burton, F. L., and Metcalf & Eddy, Inc. (1991). *Wastewater Engineering Treatment, Disposal, and Reuse* (3rd ed.). New York, NY,: Irwin/McGraw-Hill.

United States of America Environmental Protection Agency (1984). *National Pollutant Discharge Elimination System, Electronic Code of Federal Regulations, Title 40: Protection of Environment, Part 133 – Secondary Treatment Regulation* (current as of March 14, 2014). Available from U.S. Government Printing Office website: http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=c056d33340b3f9d88e6f07af7b86446e&rgn=div5&view=text&node=40:23.0.1.1.20&idno=40

Vesilind, P. A., and Morgan, S. M. (2004). *Introduction to Environmental Engineering* (2nd ed.). Belmont, CA: Brooks/Cole-Thomson Learning.

Appendix A – Priority Pollutants

1. Acenaphthene
2. Acrolein
3. Acrylonitrile
4. Benzene
5. Benzidine
6. Carbon tetrachloride
7. Chlorobenzene
8. 1,2,4-trichlorobenzene
9. Hexachlorobenzene
10. 1,2-dichloroethane
11. 1,1,1-trichloreothane
12. Hexachloroethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
16. Chloroethane
17. REMOVED
18. Bis(2-chloroethyl) ether
19. 2-chloroethyl vinyl ethers
20. 2-chloronaphthalene
21. 2,4,6-trichlorophenol
22. Parachlorometa cresol
23. Chloroform
24. 2-chlorophenol
25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3-dichlorobenzidine
29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,3-dichloropropylene
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. Ethylbenzene
39. Fluoranthene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. Bis(2-chloroisopropyl) ether
43. Bis(2-chloroethoxy) methane
44. Methylene chloride
45. Methyl chloride
46. Methyl bromide
47. Bromoform
48. Dichlorobromomethane
49. REMOVED
50. REMOVED
51. Chlorodibromomethane
52. Hexachlorobutadiene
53. Hexachlorocyclopentadiene
54. Isophorone
55. Naphthalene
56. Nitrobenzene
57. 2-nitrophenol
58. 4-nitrophenol
59. 2,4-dinitrophenol
60. 4,6-dinitro-o-cresol
61. N-nitrosodimethylamine
62. N-nitrosodiphenylamine
63. N-nitrosodi-n-propylamine
64. Pentachlorophenol
65. Phenol
66. Bis(2-ethylhexyl) phthalate
67. Butyl benzyl phthalate
68. Di-N-Butyl Phthalate
69. Di-n-octyl phthalate
70. Diethyl Phthalate
71. Dimethyl phthalate
72. benzo(a) anthracene
73. Benzo(a)pyrene
74. Benzo(b) fluoranthene
75. Benzo(k) fluoranthene
76. Chrysene
77. Acenaphthylene
78. Anthracene
79. Benzo(ghi) perylene
80. Fluorene
81. Phenanthrene
82. Dibenzo(,h) anthracene
83. Indeno (1,2,3-cd) pyrene
84. Pyrene
85. Tetrachloroethylene
86. Toluene
87. Trichloroethylene
88. Vinyl chloride
89. Aldrin
90. Dieldrin
91. Chlordane
92. 4,4-DDT
93. 4,4-DDE
94. 4,4-DDD
95. Alpha-endosulfan
96. Beta-endosulfan
97. Endosulfan sulfate
98. Endrin
99. Endrin aldehyde
100. Heptachlor
101. Heptachlor epoxide
102. Alpha-BHC
103. Beta-BHC
104. Gamma-BHC
105. Delta-BHC
106. PCB–1242 (Arochlor 1242)
107. PCB–1254 (Arochlor 1254)
108. PCB–1221 (Arochlor 1221)
109. PCB–1232 (Arochlor 1232)
110. PCB–1248 (Arochlor 1248)
111. PCB–1260 (Arochlor 1260)
112. PCB–1016 (Arochlor 1016)
113. Toxaphene
114. Antimony
115. Arsenic
116. Asbestos
117. Beryllium
118. Cadmium
119. Chromium
120. Copper
121. Cyanide, Total
122. Lead
123. Mercury
124. Nickel
125. Selenium
126. Silver
127. Thallium
128. Zinc
129. 2,3,7,8-TCDD

Appendix B – Summary of Suitable Uses for Recycled Water

Table 22: Summary of Suitable Uses for Recycled Water

SUITABLE USES OF RECYCLED WATER	R1	R2	R3
IRRIGATION: (S)pray, (D)rip & Surface, S(U)bsurface, (A)LL=S D & U, Spray with (B)uffer, (N)ot allowed, /=or			
Golf course landscapes	A	U/B	N
Freeway and cemetery landscapes	A	A	N
Food crops where recycled water contacts the edible portion of the crop, including all root crops	A*	N	N
Parks, elementary schoolyards, athletic fields and landscapes around some residential property	A	U	N
Roadside and median landscapes	A	U/B	N
Non-edible vegetation in areas with limited public exposure	A	AB	U
Sod farms	A	AB	N
Ornamental plants for commercial use	A	AB	N
Food crops above ground & not contacted by irrigation	A	U	N
Pastures for milking and other animals	A	U	N
Fodder, fiber, and seed crops not eaten by humans	A	AB	DU
Orchards and vineyards bearing food crops	A	D/U	DU
Orchards and vineyards not bearing food crops during irrigation	A	AB	DU
Timber and trees not bearing food crops	A	AB	DU
Food crops undergoing commercial pathogen destroying process before consumption	A	AB	DU
SUPPLY TO IMPOUNDMENTS: (A)llowed (N)ot allowed			
Restricted recreational impoundments	A	N	N
Basins at fish hatcheries	A	N	N
Landscape impoundments without decorative fountain	A	A	N
Landscape impoundments with decorative fountain	A	N	N
SUPPLY TO OTHER USES: (A)llowed (N)ot allowed			

Table 23: Summary of Suitable Uses for Recycled Water (continued)

SUITABLE USES OF RECYCLED WATER	R1	R2	R3
Flushing toilets and urinals	A	N	N
Structural fire fighting	A	A	N
Nonstructural fire fighting	A	A	N
Commercial and public laundries	A	N	N
Cooling saws while cutting pavement	A	N	N
Decorative fountains	A	N	N
Washing yards, lots and sidewalks	A	N	N
Flushing sanitary sewers	A	A	N
High pressure water blasting to clean surfaces	A	N	N
Industrial Process without exposure of workers	A	A	N
Industrial Process with exposure of workers	A	N	N
Cooling or air conditioning system without tower, evaporative condenser, spraying, or other features that emit vapor or droplets	A	A	N
Cooling or air conditioning system with tower, evaporative condenser, spraying, or other features that emit vapor or droplets	A	N	N
Industrial boiler feed	A	A	N
Water jetting for consolidation of backfill material around potable water piping during water shortages	A	N	N
Water jetting for consolidation of backfill material around piping for recycled water, sewage, storm drainage, and gas; and electrical conduits	A	A	N
Washing aggregate and making concrete	A	A	N
Dampening roads and other surfaces for dust control	A	A	N
Dampening brushes and street surfaces in street sweeping	A	A	N

APPENDIX K

Mana Water Prepared "Water Reclamation and Reuse Report for Waikapū Country Town"

Water Reclamation and Education Facility
Water Reclamation and Reuse Report

Prepared For

Waikapū Country Town

Waikapu Country Town
0 Honoapiilani Hwy.
Wailuku, HI, 96793

Prepared by:

Mana Water LLC
2010 Honoapiilani Hwy C-1
Lahaina, HI 96761

Kennedy/Jenks Consultants
220 Imi Kala Street, Suite 205
Wailuku, HI 96793

Table of Contents

1.1. List of Definitions and Abbreviations 4

2. Project Background 7

3. Private Water Reclamation and Education Facility 7

3.1. Existing Conditions and Management Plan 7
3.2. Ownership and Operating Structure 7
3.3. Wastewater Flow Projections 9
3.4. Influent Wastewater Characteristics 10

4. Water Reuse Management 11

4.1. WREF Effluent Quality 11
4.2. R-1 Suitable Uses: 12
4.3. R-2 Suitable Uses: 13
4.4. R-3 Suitable Uses: 14
4.5. Effluent Reuse for Agriculture 14
4.6. Alternative Disposal 15
4.7. Supply Demand Analysis 19
4.8. WREF Operating Cost and Revenue 20
4.9. Nutrient Residuals in R-1 Recycled Water 22
4.10. Biosolids Management 23
4.11. WREF Site Location 23

5. Education Center 25

5.1. Public Education 25
5.2. Operator Training 26

6. Wastewater Treatment Facility Operation 28

6.1. Introduction 28
6.2. Organica FCR Operation 28
6.3. General Introduction to Organica FCR 29
6.4. Advantages of the FCR Solution 29
6.5. Plant Roots Are Ideal Biofilm Carriers 30
6.6. The Main Unit Processes 31
6.7. Odor and Noise Control 31

7. WREF Site Plan and Location 32

8. Cost implications and Phasing 35

8.1. Total Cost Estimates and Phasing 35
8.2. Cost Reduction Strategies 36

9. Company References and Background 38

9.1. Mana Water 38
9.2. Organica Water 38

9.3. Kennedy/Jenks Consultants 39
9.4. SYM Engineers LLC 39

10. Appendix 1 - Preliminary Architectural Renderings 40

Index of Tables and Images

Image 1: WCT Ownership and Operating Structure 8
Table 1: County of Maui Flow Standards 9
Table 2: Basis for Calculations at Full Buildout 9
Table 3: Flow Projections 9
Table 4: Peak Flow Projection 10
Table 5: Influent Characteristics 11
Image 2: Water Reuse Areas of Maui 15
Image 3: UIC Line Maui 16
Image 4: Approximate Reuse and Alternative Disposal Area (in green)Below UIC Line 16
Image 5: Well Sites Approximate Locations (black triangles) 18
Image 6: SAT Basin Schematic 18
Image 7: Proposed Reuse Acreage (not limited to) within Blue Area 19
Table 6: Recycled Water Rates 20
Table 7: WREF Operating Income 20
Table 8: WREF Operating expenses without solar 21
Table 9: WREF Operating expenses with solar 22
Table 10: Net Financial Operating Result 22
Table 11: Optimal Site Location Matrix 24
Image 8: Mana Water Site Location A 25
Image 9: Mana Water Site Location B 25
Image 10: Mana Water Education Facility Rendering 26
Image 11: Mana Water Member Steve Parabicoli in Action 27
Image 12: Organica Process Diagram of Food Chain Reactors (FCR) 28
Image 13: Organica FCR Facility 30
Image 14: Architectural Rendering of WCT WREF 33
Image 15: Preliminary WCT WREF Site Plan. Total Area 12 acres, SAT basin 5.6 acres 34
Image 16: Preliminary Rendering of WCT WREF Elevations 35

1.1. List of Definitions and Abbreviations

- Alarm: an instrument or device which continuously monitors a specific function of a treatment process, equipment or pump station and automatically gives warning of an unsafe or undesirable condition by means of an electronic, visual and/or audible signal.
- Biological Treatment: methods of wastewater treatment where bacterial or biochemical action is used as a means of producing oxidized wastewater.
- CAS: conventional activated sludge
- Chapter 62: The Hawaii Administrative Rules, Title 11, Chapter 62, Wastewater Systems.
- CoM: County of Maui
- Contact: the mode of transmission by which a person or animal has the opportunity to acquire an infecting agent or pathogenic organism, by means of inhalation, skin or skin lesions, mucus membrane exposure, ingestion, or other physical contact such as placing objects in the mouth.
- Director: The Director of the Hawaii State Department of Health or a duly authorized representative.
- Domestic wastewater: Defined in HAR Chapter 62, section 11-62-03.
- Disinfection: A process which inactivates or removes pathogenic organisms in water by chemical or physical means.
- DOH: The Hawaii State Department of Health.
- F-specific bacteriophage MS2: a strain of a specific type of virus which infects coliform bacteria, is obtained from the American Type Culture Collection (ATCC 15597B1), grown on lawns of E. coli (ATCC 15597) as described by Adams in 1959 (Adams, M. H. 1959. Bacteriophages. Inter science Publishers, Inc.), and is assayed by the plaque forming unit (PFU) method described by Adams in 1959 on Trypticase soy agar (Difco, Detroit, Michigan).
- Filter: a unit for carrying out the filtration process, consisting of both the filter medium and its housing.
- FCR: food chain reactor unique to Organica Water Inc.
- Gpd: gallons per day
- HAR: The Hawaii Administrative Rules.
- MBR: membrane bioreactor
- MGD: million gallons per day
- Nephelometric Turbidity Unit or NTU: A measurement of turbidity as determined by the ratio of the intensity of light scattered by the sample to the intensity of incident light as measured by the method 2130 B. in Standard

methods for the examination of Water and Wastewater, 20th ed.; Eaton, A.D., Clesceri, L.S., and Greenberg, A.E., Eds; American Public Health Association: Washington, DC, 1995; p.2-8.

- Non-Domestic Wastewater: that as defined in HAR Chapter 62, §11-62-03, §11-62-07.1.
- NWRI UV Guidelines: The latest Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (prepared by the National Water Research Institute and Water Research Foundation) that has been accepted for use by the DOH.
- Oxidized Wastewater: Wastewater that has undergone an aerobic treatment process in which the organic matter has been stabilized, is non putrescible, and contains dissolved oxygen.
- Pathogen: means any agent, especially a microorganism, capable of causing disease.
- Peak Dry Weather Design Flow: the arithmetic mean of the maximum peak flow rates sustained over some period of time (for example three hours) during the maximum 24-hour dry weather period. Dry weather period is defined as periods of little or no rainfall.
- Potable water: water that is suitable for drinking by humans.
- Power Source: a source supplying energy to operate unit processes.
- PUC: public utilities comission
- PV: Photovoltaic solar electricity
- Recycled water: treated wastewater that by design is intended or used for a beneficial purpose. The three classes of recycled water are provided in sections D, E, and F.
- Reclamation or Treatment Facility: an arrangement of devices, structures, equipment, processes and controls which produce recycled water suitable for the intended reuse.
- SCADA: supervisory control and data acquisition
- Standby power source: an automatically actuated self-starting alternate energy source maintained in immediately operable condition and of sufficient capacity to provide necessary service during failure of the normal power supply.
- Turbidity: a measure of the ability of a solution to scatter light. Light scattering is usually caused by the presence of small particles.
- Unit Process: an individual stage in the wastewater treatment sequence which performs a major single treatment operation.
- WCT: Waikapu Country Town
- WWRD: Wastewater Reclamation Division
- WWPS: wastewater pump station

- WWRF: wastewater reclamation facility.
- WREF: water reclamation and education facility
- WRRF: water reclamation and resource facility

2. Project Background

Waikapu Country Town (WCT) is a proposed complete community, encompassing a mixture of single and multi-family residential units, commercial and civic uses. Waikapu Country Town will sit at the foothills of the West Maui Mountains with a country town planned as the core of a new community at the existing Maui Tropical Plantation. WCT aims to create a town based on the principles of responsible and sustainable development that will serve as a model for future growth and urban development by maximizing on-site use of renewable energy, water conservation, agricultural preservation and water reuse.

Mana Water LLC has partnered with Organica Water Inc. and Kennedy/Jenks Consultants Inc., to provide a unique and proven technology of sustainable wastewater treatment and water reuse. With over 50 operating references world-wide, i.e., Europe, Asia and North America, Organica has been a leader in wastewater treatment and reuse in an energy efficient and aesthetically pleasing manner by marrying state of the art technology with a natural systems approach.

3. Private Water Reclamation and Education Facility

3.1. Existing Conditions and Management Plan

Maui Tropical Plantation is serviced by a private wastewater collection system and WWPS that collects and conveys the wastewater to the County of Maui's (CoM)'s gravity line in Waikapu Gardens. The wastewater from Maui Tropical Plantation is treated at the Kahului Wastewater Reclamation Facility (WWRF) where the current treated flow is 5.4 MGD with the WWRF design capacity being 7.9 MGD. The County's WWRD has indicated that the cumulative wastewater flow allocated is upwards of 7 MGD. Although the remaining capacity allocation is based on a first-come first-served basis with multiple wastewater requests already submitted, the CoM has instructed WCT to construct and operate a private wastewater reclamation facility (WWRF) to address their wastewater treatment needs.

The planned WCT WWRF will be designed in compliance with the State of Hawaii, Department of Health Hawaii Administrative Rules 11-62. It is anticipated that the ownership and operation of the WCT's collection system, WWRF, and water reuse system will be regulated by the State of Hawaii Public Utilities Commission (PUC).

3.2. Ownership and Operating Structure

The water and wastewater infrastructure constructed to serve WCT will operate under the ownership of the Waikapu Country Town Water Company (Water Company). The Water

Company will provide the management and operations of both the water and wastewater systems. WCT WREF and water utility company are committed to provide the WCT residents, commercial centers, and agriculture farmers with the highest level of service in a sustainable and affordable manner.

The Water Company is expected to be regulated by the Hawaii Public Utilities Commission and adhere to the Hawaii DOH standards and Water Reuse Guidelines. Daily operations of the WCT Water Company will be performed by State of Hawaii certified operators as required by DOH. The utility operations team will be selected prior to commissioning.

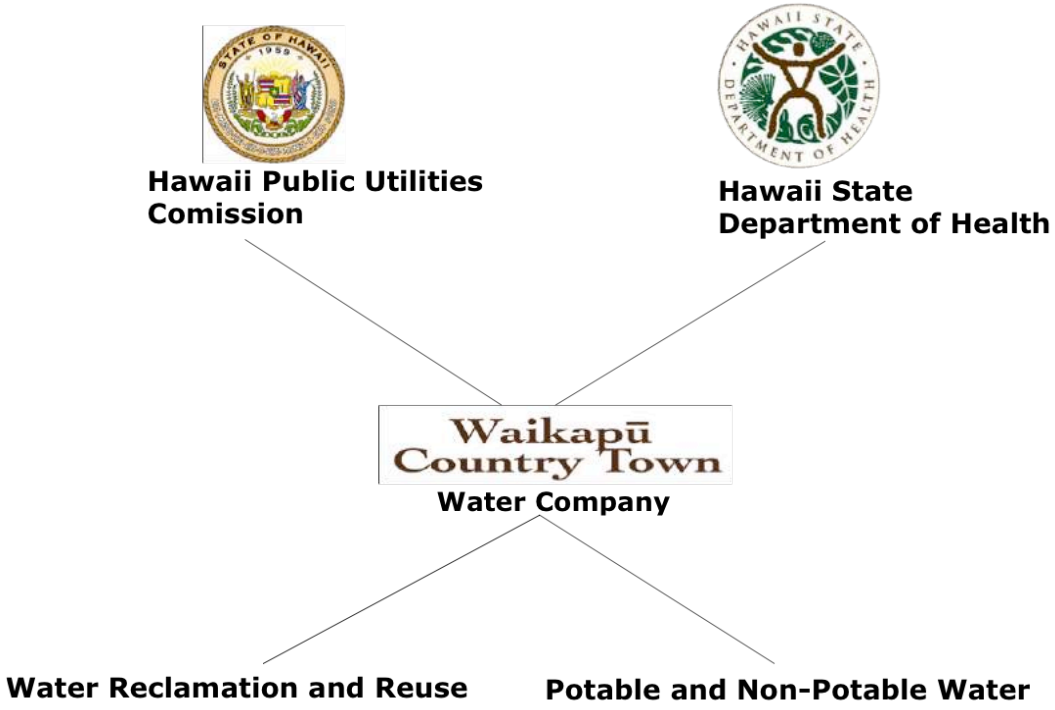


Image 1: WCT Ownership and Operating Structure

3.3. Wastewater Flow Projections

Flow projections are based on the County of Maui Wastewater Flow Standards (Feb 2, 2006), engineering report by Enviniti LLC., and adjusted per latest WCT plans.

COM Guidelines

Wastewater Flow Standards

Types of Use	Unit	Contribution (Gal/Unit/Day)
Residence, subdivision	home	350
Apartment/Condo	unit	225
Ohana (cottage)	unit	180
Office / Commercial	employee	20

Table 1: County of Maui Flow Standards

Experience has shown that the CoM Flow Standards are conservative and with modern low-flow fixtures it is anticipated that the actual flow will be lower than the listed Wastewater Flow Standards. However, a conservative approach is appropriate at this time in the planning process with the appropriate adjustments made during the planning and design phase of the project.

At full buildout, WCT will be a complete town that includes a variety of residential units, commercial units, employment uses, parks, school, other civic uses and agriculture. The following table summarizes the contributors to the WCT wastewater flow and provides the basis for wastewater flow calculations.

Basis for Wastewater Calculations at Full Buildout

Residential (Including Ohana, multi and single family homes)	1,517	Units
Office/Commercial	206,198	Square Feet
Civic (parks, church, elementary school)	50.41	Acres

Table 2: Basis for Calculations at Full Buildout

Flow Projection
(Average Dry Weather)

Residential	530,950	gpd
Office/commercial	70,300	gpd
Civic	12,800	gpd
Infiltration/Inflow	31,285	gpd
Total	**645,335**	**gpd**

Table 3: Flow Projections

CoM Flow Standard Dry weather infiltration/inflow is 5 gpcd (gallons per capita per day) based on the wastewater lines laid above the normal groundwater table and assuming a linear buildout rate to full buildout. Using a County-specified design peak flow factor of two (2) the projected peak flow is shown in the following table.

Peak Flow Projection		
Peak Design Flow	1,290,670	gpd

Table 4: Peak Flow Projection

3.4. Influent Wastewater Characteristics

Wastewater characteristics are influenced by the service area and are critical in the proper design of liquid and solids treatment processes. WCT at full buildout will predominantly be residential wastewater along with commercial generated wastewater and infiltration/inflow. Some of the key metrics used in characterizing the raw wastewater are 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), total nitrogen (TN) and Ammonia. These are important metrics in understanding the strength and nutrient content of wastewater.

The wastewater characteristics assumed for the wastewater system design will be based on County of Maui historic data and industry standards, including flow projections, and are dependent on the final buildout and master plan. The wastewater characteristics are to be adjusted accordingly during the design phase of the project.

Expected Influent Wastewater Characteristics

Parameter	Units	Value
Flow		
Average	MGD	0.65
Peak	MGD	1.3
Influent BOD_5		
Average Day	mg/L	200
Maximum month	mg/L	250
Maximum month	lb/day	177
Influent TSS		
Average Day	mg/L	200
Maximum month	mg/L	250
Maximum month	lb/day	177
Influent Ammonia		
Average Day	mg/L	25
Maximum month	mg/L	20
Maximum month	lb/day	14

Wastewater Engineering Treatment, Disposal, and Reuse, Metcalf & Eddy, 1991, Table 3-16 with adjustments

Table 5: Influent Characteristics

4. Water Reuse Management

4.1. WREF Effluent Quality

The effluent produced by the WREF is a valuable water resource that will be integrated into the WCT available water resource pool and used for its allowable and appropriate use. It is envisioned that the effluent disposal program for the WCT development will be a multifaceted program with three options for recycled water reuse.

- R-1 Recycled Water
- R-2 Recycled Water
- Soil Aquifer Treatment (SAT)

The R-1 recycled water is considered the primary effluent water resource that will serve as the irrigation water resource for the WCT agriculture development. Beyond just agricultural applications the R-1 water may be used for the irrigation of parks and open spaces as prescribed by the DOH reuse guidelines. Where acceptable, R-2 quality recycled water will be used as irrigation water for appropriate agricultural practices.

To meet the DOH requirement for recycled water effluent disposal an SAT network will be integrated into the effluent disposal program as a backup disposal system.

The WCT WWRF will be designed to produce State of Hawaii DOH-defined R-1 quality effluent as established by the Hawaii Administrative Rules, Tittle 11, Chapter 62 (HAR 11-62) and the State of Hawaii DOH Wastewater Branch, *Reuse Guidelines* (January, 2016). Recycled water irrigation is proposed as the primary method of disposal and used primarily for agricultural use and/or parks and open spaces. The WREF treatment process includes primary, secondary and tertiary treatment with filtration and UV disinfection.

The Waikapu Town Water Reclamation and Education Facility (WREF) will generate 0.65 MGD of R-1 recycled water upon full build out of the project. The following list per DOH Reuse Guidelines details the suitable uses for R-1, R-2 and R-3 water:

4.2. R-1 Suitable Uses:

A. Irrigation: All landscape and agricultural irrigation via spray, surface drip or subsurface drip irrigation.
B. Homes: Irrigation of a home on agricultural land or condominium property regimes provided there is a recycled water irrigation manager as described in Section K of the DOH Water Reuse Guidelines. Irrigation of single family residential homes without a recycled water manager is prohibited.
C. Farm Animals: Drinking water for livestock, and poultry with the exception of dairy animals that produce milk for human consumption.
D. Supply to impoundments:
    1. Restricted recreational impoundments such as golf course hazards, landscape water features, fountains, waterfalls
    2. Irrigation storage reservoirs and ponds
    3. Fish hatchery basins.
E. Dust control: Dampening, wet sweeping and/or wash-down of streets, roads, parking lots, walkways, etc.
F. Cleaning:
    1. Flushing toilets, urinals, and sanitary sewers where permitted by the applicable county plumbing code
    2. High pressure water cleaning of surfaces

3. Agricultural cleaning to wash down animals such as cattle, livestock, animal pens and housing.

G. Cooling of power equipment while cutting, coring or drilling pavements, walls and other hard surfaces;
H. Water jetting to consolidate backfill material around piping for recycled water, non-potable water, sewage, storm drains, gas and electrical conduits
I. Washing aggregate and concrete manufacturing
J. Boiler feed water
K. Industrial processes and industrial cooling
L. Cooling in air conditioning systems
M. Fire-fighting
N. Test water for gas pipeline testing.

4.3. R-2 Suitable Uses:

A. R-2 subsurface drip irrigation is allowed for the following:
    1. Golf course landscaping
    2. Parks, athletic fields, schoolyards, cemeteries
    3. Above-ground food crops (such as fruit trees) where the edible portion of the crop has minimal contact with the recycled water
    4. Impoundments without fountains or any other water features that generate spray or mist
    5. Landscapes around certain residential property such as condominiums that have a recycled water manager, as provided for in Section K, responsible for the landscape irrigation
    6. Freeway, roadside, and medial strip landscaping.
B. R-2 surface drip or subsurface drip irrigation is allowed for the following:
    1. Non-edible vegetation in areas with limited public access
    2. Sod farms
    3. Ornamental plants for commercial use
    4. Fodder, fiber, and seed crops not consumed by humans
    5. Timber and trees not bearing food crops.
C. Although R-2 spray irrigation is generally prohibited, R-2 spray irrigation may be allowed provided that an adequate buffer exists between the areas being sprayed and the adjacent residential or publicly accessible area. An adequate buffer can be accomplished by the following:
    1. Separation distance of 500 feet
    2. Physical barrier such as a wall or cliff
    3. Tall and dense vegetation
    4. Irrigating with potable water within the buffer area.

4.4. R-3 Suitable Uses:

A. R-3 drip or subsurface drip irrigation is allowed for the following:
    1. Non-edible vegetation in areas with limited public access
    2. Fodder, fiber, and seed crops not consumed by humans
    3. Timber and trees not bearing food crops.

4.5. Effluent Reuse for Agriculture

With approximately 1,077 acres of agricultural land available, along with approximately 32.44 acres of active/passive parks and 49.66 acres of proposed greenways and open spaces, the goal is to offset as much of the irrigation water demand with reclaimed R-1 water as possible. The near proximity of the agricultural lands allows for direct reuse of the reclaimed water for crop cultivation furthering the mission of a sustainable community. Another reason for utilizing recycled water for agricultural irrigation is that if the quality of recycled water degrades to R-2 quality (higher turbidity or bacterial levels), the recycled water can still be utilized (per DOH Reuse Guidelines) for the irrigation of many agricultural crops (energy crops, fruit trees etc.). Such a use will reduce the reliance of the alternate disposal system through the use of planned Soil Aquifer Treatment (SAT) basins.

Using a conservative estimate of 4,500 gallons of water required to irrigate each acre per day, it is estimated that approximately 139 acres of agricultural land will be required to utilize the entire volume of 0.65 MGD of recycled water during dry weather years. An alternative option for consideration is to use produced R-1 quality water for the irrigation of common areas and parks. This option would reduce the volume of recycled water available for agricultural irrigation and associated environmental benefits and may result in a more complicated and expensive recycled distribution system however, the optional use for open space irrigation is a proven and acceptable practice and is viable should demand warrant. The use of reclaimed water for agricultural irrigation will be done in the areas defined as “unrestricted” per the DOH Reuse Guidelines.

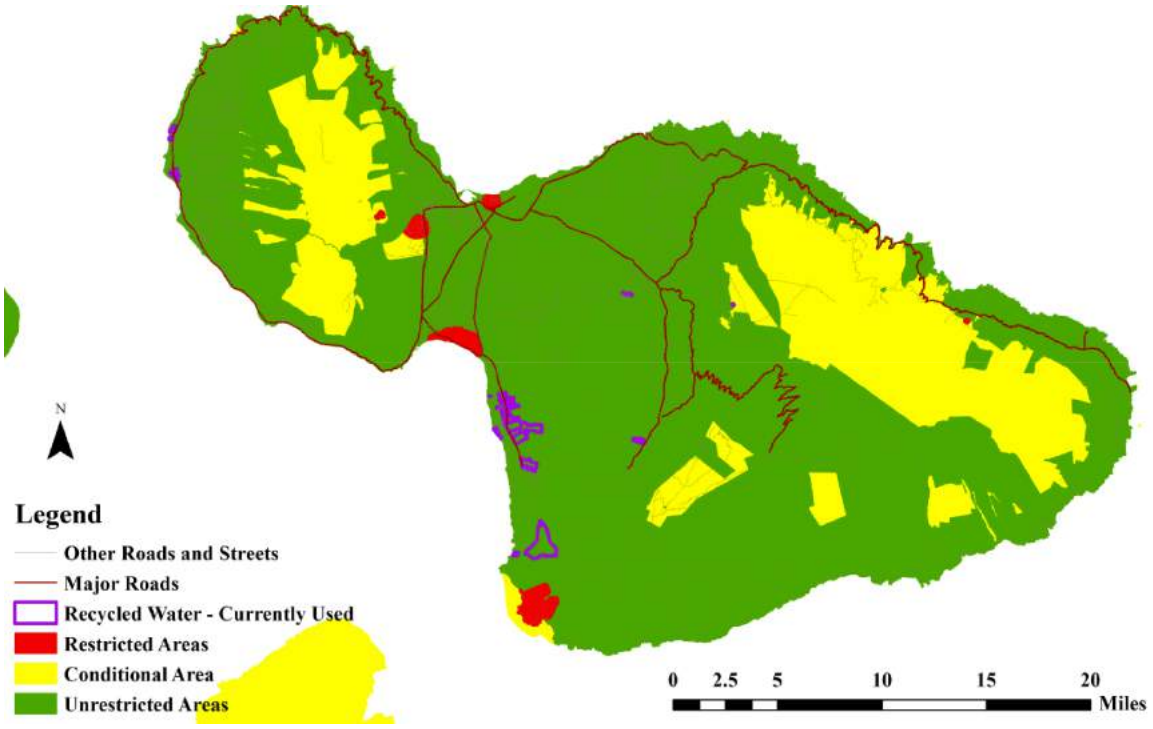


Image 2: Water Reuse Areas of Maui

As stated above, the expected 0.65 MGD of recycle water produced at buildout will irrigate at least approximately 139 acres of agricultural land during dry years. During wet weather years, more land will be required to utilize this volume. It is recommended that the area designated for recycled water use be doubled to approximately 278 acres to accommodate the entire 0.65 MGD of available recycled water during wet weather periods. Since approximately 1,077 acres of land are available for agricultural use, the area designated for recycled water use (278 acres) could be increased if needed to accommodate recycled water application as a means to reduce the use of SAT basins for wet-weather and backup effluent disposal. The rate of water demand is a function of the specific crop. In this analysis a conservative approach was selected assuming open field grass, however, the rate at which an agricultural crop is watered can be increased by selecting crops with greater water need (e.g. sorghum or sugar).

4.6. Alternative Disposal

Alternative disposal for excess reclaimed water and treated effluent which does not meet reuse standards must adhere to the Underground Injection Control Areas (UIC) or UIC lines. Areas below the established UIC lines are acceptable locations for effluent disposal practices (Image 3). This regulatory requirement is to ensure that the water percolating through the soil does not adversely affect the underlying potable water aquifer, irrespective of the method of disposal, such as injection wells or Soil Aquifer Treatment (SAT) (Image 4).

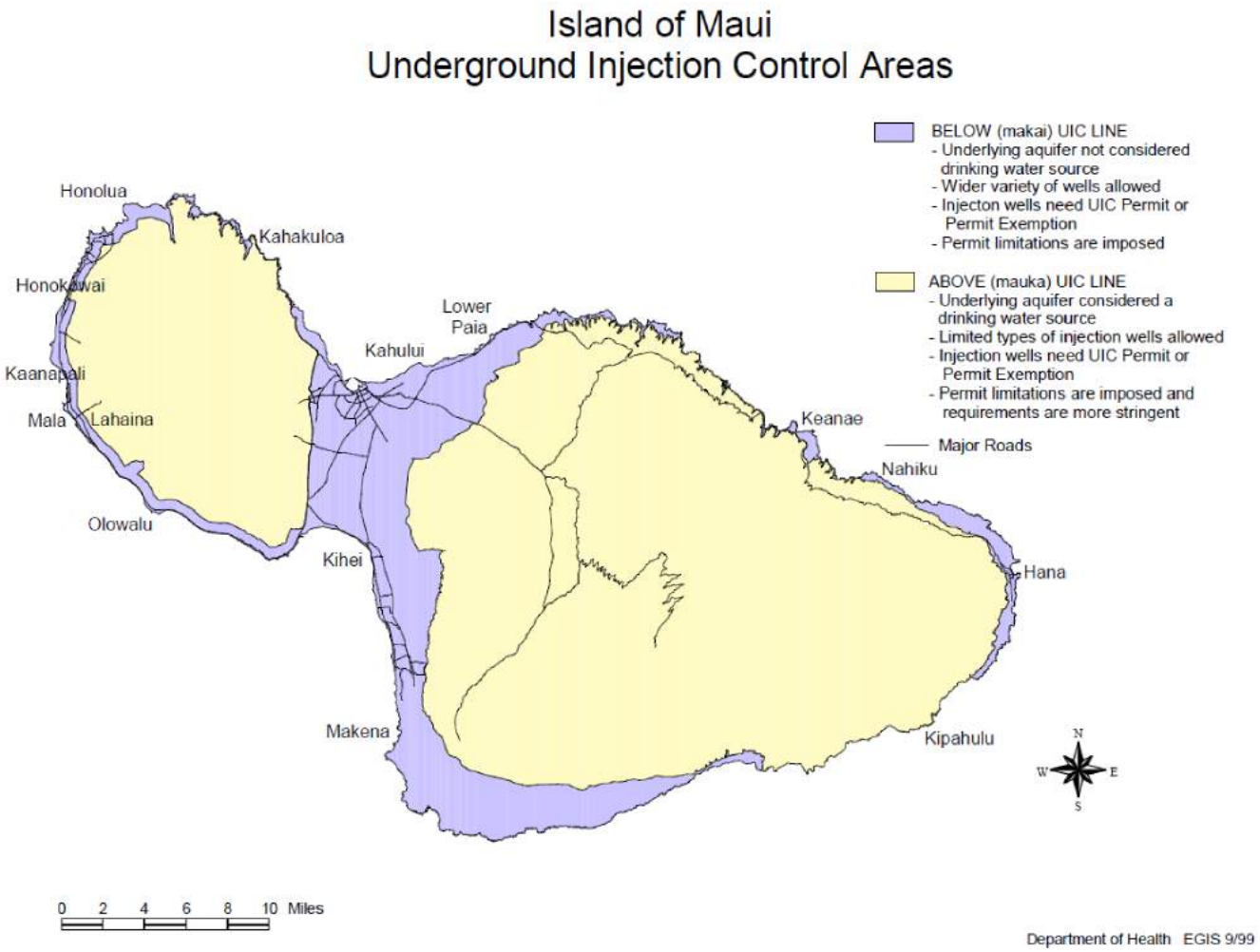


Image 3: UIC Line Maui

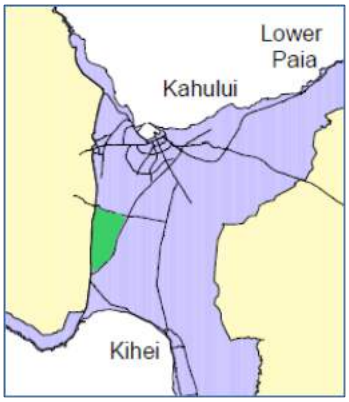


Image 4: Approximate Reuse and Alternative Disposal Area (in green)Below UIC Line

SAT basins are the preferred alternative disposal means as they provide additional buffer and further polish the water through slow percolation and reduce the possibility of contaminating the underlying aquifer when compared to injection wells. SAT basins use physical, chemical and biological treatment to wastewater/recycled water as it infiltrates and percolates through soil to groundwater. Nutrients (nitrogen, phosphorus), trace organics, heavy metals and endocrine disrupting compounds are removed thus making SAT basins a better choice than deep injection wells for disposing of excess recycled water. A SAT basin system consists of multiple basins that are built on soil that is porous. Recycled water that is not needed for irrigation or does not meet R-1 or R-2 standards and not suitable for water reuse would be intermittently applied to the basins over a period of several days. The preliminary required total basin area has been established at 5.6 acres ideally situated on site and/or adjacent, however, there will need to be geotechnical evaluations during the design phase to determine the actual final system size and exact location.

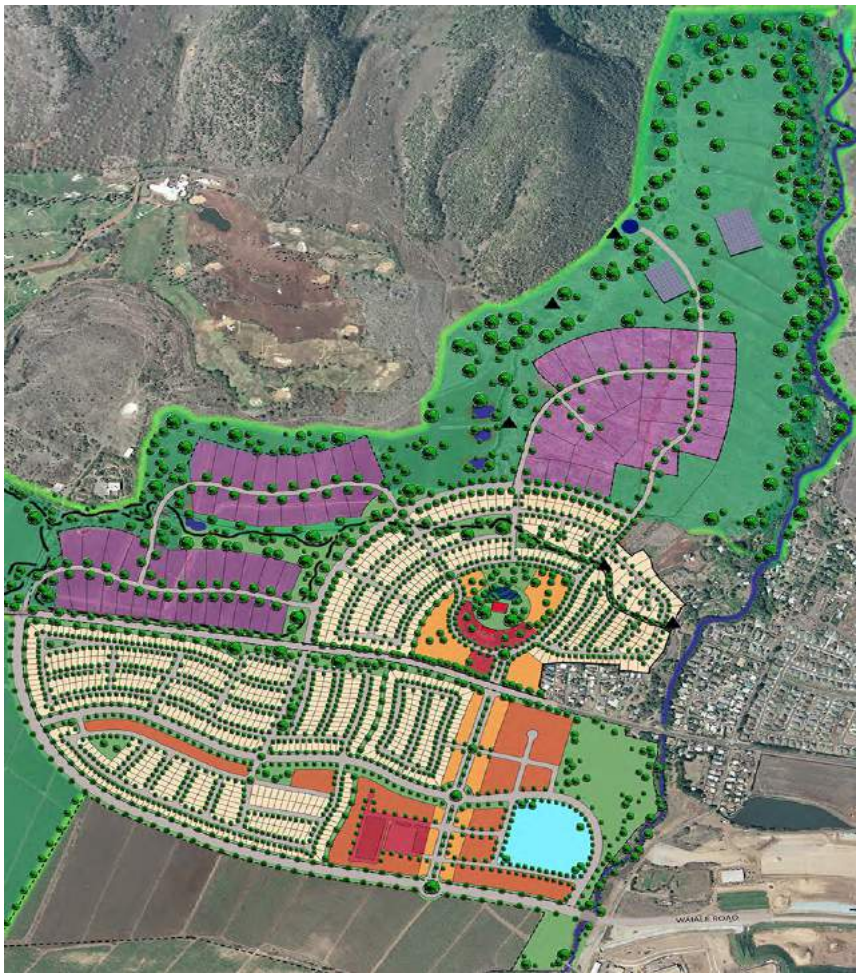


Image 5: Well Sites Approximate Locations (black triangles)

Soil Aquifer Treatment (SAT) refers to the process of treating wastewater effluent by percolating water through the unsaturated (vadoze) zone for the purposes of groundwater recharge and disposal. SAT utilizes physical, chemical and biological properties of the soil to improve the water quality of the wastewater effluent. The treatment benefits are initially attained during vertical infiltration of wastewater effluent through the vadoze zone and eventually during its horizontal movement in the saturated zone before it is extracted again from a recovery well for downstream irrigation. SAT has been used as a means of effluent treatment and groundwater recharge for hundreds of years throughout the world and is still a common methodology used in municipal and industrial applications.

Several factors are considered when determining the suitability for implementing a SAT system as well as selecting the type that is appropriate for a particular site. Factors that are considered include soil infiltration rates, aquifer characteristics, localized groundwater mounding, and plugging potential of the system. These factors are evaluated to assist SAT designers, operators, regulators, and the public in understanding the performance and compliance of a facility. There are a variety of different types of SAT systems including infiltration basins, leach fields, swales, and percolation ponds.

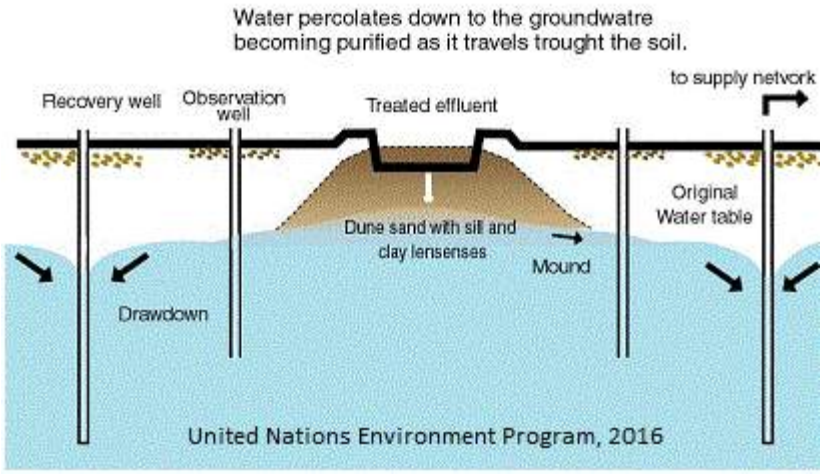


Image 6: SAT Basin Schematic

4.7. Supply Demand Analysis

Approximately 1,077 acres of land are available for cultivation of agricultural crops, along with approximately 32.44 acres of active/passive parks and 49.66 acres of proposed greenways and open spaces. At 4,500 gallons of water per acre per day during dry years, about 4.5 million gallons per day would be required to irrigate the entire 1,077 acres using a conservative crop uptake factor. Thus, the daily volume of 0.65 MGD of recycled water would fall far short of meeting the irrigation requirement of the entire agricultural site. Supplemental non-potable water would be required to satisfy the entire irrigation demand of the agricultural land and this fact provides the WCT with tremendous flexibility in managing its recycled water supply since the water demand of the agricultural area will greatly exceed the volume of recycled water produced. The reuse of R-1 water is preferable in the large area highlighted in blue (Image 7) due to proximity and on-site drainage pattern, however, can be applied to open park spaces as well should demand warrant.

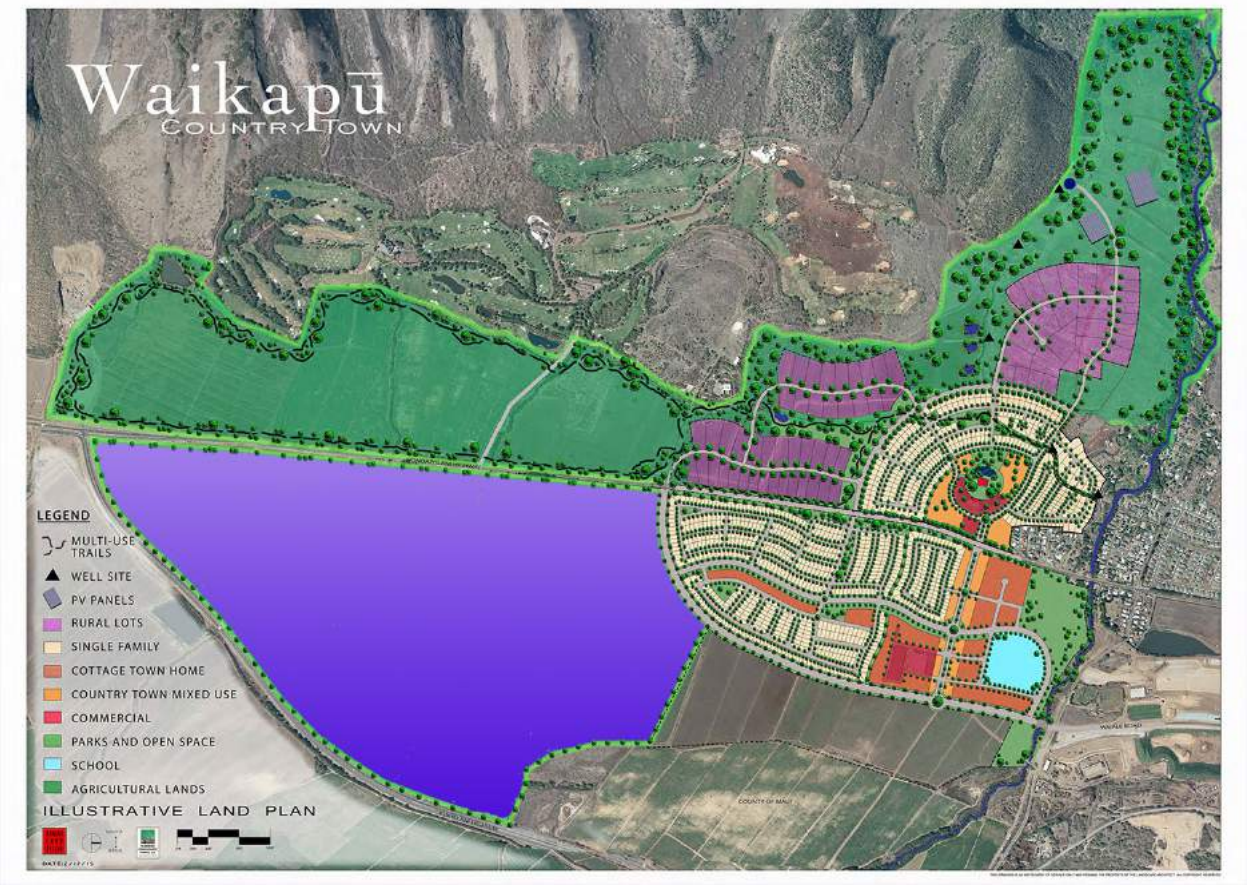


Image 7: Proposed Reuse Acreage (not limited to) within Blue Area

4.8. WREF Operating Cost and Revenue

Recycled water is a commodity governed by supply and demand with rate structures approved by the PUC and/or the CoM. The wholesale of recycled water can significantly offset operational costs of the WREF depending on who the buyer is. Despite current municipal recycled water rates on Maui being lower than rates on neighboring islands, they serve as a good metric to identify potential revenues that can be realized through the sale of recycled water.

User Categories	CoM Recycled Water Rates (per 1000 gallons)
Major Agriculture	$0.25
Agriculture (including Golf Courses)	$0.40
All Others	$1.50

Table 6: Recycled Water Rates

It is advisable to analyze the off-takers from an economic perspective in order to maximize potential revenues. Table 7 illustrates three (3) options assuming full buildout of WCT at 1,517 units, and a sewer fee of $80. Of this $80 we allocate $40 towards the operation of the facility with the other portion dedicated to the maintenance of the wastewater network. Recycled water revenue assumes 650,000 gpd sale of R-1 water and $40 revenue per unit.

	User Categories	Recycled Water revenue	Sewage Fees	Total Operating Revenue
Option 1	Major Agriculture	$59,313	$728,160	$787,473
Option 2	Agriculture	$94,900	$728,160	$823,060
Option 3	All Others	$355,875	$728,160	$1,084,035

Table 7: WREF Operating Income

Operating expenses are a function of wages, electrical cost, equipment maintenance, chemicals, biosolids disposal costs, materials and miscellaneous expenses such as permit filing fees, insurance and regulatory compliance costs. One of the most effective ways to decrease operational costs is to offset electricity purchase from the utility by generating electricity on site using solar photovoltaic renewable energy and or wind energy. Not only will this further the mission of sustainability but it provides a tangible cost benefit that can be enhanced by taking advantage of the available state and federal tax credits and/or rebates. It is estimated that the

650,000 gpd Organica FCR facility will use approximately 306,855 kWh of electrical power per year. The following table shows the estimated operating expenses over the course of one year at full buildout.

Cost Category	Total
Personnel cost	$610,500.00
Energy Cost	$116,605.09
Sludge handling	$106,758.24
Materials/Maintenance	$52,000.00
Misc. (insurance, permit fees, etc.)	$14,000.00
Total	**$899,863.33**

Table 8: WREF Operating expenses without solar

The types of personnel required to operate the facility are:

a. Superintendent or Supervisor - this person would oversee all operations and maintenance and could handle administrative functions including budget preparation and associated accounting/clerical duties along with educational responsibilities.
b. Plant operators - two full time certified operators are required. Besides operating the plant, the operators could perform basic preventative maintenance including pruning the FCR vegetation/yard work/janitorial duties, recycle water system monitoring and meter reading, and perform laboratory duties and guided tours included in educational responsibilities.
c. Mechanical and Electrical maintenance personnel (note: these positions may not need to be full time and they could be contracted out, however, for conservative cost estimation purposes both positions are calculated based on fulltime employment).

As an R-1 facility, 7 days per week bacteriological monitoring of the recycled water is required. This means that on weekends, an operator will need to be on duty at least 1/2 day to oversee the plant and perform the lab work. Salary estimates used for calculating labor are based on County of Maui Wastewater Division pay scales and assume one full time position for mechanical maintenance personnel and one full time position for electrical/instrumentation maintenance personnel.

Removal of the biosolids from the facility will not be needed every day; however, will likely be about once or twice per week. The dewatering of the biosolids will be handled by the plant operators. However, the hauling should be contracted out to a waste disposal company. Costs are based on 2 times off haul per week and Maui EKO cost of $103 per ton for processing.

The plant operators are to handle the yard work and pruning the FCR vegetation. The Education Facility is to be part of the job description of the Supervisor and/or plant operator. Educational duties will include guiding of school groups, private tours and basic introduction to the biological wastewater treatment process. Collaborating with outside companies to use the Educational Facility as a place to provide workshops and training to operators is an ancillary service the WREF would provide for a fee.

The following table illustrates the operational savings that can be realized by utilizing onsite renewable energy generation assuming the solar PV system offsets 75% of the power purchased from the utility company.

Cost Category w/ onsite solar energy	**Total**
Personnel cost	$610,500.00
Energy Cost	$29,151.27
Sludge handling	$106,758.24
Materials/Maintenance	$52,000.00
Misc (insurance, permit fees, etc.)	$14,000.00
Total	**$812,409.51**

Table 9: WREF Operating expenses with solar

When comparing operating costs with potential revenue streams, it is apparent that the sale of R-1 water coupled with optimized operating cost and sewage fees allow for the possibility of positive operating finances.

User categories	Total Operating Revenue	Operating Cost (w/ solar)	**Net Result**
Option 1	$787,473	$812,410	**-$24,937**
Option 2	$823,060	$812,410	**$10,650**
Option 3	$1,084,035	$812,410	**$271,625**

Table 10: Net Financial Operating Result

4.9. Nutrient Residuals in R-1 Recycled Water

The Organica FCR wastewater treatment process is designed to reduce nutrient concentrations of nitrogen and phosphorus as well as trace organic compounds. Total nitrogen will be reduced to below 10 mg/L and Total phosphorus will be reduced to below 3 mg/L. The nutrients that do remain will serve as a fertilizer source for the vegetation that is irrigated with the recycled water and thus reduce the overall fertilizer requirements of such vegetation. The SAT basins, when used for disposal of excess recycled water, will also be capable of removing nutrients, trace

organic compounds, heavy metals and endocrine disrupting chemicals through natural processes as the recycled water percolates through the soil and landscape root zone.

4.10. Biosolids Management

Biosolids (sludge) removed from the WWRF will be dewatered at the facility with a biosolids dewatering unit and hauled to Maui EKO Systems located at the Central Maui Landfill. WCT will contract with Maui EKO Systems to process the biosolids into a usable soil amendment. The Environmental Protection Agency currently oversees biosolids for Hawaii. However, Hawaii plans to seek authorization of EPA's program in the future. Hawaii State Department of Health (DOH) places biosolids conditions in NPDES permits and tracks compliance through its wastewater branch.

4.11. WREF Site Location

During the initial analysis two locations were identified as potential WREF host sites. The following criteria were the primary drivers in selecting the ideal location:

- Proximity to planned wastewater collection system network
- Proximity to reclaimed water users
- Prevailing winds and possible odor impacts
- Pumping costs and network optimization
- Environmental impacts
- Drainage and flooding impacts
- Expansion and interconnection potential for offsite users
- Accessibility

Site Location A, located at the North-East corner of the development did provide enough acreage, however, it did not satisfy the the majority of the criteria listed above. Furthermore, the near proximity of the Waikapu stream raised concerns of the location being too close to a potential flood plain. The table below details attributes a score of -3 as the worst and +3 as the best.

Considerations	Location B	Location A
Proximity to planned wastewater collection system network	3	1
Proximity to reclaimed water users	3	1
Prevailing winds and possible odor impacts	1	0
Pumping costs and network optimization	2	0
Drainage and flooding impacts	3	-1
Expansion and interconnection potential for offsite users	2	2
Accessibility	2	2
Total	**16**	**5**

Table 11: Optimal Site Location Matrix

Site Location B is located near the South-East edge of the development. This location does satisfy the criteria listed while allowing for reclaimed water to be used for agricultural and/or open space irrigation. It is located adjacent to the agricultural site of reuse, reducing pumping and energy consumption which further reduces the carbon footprint of WCT.

Image 8: Mana Water Site Location A

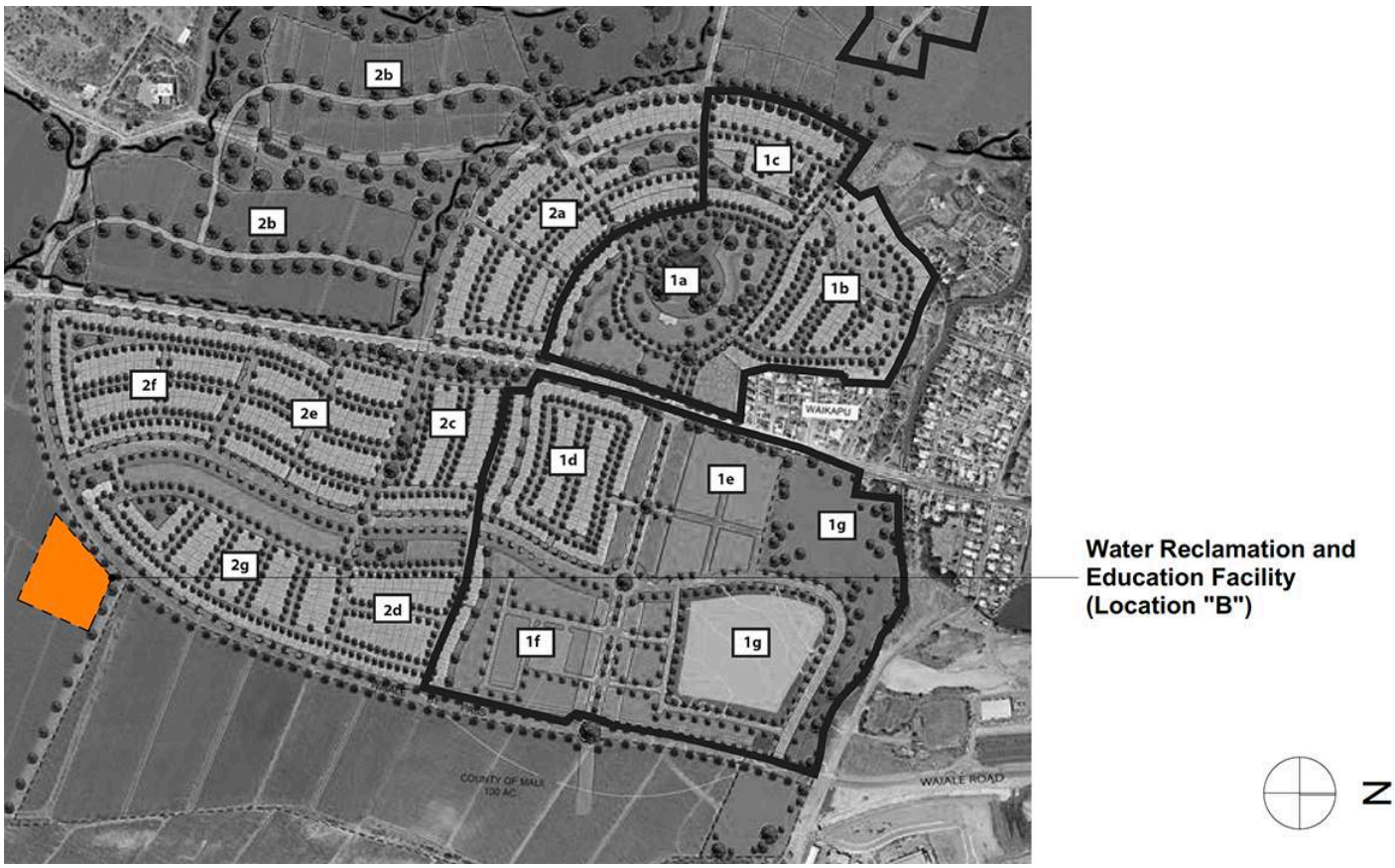


Image 9: Mana Water Site Location B

5. Education Center

5.1. Public Education

A key component of any successful wastewater treatment system and water reuse program is proactive public education. The proposed education center will be utilized by the WCT community and the general public to learn how wastewater is treated and how recycled water is beneficially reused. The Recycled Water Supervisor, as part of his/her work responsibilities will manage the public education program and utilize a variety of tools within the education center including videos, slide presentations, poster boards, and microbiology demonstrations to educate schools, community groups, environmental organizations etc. about wastewater treatment and

reuse. Tours of the wastewater reclamation facility and water reuse sites will be provided in conjunction with the presentations provided at the education center.

Image 10: Mana Water Education Facility Rendering

5.2. Operator Training

Furthermore, the WCT Water Reclamation and Education Facility (WREF) will serve as a training room for the project's wastewater, water and recycled water distribution system operators. Both professions require State of Hawaii DOH certification thus the education center will provide an excellent location for operations personnel to prepare for their respective certification examinations as well at train entry level operations personnel on the basics of wastewater treatment and water distribution. The inclusion of an education center will greatly contribute to the success of the wastewater treatment and recycled water component of this project and be a source of community pride for years to come.

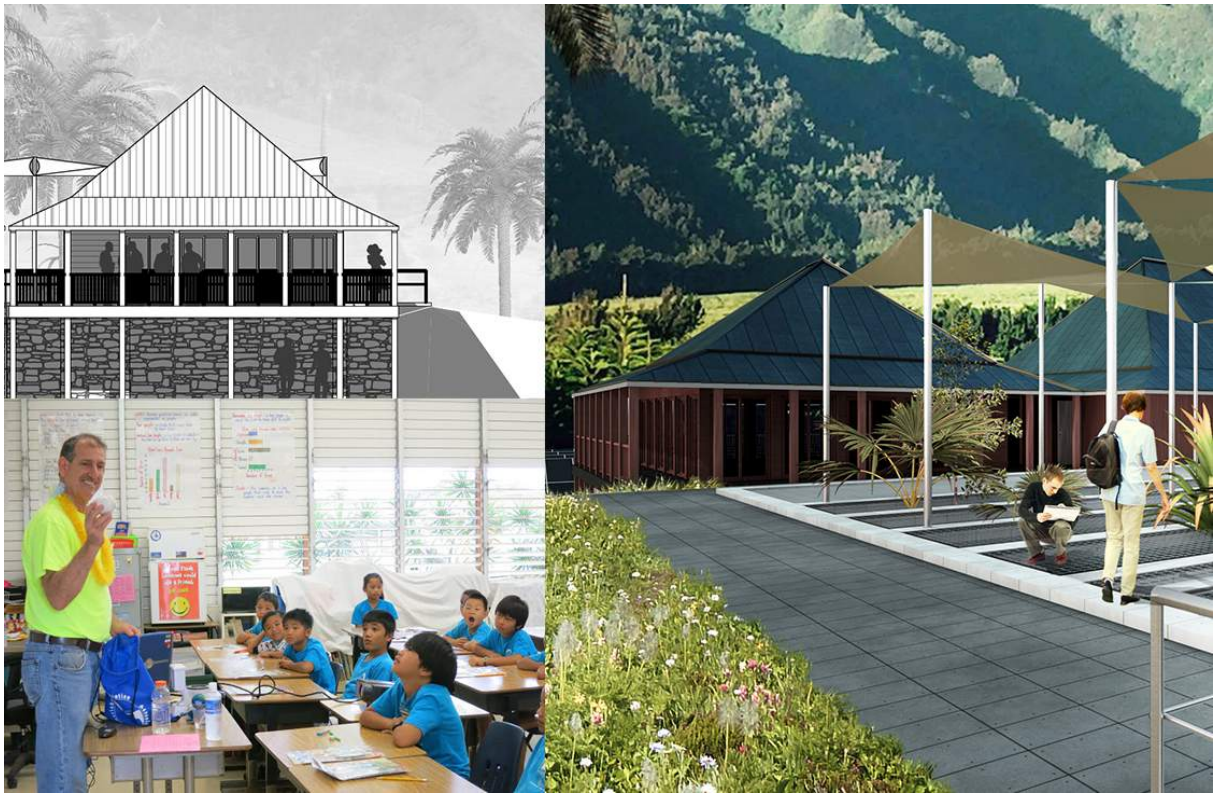


Image 11: Mana Water Member Steve Parabicoli in Action, Doing Water Reuse Outreach Education at Lihikai Elementary School (May 21, 2013 Maui) and renderings

6. Wastewater Treatment Facility Operation

6.1. Introduction

Organica solutions utilize a Food Chain Reactor (FCR) configuration, consisting of biological treatment in successive reactor zones utilizing fixed biomass on a combination of natural plant roots and Organica's engineered biofiber media, along with a limited amount of suspended biomass.

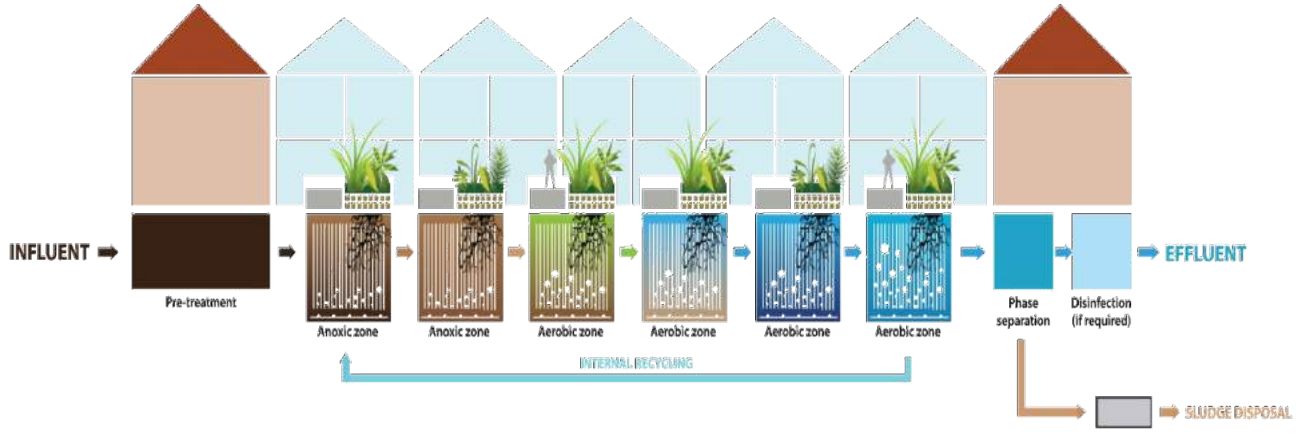


Image 12: Organica Process Diagram of Food Chain Reactors (FCR)

6.2. Organica FCR Operation

Organica FCR facilities are highly automated with minimum operator intervention required. Equipment and basic principles of operation are similar to conventional wastewater treatment. In selecting the technology Mana Water carefully examined the operator sophistication required to operate this type of facility to ensure that the level of sophistication, at minimum, does not exceed that required at conventional WWRFs on Maui. Generally, the level of sophistication required is significantly lower than a membrane bioreactor (MBR) and comparable to a conventional activated sludge (CAS) plant. It is anticipated that operation of the WREF will require:

- 1 superintendent/Supervisor
- 2 operators
- 1 part time mechanical maintenance personnel[1]
- 1 part time electrical maintenance personnel[2]

[1] can be outsourced
[2] can be outsourced

An operator that currently operates any of the Maui facilities will be competent in operating an Organica FCR facility. Mana Water in collaboration with Organica will provide operator training at the time of commissioning. Maintenance of plants (vegetation) can be done by the same personnel that manage the facility. Plant (vegetation) maintenance is similar to a home garden or other landscaping.

6.3. General Introduction to Organica FCR

Organica FCR solutions consist of a series of biological treatment zones simultaneously utilizing both fixed biofilm and suspended biomass in the reactors. Biodegradation of influent contaminants is accomplished by the combination of fixed and suspended biological cultures. Biomass in the Organica FCR is primarily fixed-film, utilizing natural plant roots along with additional engineered (biofiber) media as biofilm carriers. As influent travels through the FCR zones, the available organics and nutrients (various carbon, nitrogen, and phosphorus fractions) are consumed and/or transformed. As a result, the composition of the ecosystem fixed in the biofilm changes from zone to zone, gradually adapting to localized conditions as the organic and nutrient concentrations vary, as well as dissolved oxygen content. The end result is a specially-adapted ecosystem in each zone, acclimatized to the specific conditions to maximize treatment efficiency.

6.4. Advantages of the FCR Solution

A significant fraction of microorganisms responsible for biodegradation is in fixed-film form (attached growth). Benefits of fixed-film solutions include:

- Mixed liquor suspended solids (MLSS) concentrations significantly lower than conventional activated sludge systems
- Improved aeration & mixing efficiency (reducing energy requirements)
- Flexible phase-separation alternatives, including option of direct filtration (without clarifiers) to conserve space
- Increased concentration of active biomass in the treatment zones
- Eliminated requirement for sludge recirculation (RAS)
- Longer effective SRT (sludge age); resulting in more complex organisms with longer lifecycles (unicellular cilia, larvae, arthropods) establishing themselves on the biofilm
- Eliminated potential for biomass "washout"
- Significant reduction in biological reactor space requirements

6.5. Plant Roots Are Ideal Biofilm Carriers

Plant root specific surface area is an order of magnitude higher than most artificial carrier media, resulting in higher concentrations of active biomass.

- Plant roots are not susceptible to clogging, thus reducing operational risk.
- Plants excrete small amounts of organic acids from their root surfaces which act as a food source for the biofilm. This is of high importance when the influent organic load is low. This symbiotic relationship helps bacteria survive starvation periods, resulting in a larger and more diverse population of bacteria in the system when the wastewater load is re-established. As a result, FCR facilities have far greater flexibility compared to conventional activated sludge systems.
- Utilization of marsh plants (reeds, sedges, bulrushes, etc.) transport oxygen to their roots and increase biofilm activity.
- Plant roots provide a better habitat for slow-growing species, such as nitrifiers and eukaryotic organisms, resulting in improved nutrient removal performance over conventional processes.

Image 13: Organica FCR Facility

6.6. The Main Unit Processes

The main unit processes of the proposed facility include

1. Pretreatment
2. Biological Treatment
    - FCR multi-zone reactor with 6 zones in each reactor train
3. Secondary Phase Separation
    - Coagulation
    - Flocculation
    - Secondary clarifier or filtration
4. Tertiary Treatment
    - Tertiary filtration
    - UV disinfection
5. Solids Management
    - Sludge storage tank
    - Sludge thickening and dewatering
6. Reuse and Disposal
    - R-1 storage
    - R-1 pump station
    - SAT basin

6.7. Odor and Noise Control

Odor release from a WREF is a critical concern of the neighboring residents and businesses and must be addressed during the design phase of the WREF. The WREF will locate odor producing processes in buildings to contain and treat the potential foul odors prior to discharging the treated air to the atmosphere. Based on the size of the proposed collection system at WCT the collected wastewater is expected to reach the WREF in a relatively short period of time, thus minimizing the possibility of anaerobic conditions to develop within the collection system. This is based on a recommended design minimum flow rate of 2 feet per second in the collection system. During the early stages of build-out it is possible that the wastewater flow will be lower than design capacity, resulting in longer detention time of raw sewage in the collection system. A preventative maintenance program is recommended to prevent solids deposition in the collection system by means of regular flushing and the addition of caustic soda (as required) in order to reduce H2S formation. The WREF is committed to reducing the H2S concentration at the fence line to at or below 5 ppb to eliminate off-site odors. This concentration is well below the State air

requirement for instantaneous concentration of hydrogen sulfide of 25 ppb or less. The sewage intake and headwords equipment is to be housed in a contained pre-treatment building equipped with air filters. Proven and reliable technologies will be incorporated into the planned odor mitigation. Noise control is mitigated by machinery (blowers, scrubbers) being confined to the enclosed pre-treatment area. Minimal noise associated with off haul and/or pumping of sludge is to be limited to 1-2 times per week and scheduled during normal business hours.

7. WREF Site Plan and Location

Mana Water, in conjunction with Kennedy/Jenks and Waikapu Country Town, has worked to develop a Water Reclamation and Education Facility that can serve as a model facility for the state of Hawaii. The following goals were set during the design process:

- Meet and/or exceed water treatment and reuse standards as set for the by the State Department of Health
- Reuse up to 100% of reclaimed water when feasible
- Use an innovative approach while staying within the bounds of industry accepted biological treatment standards
- Minimize the amount of land acreage allocated for structures
- Provide public outreach and education through dedicated facility
- Minimize any noise or odor impacts on neighboring community
- Design facility with best practice sustainable development standards
- Design facility to be both visually and aesthetically appealing
- Use natural processes where possible
- Integrate native Hawaiian plants for the landscaping and in Organica FCR plant racks
- Use renewable energy to offset as much power as possible

With odor causing processes contained in the pre-treatment area, the biological treatment process allows for a botanical garden style treatment area that is pleasant and accessible. In stark contrast with traditional wastewater treatment systems, with their exposed concrete reactors, large footprint and foul odors, the Organica facilities allow for an aesthetically pleasing approach to wastewater treatment embraced by communities around the world with over 80 facilities globally.

Image 14: Architectural Rendering of WCT WREF

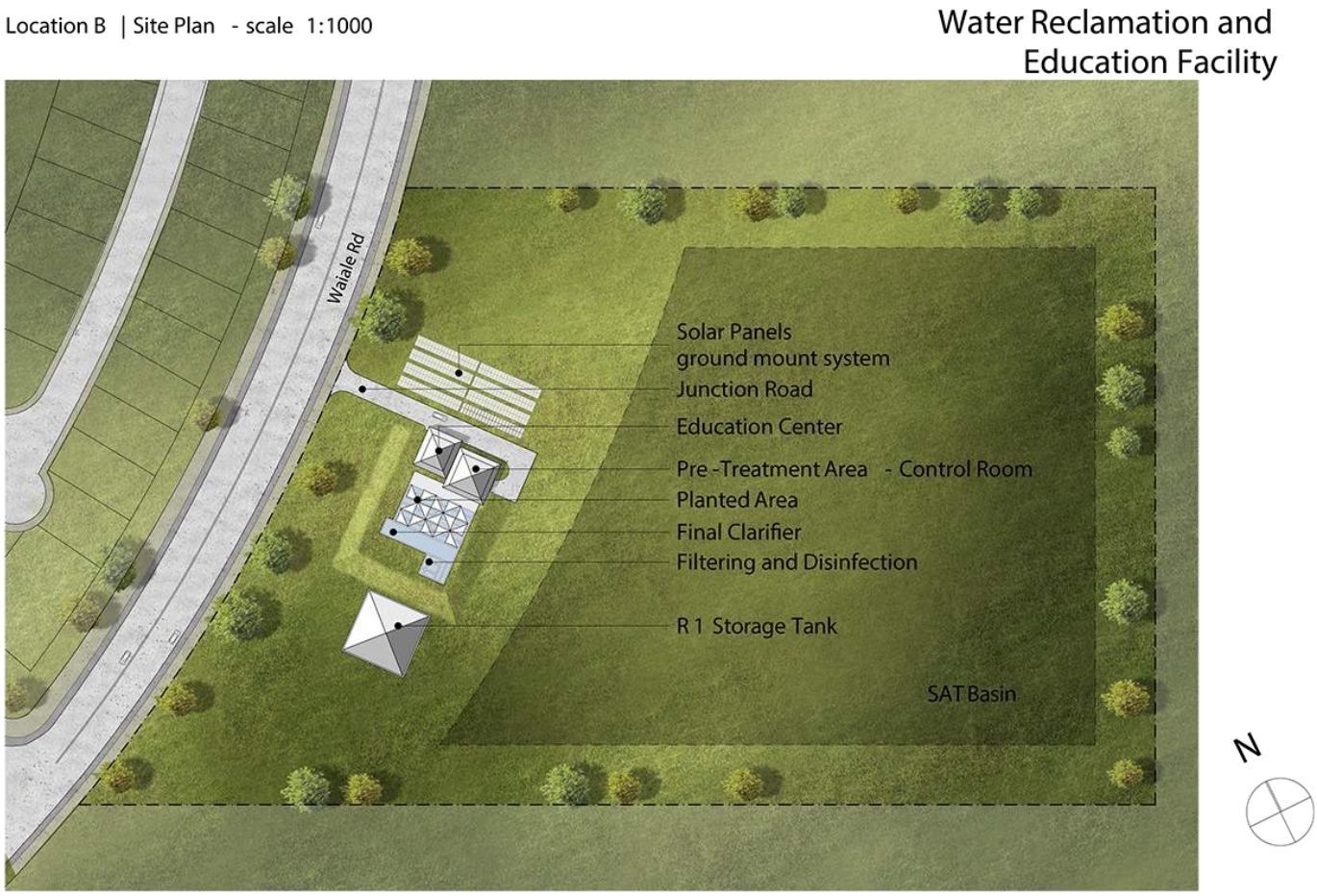


Image 15: Preliminary WCT WREF Site Plan. Total Area 12 acres, SAT basin 5.6 acres

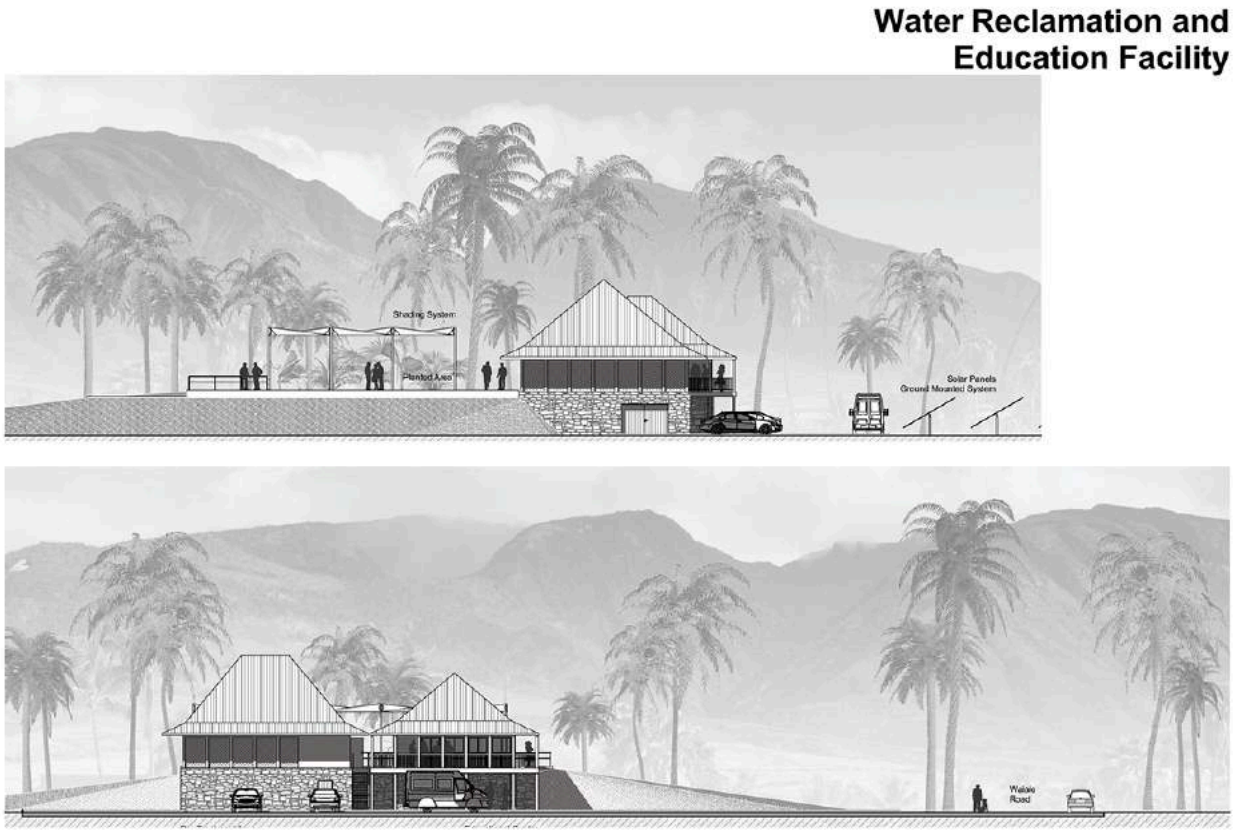


Image 16: Preliminary Rendering of WCT WREF Elevations

8. Cost implications and Phasing

8.1. Total Cost Estimates and Phasing

In order to most economically construct and commission the WREF, it is possible to synchronize certain aspects of the treatment process with the build out of WCT. While it is necessary to maintain the full treatment and redundancy requirements, not all phases of the treatment process need to be completed to 100% of expected final capacity. For this reason, the preliminary WREF design is a two train reactor system in order to allow for commissioning of each train in sync with the two phase build-out of WCT. By phasing WREF construction in tandem with WCT build-out, significant upfront capital cost savings can be realized in equipment such as headworks, limited secondary treatment commissioning, tertiary filtration, UV disinfection channel, aeration diffusers etc.

Scope	Phase1 ($M)	Phase 2 ($M)	Total ($M)
Engineering	$1.78	$0.20	**$1.98**
Civil Works	$1.61	$0.37	**$1.98**
Mechanical & Electrical	$3.10	$1.03	**$4.13**
Primary Treatment Process	$1.82	$0.93	**$2.75**
Secondary Treatment Process	$4.73	$3.15	**$7.88**
Tertiary Treatment Process	$1.69	$1.13	**$2.81**
Reuse and disposal system	$2.69	$1.13	**$3.82**
Solar PV Electric	$0.25	$0.25	**$0.50**
Total	**$17.66**	**$8.19**	**$25.84**

8.2. Cost Reduction Strategies

From technical and ecological perspectives, a private water reclamation facility is an enabling factor for sustainable development allowing for treatment and reuse to happen on site, while reducing reliance on county owned and operated municipal infrastructure. However, from an economic perspective, building and operating such a facility can burden the total cost structure of the overall development to a point where it may not be economically viable. To ensure a successful project both economically and environmentally the following cost reduction methods are encouraged:

- Following final approvals and master development plan, revisit the CoM Flow rates. As explained in this report, the CoM Flow rates are conservative and experience has shown that new developments indeed contribute significantly less wastewater than older existing dwellings. The case would have to be made with the appropriate agencies to justify such claims; however, the data is available and viable.
- Work with the CoM to offer capacity to surrounding neighborhoods (e.g. Wailuku Heights) using municipal infrastructure, to relieve the Kahului WRRF. It is known that the County facilities are under pressure from the EPA to stop using injection wells. One approach, specific to Kahului, is to incrementally decrease the influent flow to the facility by either setting up scalping plants along the sewage collection network or send wastewater to private facilities. The CoM "Capital Improvement Projects Report" has $46 million listed for a Central Maui Regional WWRF (Waikapu) [3]. Another issue surrounding the Kahului WRRF is its location within the federally designated tsunami zone and it would benefit all of Maui if that facility was relocated.

[3] County of Maui "Capital Improvement Projects Report" March 31, 2016

- Coordinate with neighboring developments (e.g. A&B Waiale, Pacific Rim and Land Waiko base yard, CoM Parks and Recreation) to invest in this facility and arrange a capital cost structure whereby they are charged a $/Gal fee to interconnect to the WCT WREF.
- Federal, State, USDA, and Rural Development funds exist for projects of this scope; including bonds, low interest loans etc. The securing of these funds are subject to application and the fulfilment of a variety of requirements. The availability of such funding mechanisms will need to be researched and a roadmap prepared in order to begin the application processes.

9. Company References and Background

9.1. Mana Water

2010 Honoapiilani Hwy., C-1
Lahaina, Hawaii 96761
www.mana-water.com
Project Manager: Zoltan Milaskey
Treatment and Reuse Manager: Steve Parabicoli

Mana Water is a management company created to usher in the next generation of wastewater treatment and reuse, striving to set a benchmark for the twenty-first century wastewater treatment infrastructure in Hawaii. Mana Water is aware of the current and foreseeable issues surrounding Hawaii's water resources. Not only is water scarce, but outdated wastewater treatment infrastructure and the limited reuse of effluent, all within a very prestigious and sensitive ecosystem, are further endangering our supply of clean water. Mana Water has partnered with the best in the industry locally and globally to provide solutions to Hawaii's wastewater challenges.

9.2. Organica Water

61 Princeton-Hightstown Road
Princeton, NJ 08550
www.organicawater.com
Project Coordinator: Peter Varga

Organica Water is a global provider of innovative solutions for the treatment and recycling of wastewater with operating references in North America, Europe and Asia. With nearly two decades of experience and more than 50 operating references that utilize root structures as a biofilm carrier, Organica offers proven, economic, and sustainable solutions for today's wastewater management challenges.

9.3. Kennedy/Jenks Consultants

220 Imi Kala Street, Suite 205
Wailuku, Hawaii 96793
www.kennedyjenks.com
Senior Engineer: Eassie Miller

Kennedy/Jenks provides engineering and scientific solutions for water, environmental, energy, and innovative projects to government agencies and private utilities, industry and business, federal programs, and transportation clients. Kennedy/Jenks is employee-owned, with offices throughout the United States.

9.4. SYM Engineers LLC

390B Haleloa Place
Honolulu, Hawaii 9681
Structural Engineer: Shawn Matsumoto

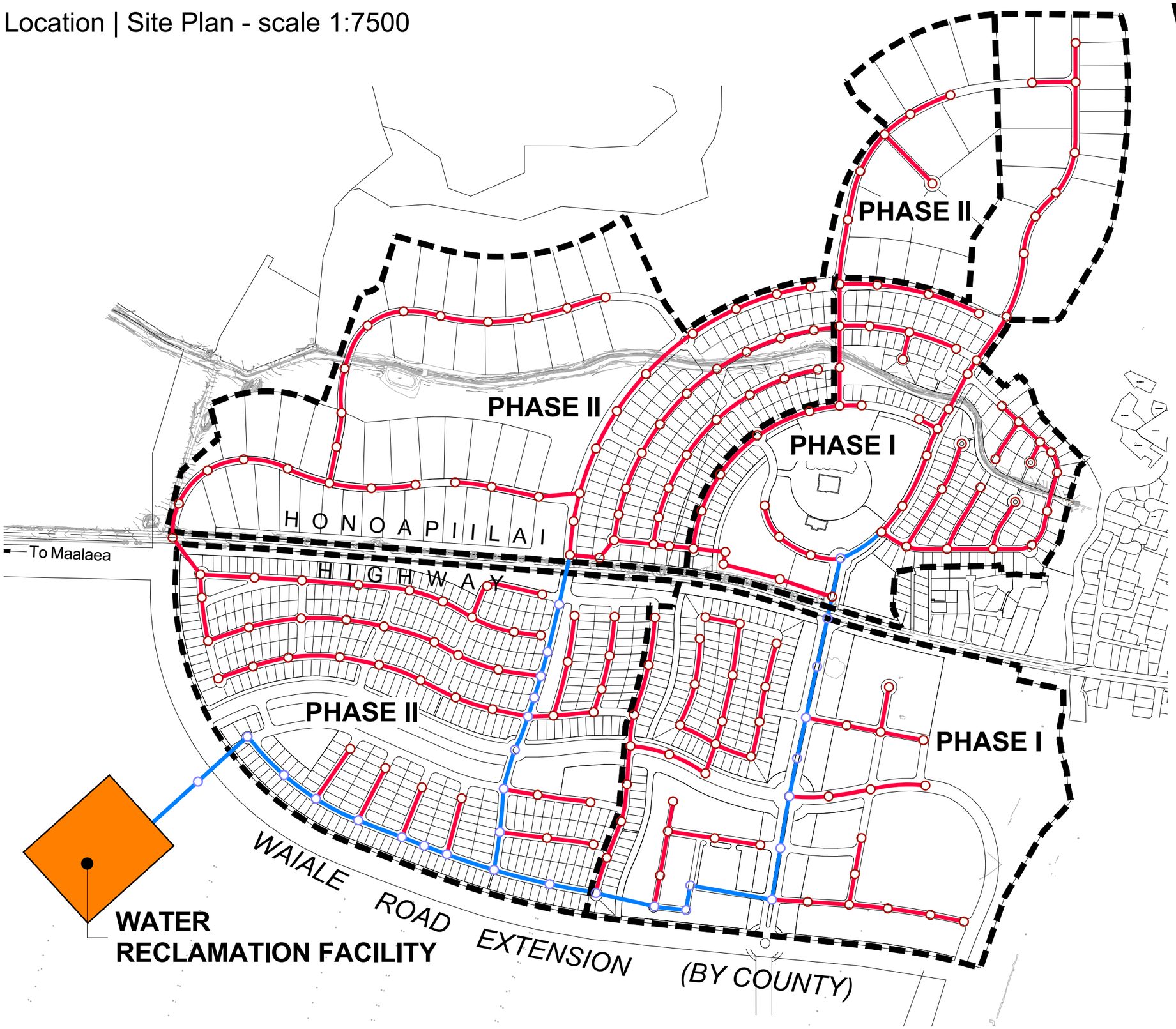
SYM Engineers LLC of Honolulu is a structural engineering firm licensed in the state of Hawaii. Engineering services include structural designs for new construction, repairs and renovations of various types of buildings and structural components. With over two decades of experience, SYM Engineers LLC has formulated structural framing schemes for a large variety of project types for both private and public sector clients. Design specialty includes a wide variety of structural systems using a large array of materials such as but not limited to, poured-in-place concrete, precast/prestressed concrete, post-tensioned concrete; structural and light-gage steel; concrete masonry; and timber.

10. Appendix 1 - Preliminary Architectural Renderings

10. Appendix 1 - Preliminary Architectural Renderings

Location | Site Plan - scale 1:7500

Water Reclamation Facility



N

Proposal - 1

Location A | Site Plan - scale 1:7500

Water Reclamation Facility

Water Reclamation Facility (Location "A")

N

Location B | Site Plan - scale 1:7500

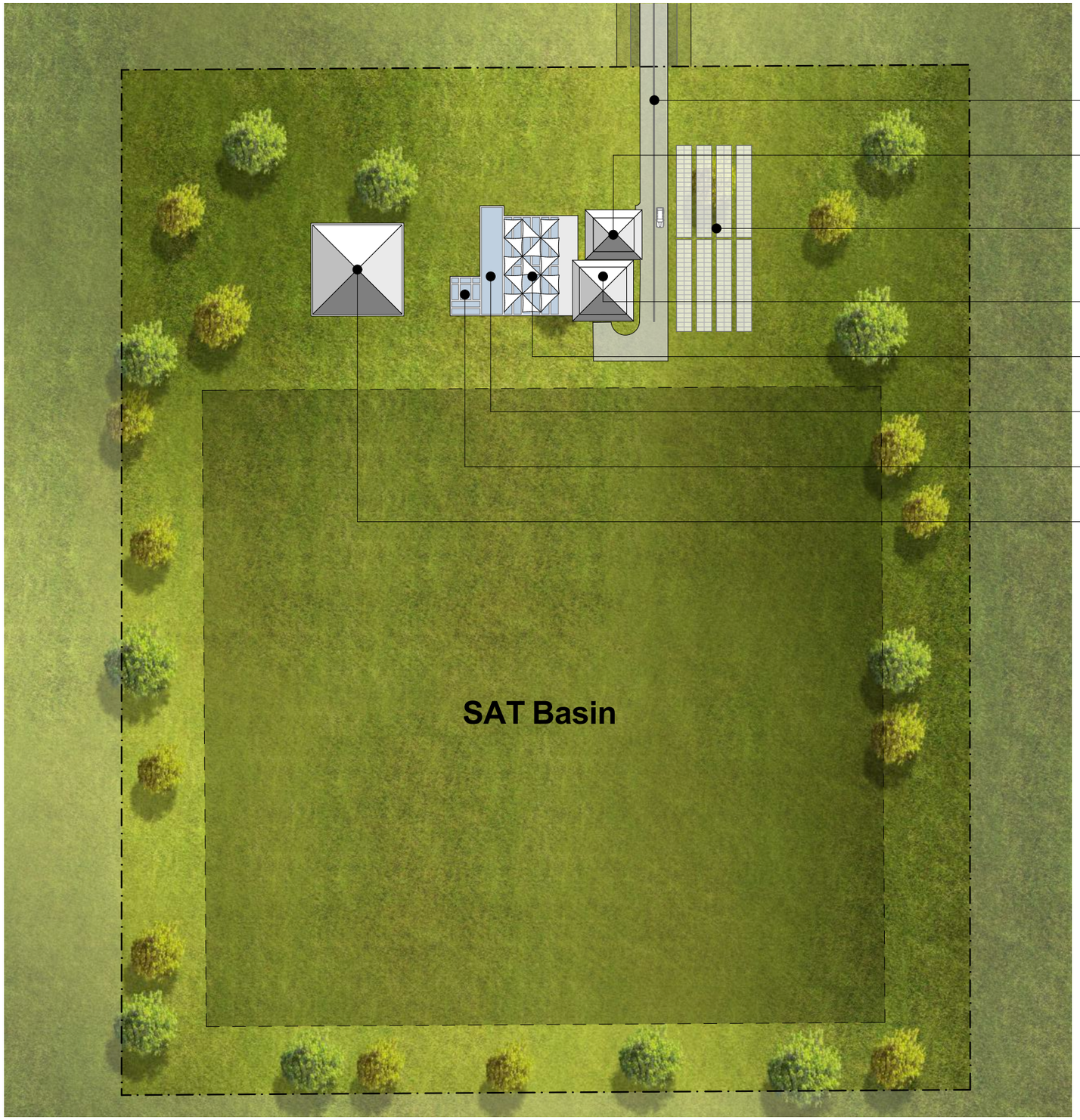
Water Reclamation Facility

Water Reclamation Facility (Location "B")

N

Location | Site Plan - scale 1:1000

Water Reclamation Facility



Junction Road

Education Center

Solar Panels
ground mount system

Pre-Treatment Area - Control Room

Planted Area

Final Clarifier

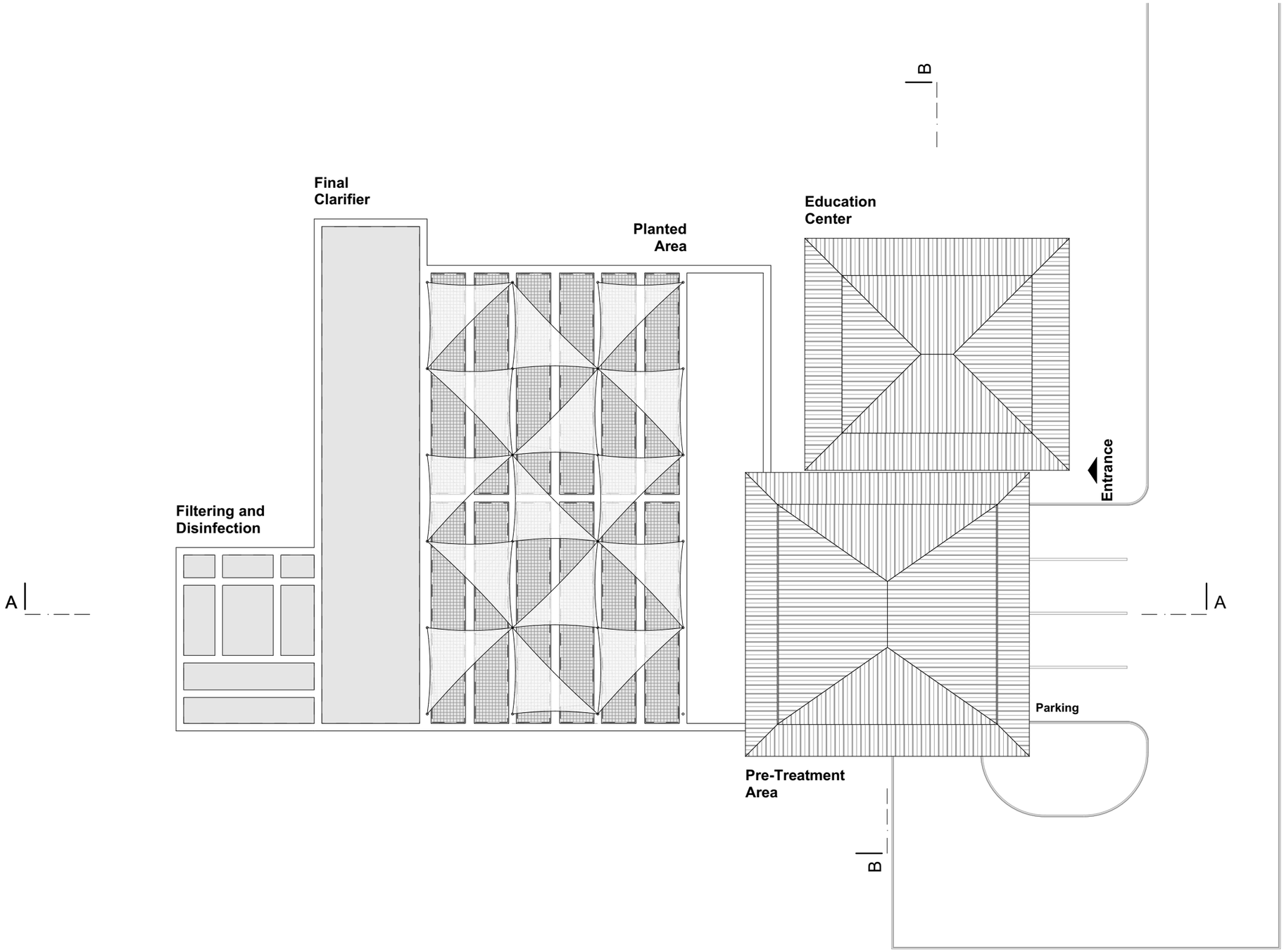
Filtering and Disinfection

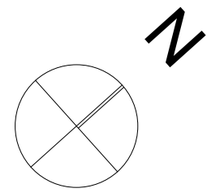
R1 Storage Tank

N

Overview - scale 1:200

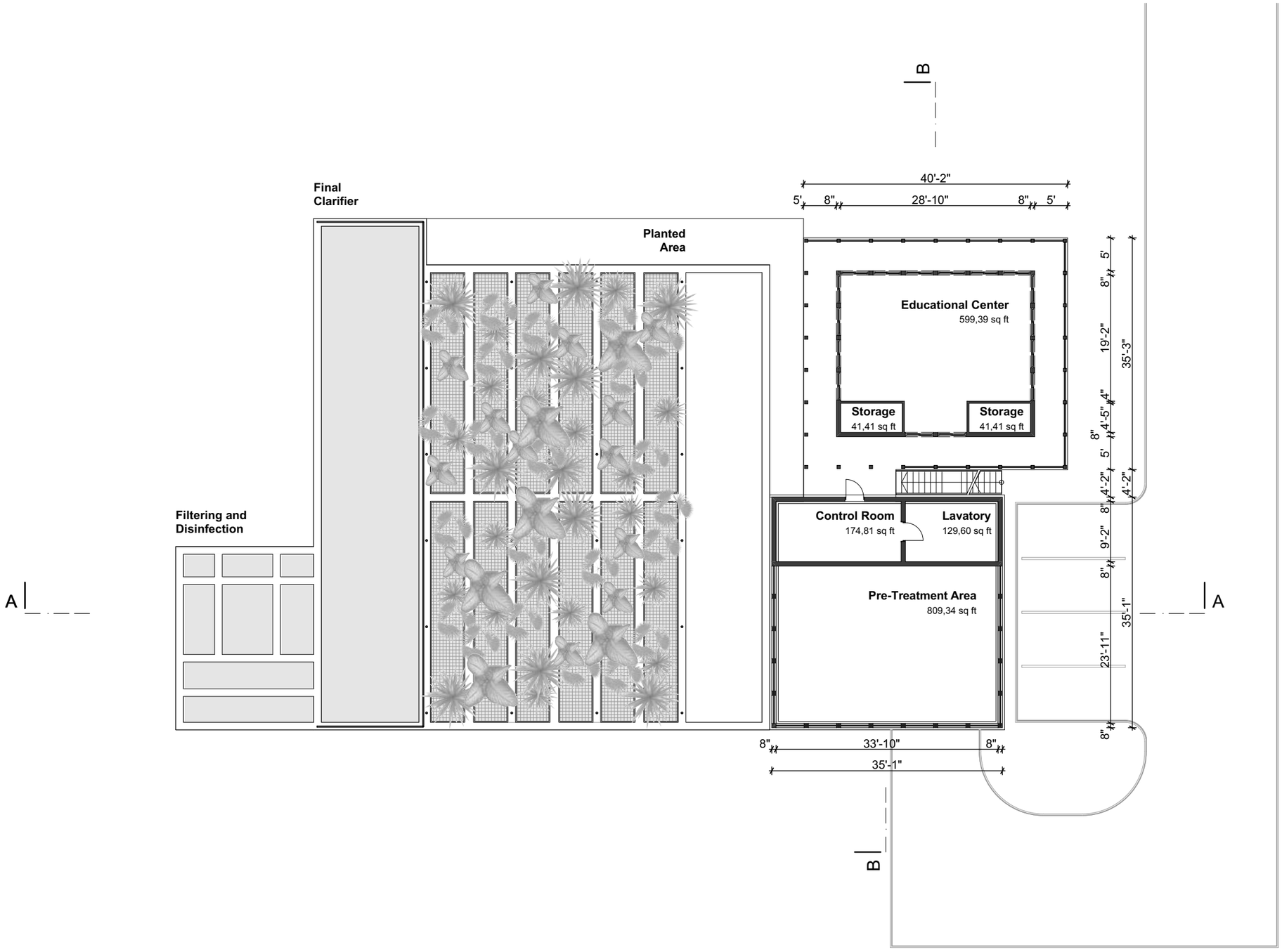
Water Reclamation Facility

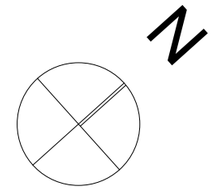




Ground Floor Plan - scale 1:200

Water Reclamation Facility

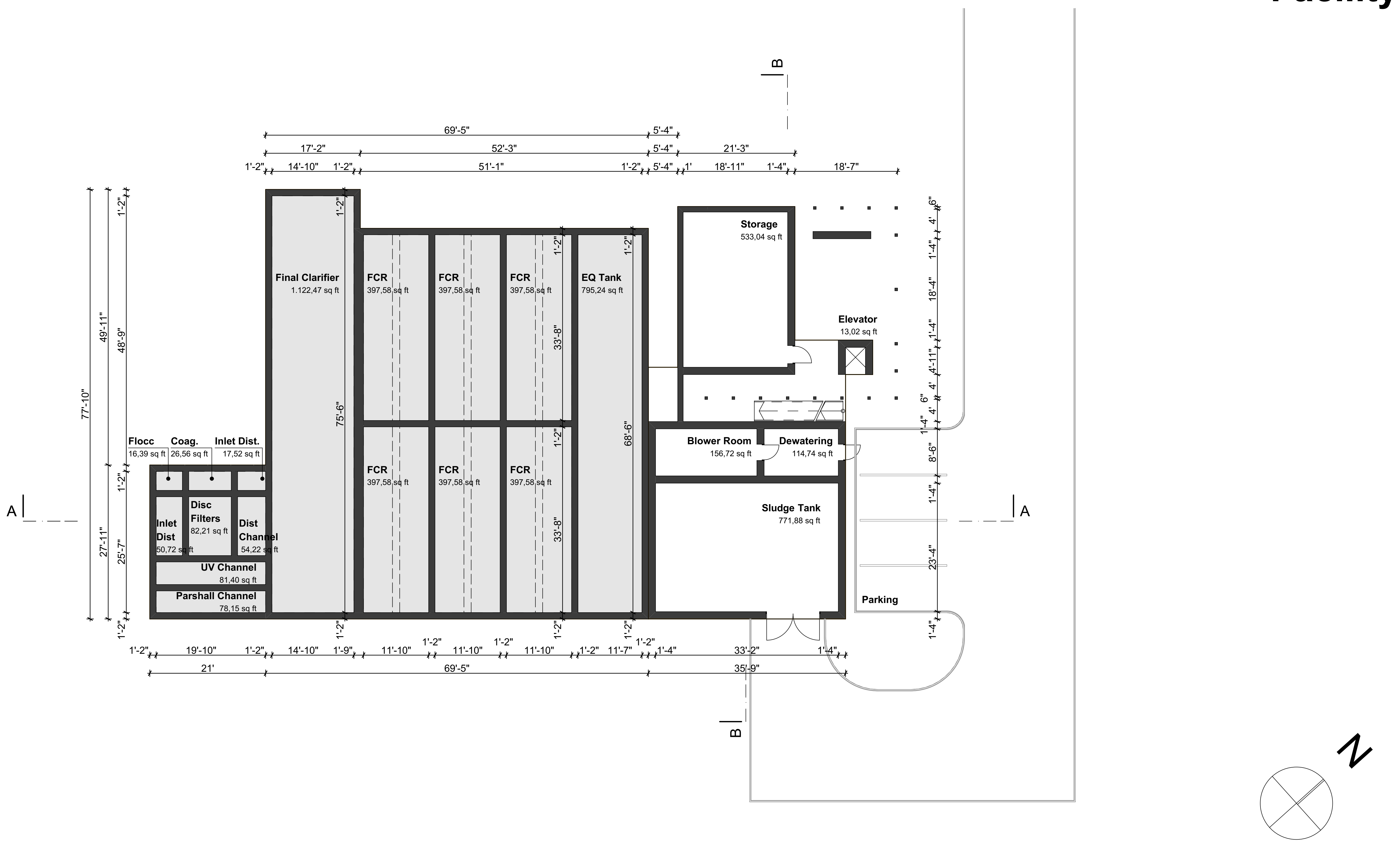




Proposal - 6

Ground Floor Plan - scale 1:200

Water Reclamation Facility

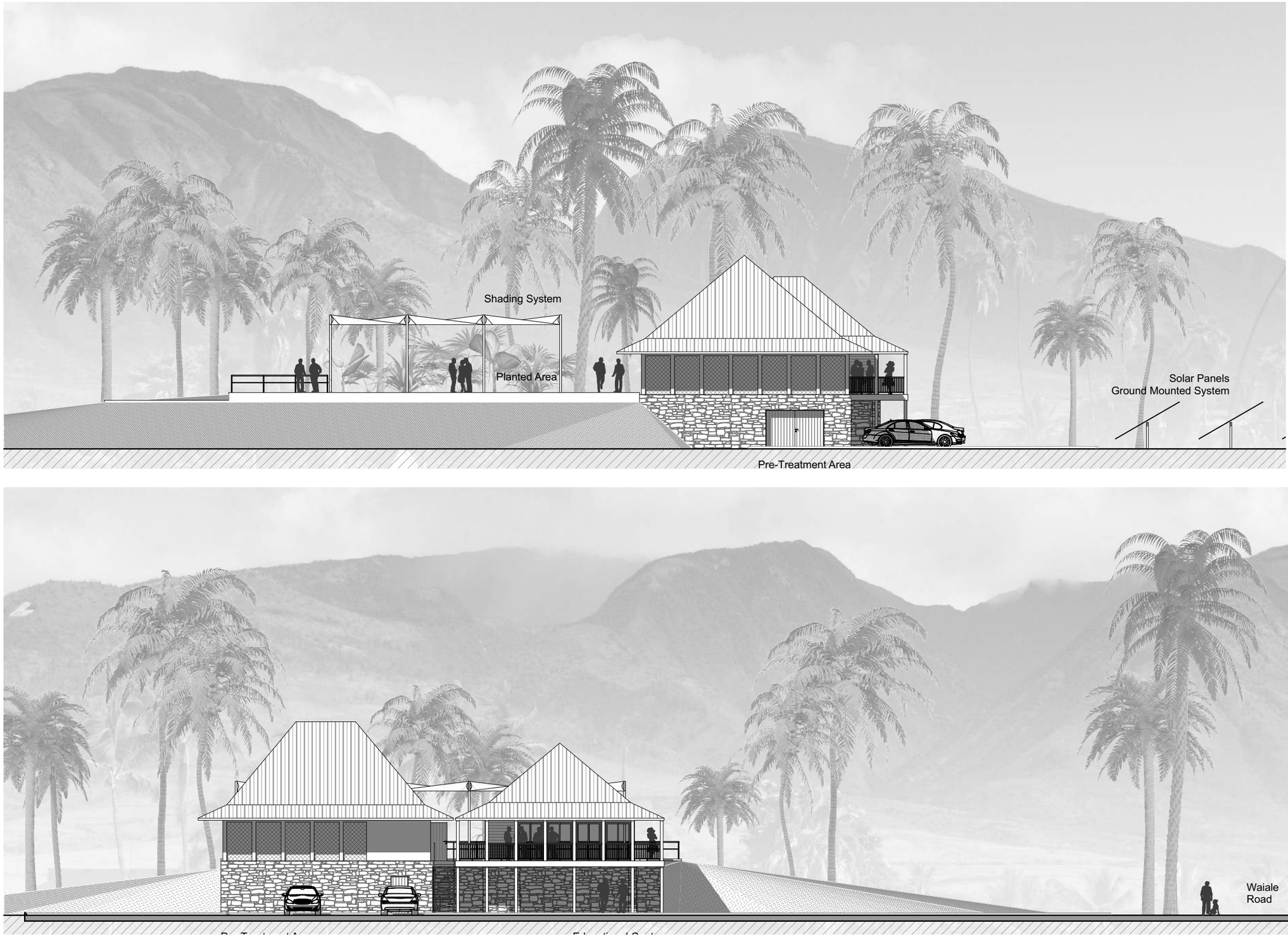


Sections - scale 1:200

Water Reclamation Facility

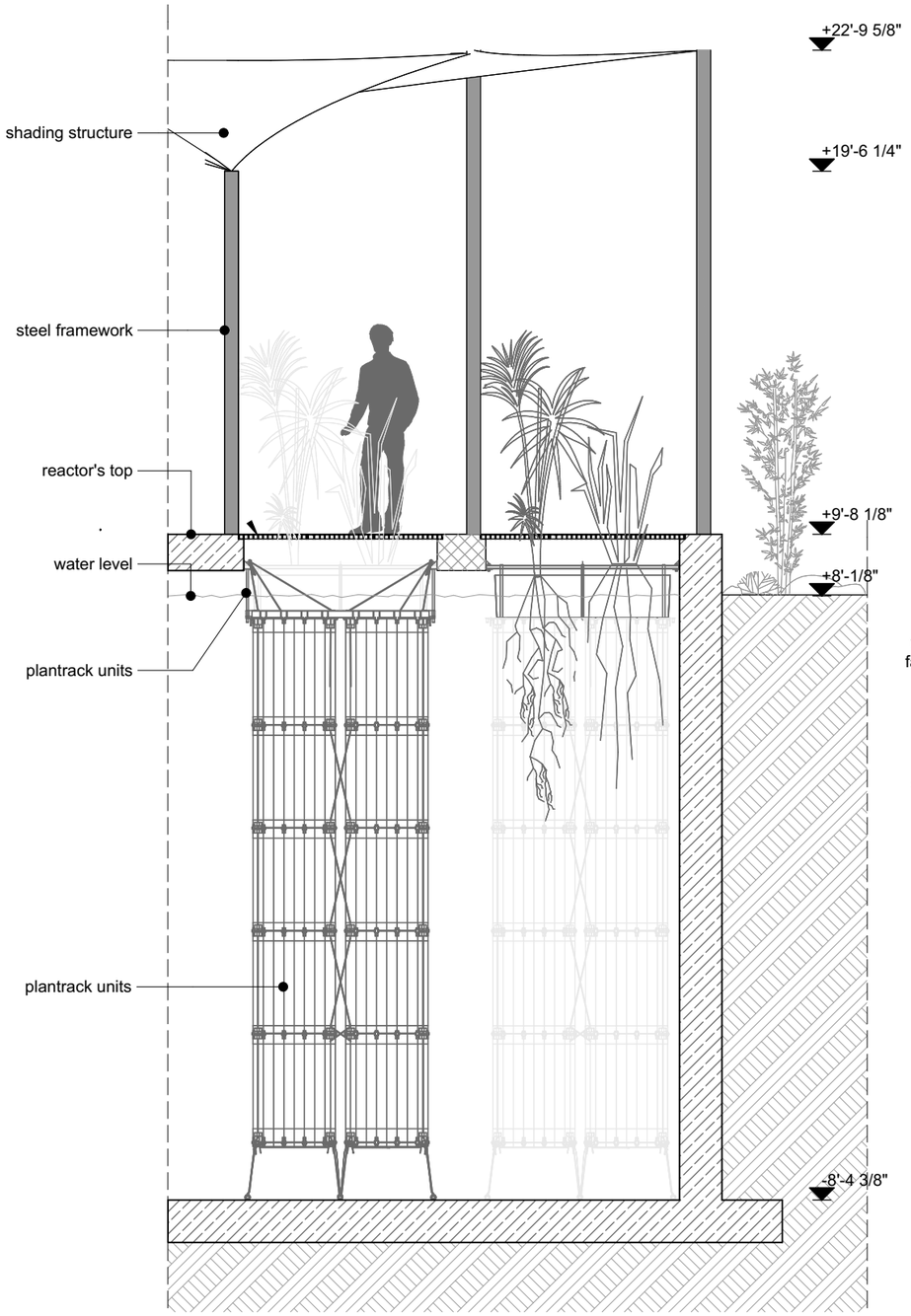
Elevations - scale 1:200

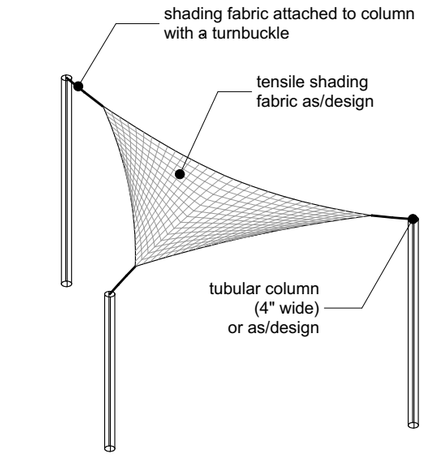
Water Reclamation Facility



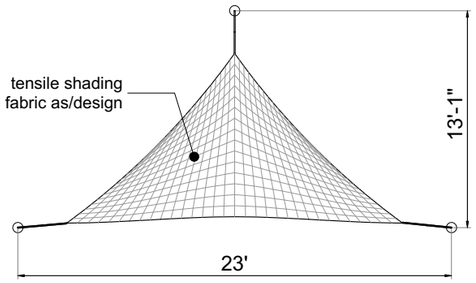
Water Reclamation Facility

Detailed Reactor Section - scale 1:50

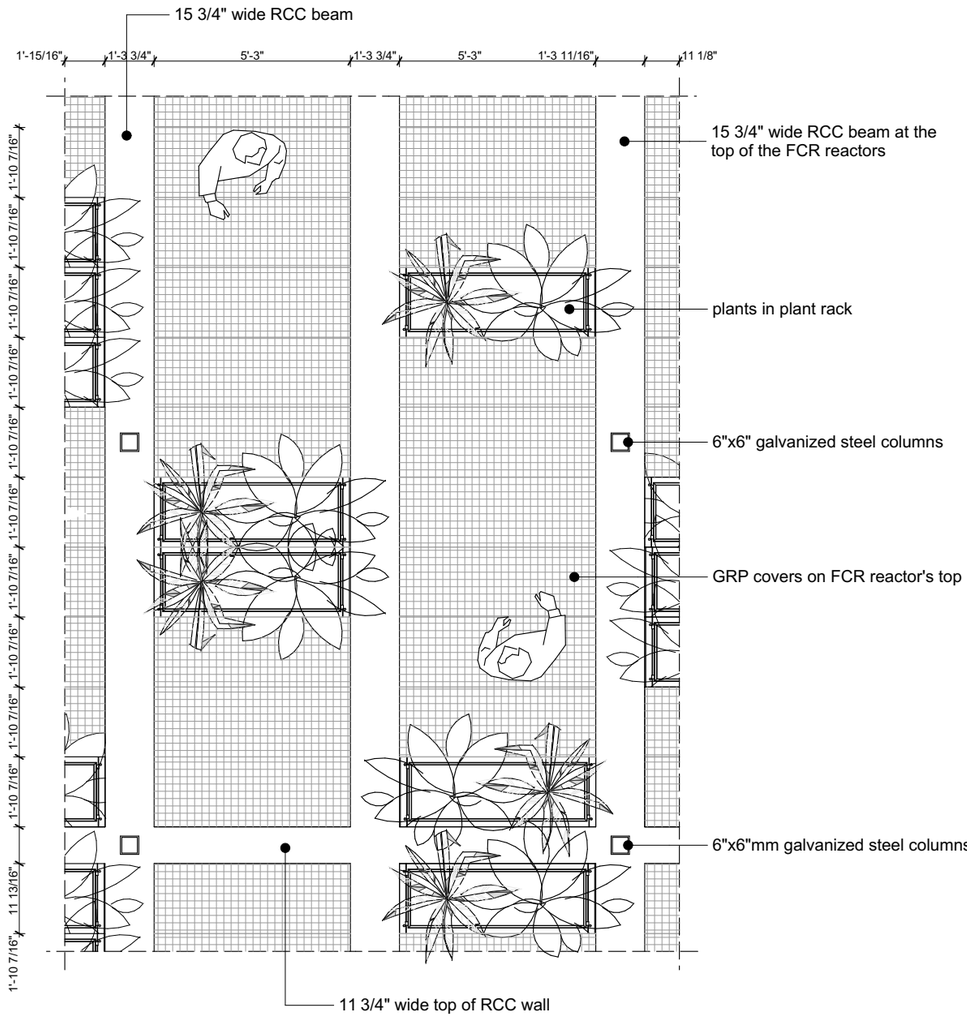




shading structure
(typical module concepttual 3D view)

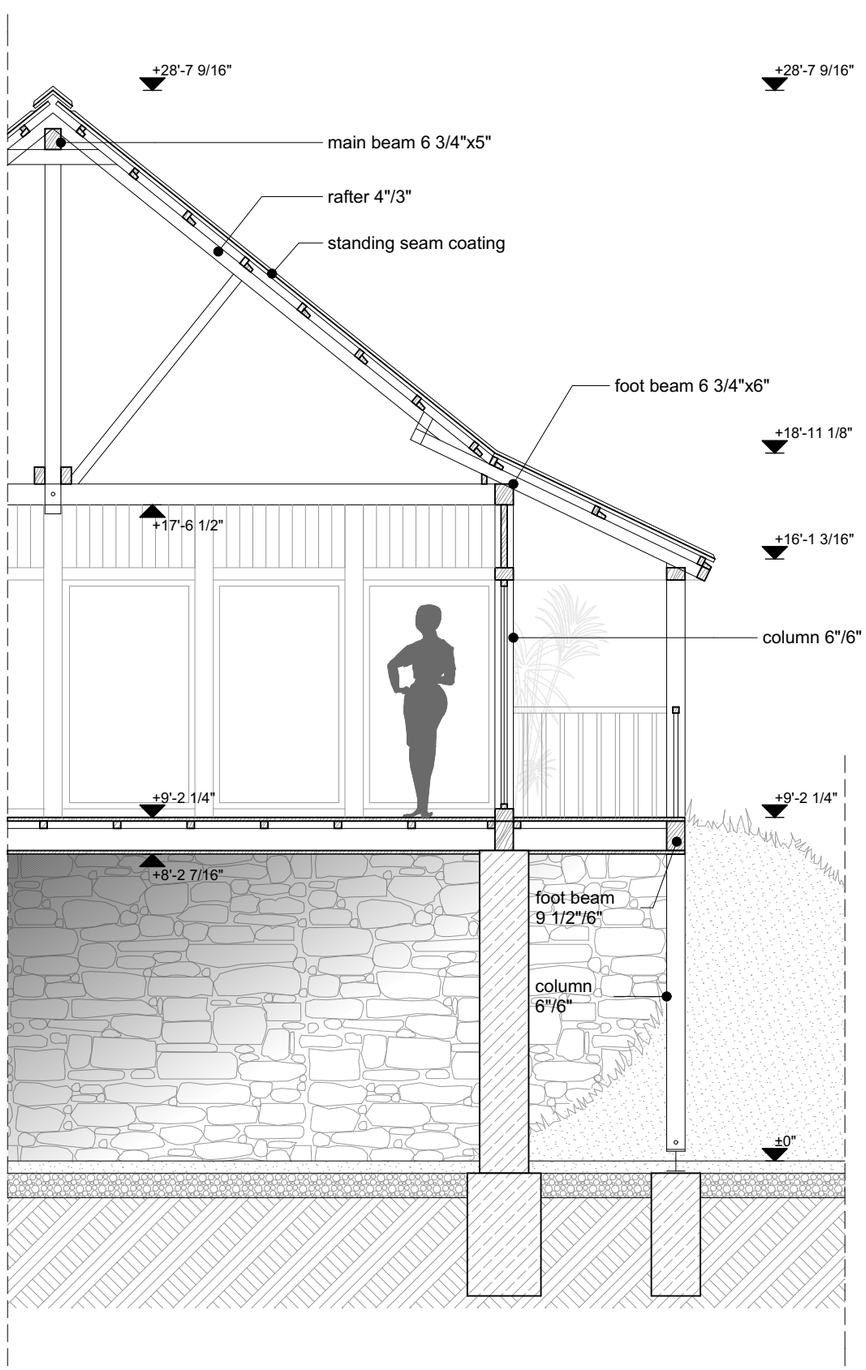


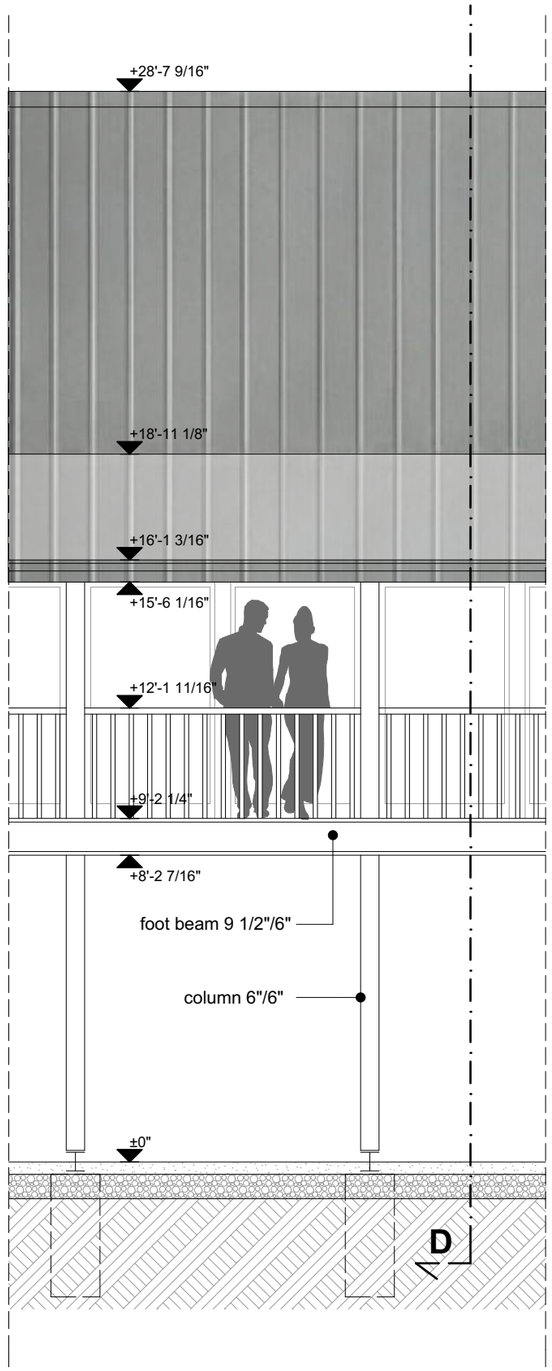
shading structure
(typical module plan)



Water Reclamation Facility

Detailed Building Section - scale 1:50





APPENDIX L

Traffic Impact Analysis Report

WAIKAPU COUNTRY TOWN TRANSPORTATION IMPACT ANALYSIS REPORT - FINAL

Submitted by:

FEHR & PEERS
500 Ala Moana Blvd
Suite 7-400
Honolulu, HI 96813

Submitted to:

Planning Consultants
Hawaii, LLC

December 2016

FEHR & PEERS

Waikapu Country Town

Transportation Impact Analysis Report

Prepared for:

Planning Consultants Hawaii, LLC

Prepared by:

FEHR PEERS

December 2014

Ref: SD13-0085

Table of Contents

1. Executive Summary 4

2. Introduction 7

Project Description 7

Project Study Area 10

Intersection Analysis Scenarios 11

Traffic Analysis Methods 11

Signalized Intersections 12

Unsignalized Intersections 13

Significant Impact Criteria 13

Report Organization 14

3. Existing Conditions 15

Existing Transportation Facilities 15

Existing Street System 15

Existing Transit Facilities 16

Existing Bicycle Facilities 17

Existing Pedestrian FacilitIes 18

Existing Intersection Volumes and Lane Configurations 19

Existing Intersection Levels of Service 19

4. Future Traffic Projections 24

Cumulative Base Traffic Projections 24

Areawide Traffic Growth and Cumulative Development Projects 24

Baseline Street System Improvements 27

Cumulative Base Traffic Volumes 30

Project Traffic Projections 30

Project Street System Improvements 30

Project Trip Generation Estimates 36

Project Trip Distribution and Assignment 39

Cumulative Plus Project Traffic projections 39

5. Intersection Analysis 48

Year 2022 No Project Traffic Conditions 48

Year 2022 with Partial Development Traffic Conditions 48

Year 2026 No Project Traffic Conditions 50

Year 2026 with Project Traffic Conditions 52

Potential Traffic Improvements 52

Mitigation Funding 61

Proposed WCT Mitigation Program 63

Improvements to be Implemented by Others 63

6. Assessment of Site Plan and Multi-Modal Review 64

Roadway Network 64

Roundabout Analysis 64

Pedestrian Network 65

Bike Network 66

Transit Network 68

Appendices

Appendix A: Traffic Count Data

Appendix B: LOS Worksheets

Appendix C: Related Projects

Appendix D: MXD+ Worksheets

Appendix E: Year 2026 Project Trip Generation Estimtates

Appendix F: Proposed Mitigation Measures

List of Figures

Figure A – Study Area and Analyzed Intersections 6

Figure 1 – Study Area and Analyzed Intersections 8

Figure 2 – Conceptual Site Plan 9

Figure 3A – Peak Hour Volumes and Lane Configurations - Existing (2013) Conditions 21

Figure 3B – Peak Hour Volumes and Lane Configurations - Existing (2013) Conditions 22

Figure 4A – Peak Hour Volumes and Lane Configurations – Year 2022 No Project Conditions 31

Figure 4B – Peak Hour Volumes and Lane Configurations – Year 2022 No Project Conditions 32

Figure 5A – Peak Hour Volumes and Lane Configurations – Year 2026 No Project Conditions 33

Figure 5B – Peak Hour Volumes and Lane Configurations – Year 2026 No Project Conditions 34

Figure 6A – Peak Hour Volumes and Lane Configurations – Net New Project Only, Phase 1 (2022) 40

Figure 6B – Peak Hour Volumes and Lane Configurations – Net New Project Only, Phase 1 (2022) 41

Figure 7A – Peak Hour Volumes and Lane Configurations – Net New Project Only, Phase 1&2 (2026) 42

Figure 7B – Peak Hour Volumes and Lane Configurations – Net New Project Only, Phase 1&2 (2026) 43

Figure 8A – Peak Hour Volumes and Lane Configurations – Year 2022 with Partial Development – Phase 1 Conditions 44

Figure 8B – Peak Hour Volumes and Lane Configurations – Year 2022 with Partial Development – Phase 1 Conditions 45

Figure 9A – Peak Hour Volumes and Lane Configurations –Year 2026 with Project Conditions – Phase 1&2 Conditions 46

Figure 9B – Peak Hour Volumes and Lane Configurations – Year 2026 with Project Conditions – Phase 1&2 Conditions 47

Figure 10 – Waikapu Country Town Pedestrian and Bicycle Facility Network 67

List of Tables

Table 1 – Signalized Intersection Level of Service Definitions 12

Table 2 – Unsignalized Intersection Level of Service Definitions 13

Table 3 – Existing Intersection Level of Service 20

Table 4 – Central Maui Future Cumulative Project List [1,2] 25

Table 5 – Trip Generation Rate and Estimates 38

Table 6 – Year 2022 Levels of Service – Waikapu Country Town Partial Development (Phase 1) 49

Table 7 – Year 2026 Levels of Service - Waikapu Country Town Full Development (Phase 1 & 2) 51

Table 8 – Year 2026 Project Fair Share Intersection Traffic Contribution 62

1. EXECUTIVE SUMMARY

This report presents the results of the Transportation Impact Analysis (TIAR) for the Waikapu Country Town Project (the Project).

The Project. The Project is a mixed use neighborhood development on mostly undeveloped land south of Waiko Road in the Waikapu community in Central Maui. It is located on both the mauka and makai side of Honoapiilani Highway (Highway 30).

The Project will be developed in two phases: 2017 through 2021 is the first phase, and the second phase will be from 2022 through 2026. Figure A in this Executive Summary depicts the proposed land use plan and street network for the Project, and more detail is provided in Figures 2 and 10 in the report.

Two Phases. The first phase is to be developed as a "Village Center" on the mauka side of Honoapiilani Highway and will contain approximately 170,000 square feet of commercial and employment uses, as well as 731 residential units, an elementary school and 27 acres of park and open space. Phase 2 will include: 848 residential units and approximately 6 acres of park and open space. Primary access would be provided via Honoapiilani Highway and Waiale Road, via the planned southward extension of Waiale Road known as the Waiale Bypass. Much of the right-of-way necessary to construct the Waiale Bypass lies within the Project site.

Project Site Plan. The proposed site plan provides an extensive internal roadway system which will provide community residents and visitors multiple options for accessing neighborhoods, employment centers, commercial areas, and institutional uses. The Project embodies Country Town Design principles that include a country sense of place with a mix of uses, and fosters walkability and connectivity through pedestrian/bicycle routing, with bridges and approximately 8 miles of hiking, biking, and walking trails. These characteristics promote the use of non-motorized modes, especially for short commutes, and help to reduce external vehicle trip generation.

Study Methodology. The study first forecasts traffic volumes based without the development of the Project, and then forecasts volumes with the development of each phase of the Project. It documents estimated traffic movements at the analyzed intersections and determines volume-to-capacity (V/C) ratios, average delay times and the resulting level of service (LOS) ratings. This study recommends specific mitigation measures to address locations where undesirable levels of service are projected. The project site plan and study area are depicted in Figure A in this Executive Summary.

Vehicle Trip Generation. The first phase of the Project is estimated to generate approximately 13,100 week day daily trips including approximately 700 trips during the weekday morning peak hour and 1,000 trips during the weekday afternoon peak hour. At the end of the second phase, the Project would

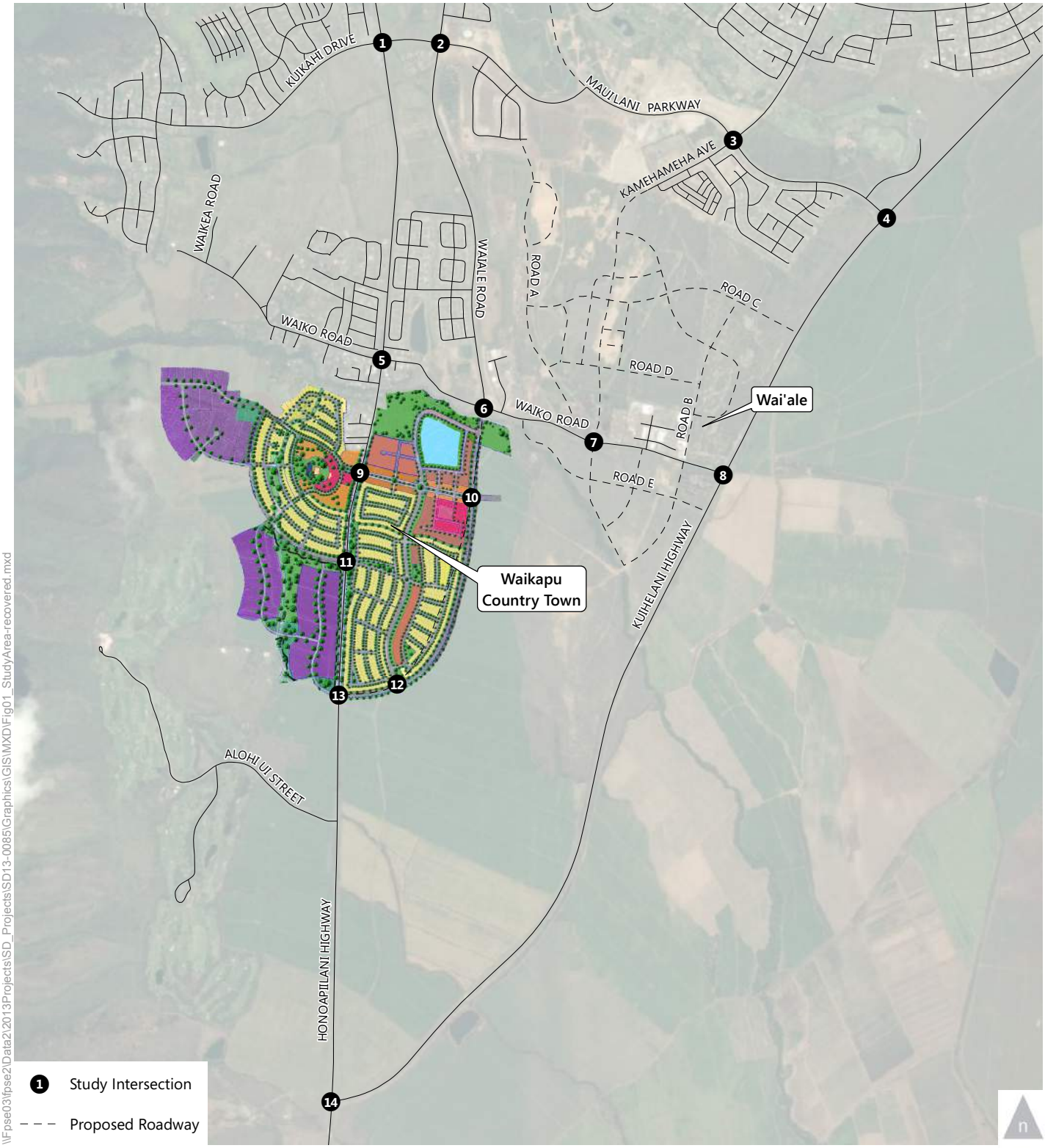
generate a total of approximately 19,000 weekday trips including approximately 1,200 trips in the weekday AM peak hour and 1,500 trips in the weekday PM peak hour.

Intersection Analysis. The traffic impact analysis was evaluated pursuant to guidelines established by the County of Maui and the Hawaii Department of Transportation-Highways Division-Planning Branch. Weekday a.m. and p.m. peak hour capacity analysis was conducted for eight (8) existing and six (6) future intersections in the vicinity of the Project site. Under the current baseline 2013 conditions, seven (7) of the eight (8) existing intersections are operating at the desired LOS of D or better during the weekday peak hours. The existing intersection LOS analysis is presented in Table 3 of the report.

Future Conditions without Project. The future intersection operating conditions will be significantly affected by regional growth and development in the study area before project implementation. By 2022 and 2026 the Project area will have experienced significant residential and commercial growth and due to the development of neighboring projects including Waiale, Maui Lani Development, Kehalani Development, Puunani residences, and other developments as outlined in Table 4. Future regional development will be accompanied by roadway network changes will improve mobility options for residents and visitors, as well as expand roadway capacity at various locations within the study area. Nevertheless, with this growth, five (5) of the 14 study intersections are projected to operate at an undesirable LOS E or F during one or both peak hours in each future year.

Project Traffic Impact. The traffic analysis addressed the completion of the first phase (2022) and the second phase (2026) with the Project. Following development of both the first phase and second phase of the Project, six (6) of the fourteen (14) intersections studied (Intersection 1-4 and 7-8) would operate at LOS (E) or (F) in either the AM and/or PM peak hour. As noted above, all but one of these six intersections (Intersection 8) are projected to operate at undesirable levels without the addition of project traffic. Eight (8) of the study intersections (Intersections 5-6 and 9-14) are projected to operate at acceptable LOS with buildout of the project and will not require mitigation strategies. See Tables 6 and 7.

Mitigation Strategies. Mitigation strategies were developed to identify recommended improvements at the intersections with projected overall intersection levels of service, LOS (E) or LOS (F) in the years 2022 and 2026. Each of the identified project-related and cumulative impacts would be fully mitigated (achieving LOS D or better for intersection operations) with recommended improvements as described in Chapter 5 and Appendix F of the TIAR. In some cases, certain individual turning movements or approaches would continue to operate at LOS (E) or (F), even with overall intersection mitigation. However, further mitigation measures to address specific turning movement or approach operations are not recommended because they do not meet typical traffic engineering guidelines or would result in atypical improvements (i.e., triple left-turn lanes) that could have significant right-of-way impacts or change community character. The estimated share of traffic mitigation cost shown on Table 8 was calculated for proposed mitigations under Year 2026 with project conditions.



\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig01_StudyArea-recovered.mxd

Figure A

Study Area and Analyzed Intersections

2. INTRODUCTION

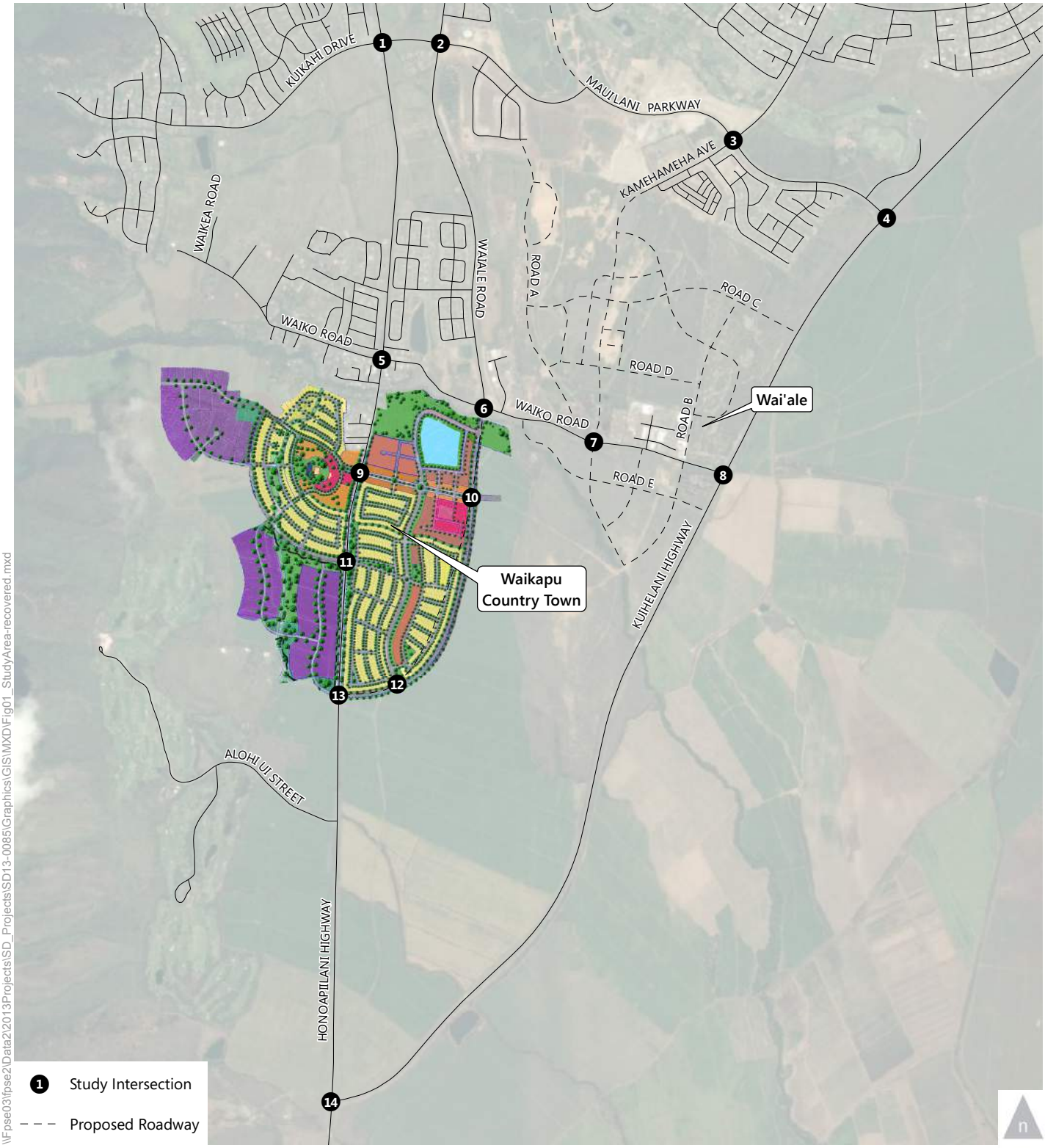
This transportation impact analysis report (TIAR) presents the results of the study conducted by Fehr & Peers for the proposed Waikapu Country Town Project (hereafter "WCT" or "Project") located in the area of south Waikapu in Central Maui, which is approximately two miles south of Wailuku. The purpose of this analysis is to identify the impacts of the proposed project on the surrounding transportation system. The TIAR includes a description of the assumptions and methods used to conduct the study, as well as a discussion of the results. This TIAR was conducted in accordance with the requirements of the affected government agencies.

PROJECT DESCRIPTION

The project would construct a new mixed-use neighborhood on approximately 500 acres of mostly undeveloped land south of Waiko Road on both the mauka and makai side of Honoapiilani Highway (Highway 30). The proposed development site lies within the County's adopted urban growth boundary and is part of larger property that totals approximately 1,562 acres. The area outside of the proposed WCT site will remain in agricultural use within the State's Agricultural District. **Figure 1** illustrates the study area of the proposed project.

WCT will be built in two phases through 2026 and the proposed land use plan and street network for the project is illustrated on **Figure 2**. The "village center" type development on the mauka side of Honoapiilani Highway is proposed to be constructed in the first phase, 2017 through 2021. Phase 1 also includes the development of residential parcels directly north and northwest of the "village center," as well as the northern half of the project site on the makai side of Honoapiilani Highway. Phase 1 is programmed as follows:

- 332 single-family dwelling units;
- 15 rural residential units;
- 216 mixed-use multi-family dwelling units;
- 41 "ohana" units;
- 127 country town mixed-use residential units;
- 58,475 square feet of country town mixed-use commercial;
- 111,122 square feet of new commercial and employment;
- an elementary school (12 acres); and
- 26.66 acres of parks and open space.



\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig01_StudyArea-recovered.mxd

Figure 1

Study Area and Analyzed Intersections

\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig02_SitePlan.mxd

Figure 2

Conceptual Site Plan

Additionally, it is assumed that the 29,250 square feet of existing commercial uses located in the same area as the "village center" will remain.

Phase 2 of the development program, 2022-2026, will construct the remainder of the project and includes:

- 638 single-family dwelling units;
- 65 rural residential units;
- 40 multi-family dwelling units;
- 105 "ohana" units; and
- 5.78 acres of parks and open space.

Primary access would be provided via Honoapiilani Highway and Waiale Road via the planned southward extension of Waiale Road, known as the Waiale Bypass.

PROJECT STUDY AREA

The study analyzed the potential project-related traffic impacts under typical weekday AM and PM peak hour traffic conditions at partial buildout in 2022 and at full buildout in 2026. The transportation analysis evaluated the operations at eight existing and six future intersections (a total of 14 study intersections) in the vicinity of the proposed project. The analyzed intersections are listed below and are shown in **Figure 1**:

1. Honoapiilani Highway (Highway 30)/Kuikahi Drive
2. Waiale Road/Kuikahi Drive
3. S. Kamehameha Avenue/Maui Lani Parkway
4. Kuihelani Highway (Highway 380)/Maui Lani Parkway
5. Honoapiilani Highway (Highway 30)/Waiko Road
6. Waiale Road/Waiko Road
7. *S. Kamehameha Avenue/Waiko Road**
8. Kuihelani Highway (Highway 380)/Waiko Road
9. *Honoapiilani Highway (Highway 30)/Main Street**
10. *Waiale Road/Main Street**
11. *Honoapiilani Highway/East-West Residential Street**
12. *North-South Residential Street/ Waiale Road**
13. *Honoapiilani Highway* (Highway 30)*/Waiale Road**
14. Honoapiilani Highway (Highway 30)/Kuihelani Highway (Highway 380)

**Future intersection*

INTERSECTION ANALYSIS SCENARIOS

The operations of the study intersections were evaluated during the weekday morning and evening peak hours for the following scenarios:

- Scenario 1: Existing (2013) Conditions – The analysis of existing traffic conditions was based on 2013 counts collected for analyzed peak hours. The existing conditions analysis includes a description of key area streets and highways, and an assessment of traffic volumes and intersection operating conditions.
- Scenario 2: Year 2022 No Project Conditions – Future Year 2022 volumes were projected using the Maui Travel Demand Forecasting Model (TDFM). Traffic from approved but not yet constructed (and possibly pending) developments in the area were also be added to this scenario. Although the anticipated completion year of the first phase of the WCT development is 2021, the Phase 1 traffic impact analysis was conducted for 2022 to be consistent with the planned completion of large background projects in the area, such as the Waiale development and the Waiale Bypass, and to provide a conservative analysis.
- Scenario 3: Year 2022 with Partial Development Conditions – Traffic projections from Scenario 2 plus traffic estimates from the first phase of project development.
- Scenario 4: Year 2026 No Project Conditions **–** Future volumes in the anticipated year of project buildout and full occupancy were projected using the Maui TDFM. Traffic from approved and pending developments in the area not included in Scenario 2 is added in this scenario.
- Scenario 5: Year 2026 with Project Conditions – Traffic projections from Scenario 4 plus traffic estimates anticipated from project buildout and full occupancy.

TRAFFIC ANALYSIS METHODS

The analysis of roadway operations performed for this study is based on procedures presented in the *Highway Capacity Manual* (HCM), published by the Transportation Research Board in 2000. Although the 2010 *HCM* was available at the time this report was published; not many jurisdictions have yet adopted the 2010 HCM, as many LOS software programs are still fine tuning versions incorporating updated 2010 methods. Differences in analysis results for intersection level of service (LOS) evaluation have been found to be negligible between the 2000 and 2010 HCM and are not expected to change the conclusions of this report.

The operations of roadway facilities are described with the term level of service. LOS is a qualitative description of traffic flow based on such factors as speed, travel time, delay, and freedom to maneuver. Six

levels are defined from LOS A, with the least congested operating conditions, to LOS F, with the most congested operating conditions. LOS E represents "at-capacity" operations. Operations are designated as LOS F when volumes exceed capacity, resulting in stop-and-go conditions. The methodologies for signalized and unsignalized intersections are described below.

SIGNALIZED INTERSECTIONS

The method described in Chapter 16 of the 2000 *Highway Capacity Manual* was used to prepare the LOS calculations for the signalized study intersections. This LOS method analyzes a signalized intersection's operation based on average control delay per vehicle. Control delay includes the initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The average control delay for signalized intersections is calculated using Synchro analysis software and is correlated to a LOS designation as shown in **Table 1**.

TABLE 1 – SIGNALIZED INTERSECTION LEVEL OF SERVICE DEFINITIONS

Level of Service	Description	Average Control Delay Per Vehicle (Seconds)
A	Operations with very low delay occurring with favorable progression and/or short cycle lengths.	≤ 10.0
B	Operations with low delay occurring with good progression and/or short cycle lengths.	10.1 to 20.0
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	20.1 to 35.0
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, and high V/C ratios. Many vehicles stop and individual cycle failures are noticeable.	35.1 to 55.0
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	55.1 to 80.0
F	Operations with delays unacceptable to most drivers occurring due to over-saturation, poor progression, or very long cycle lengths.	> 80.0

Source: *Highway Capacity Manual*, Transportation Research Board, 2000.

UNSIGNALIZED INTERSECTIONS

The operations of the unsignalized intersections were evaluated using the method contained in Chapter 17 of the 2000 *Highway Capacity Manual*. LOS ratings for stop-sign-controlled intersections are based on the average control delay expressed in seconds per vehicle. At two-way or side-street-controlled intersections, the average control delay is calculated for each stopped movement, not for the intersection as a whole. For approaches composed of a single lane, the control delay is computed as the average of all movements in that lane. For approaches with multiple lanes, the control delay is computed for each movement; the movement with the worst (i.e., longest) delay is presented. The average control delay for unsignalized intersections is calculated using Synchro analysis software and is correlated to a LOS designation as shown in **Table 2**.

TABLE 2 – UNSIGNALIZED INTERSECTION LEVEL OF SERVICE DEFINITIONS

Level of Service	Description	Average Control Delay Per Vehicle (Seconds)
A	Little or no delay.	≤ 10.0
B	Short traffic delay.	10.1 to 15.0
C	Average traffic delays.	15.1 to 25.0
D	Long traffic delays.	25.1 to 35.0
E	Very long traffic delays.	35.1 to 50.0
F	Extreme traffic delays with intersection capacity exceeded.	> 50.0

Source: *Highway Capacity Manual*, Transportation Research Board, 2000.

SIGNIFICANT IMPACT CRITERIA

The analysis of future conditions compares baseline scenarios with Phase 1 of the project and full buildout year of the project to determine whether the project traffic is expected to result in a significant impact on the surrounding roadways. Based on previous studies conducted for the County of Maui, the minimum acceptable operating standard for a signalized intersection is LOS D for the overall intersection. Additionally, the Hawaii Department of Transportation (HDOT) strives to universally maintain LOS D conditions and in their *HDOT Best Practices for Traffic Impact Report* (June 2012) defines a significant impact when the operations of an intersection, turning movement, or roadway segment changes from LOS D or better to LOS E or F. Also when evaluating intersection approach LOS at any location, other

factors should be considered in the analysis, such as traffic volumes, volume-to-capacity (V/C) ratios (should ideally be less than 1.00), and secondary impacts to pedestrian, bicycle, and transit travel.

Each of the identified significant impacts could be further categorized as either a cumulative impact or a project-related impact. If the addition of project traffic is expected to degrade acceptable service levels (LOS D or better) to unacceptable service levels (LOS E or F) then the project is considered to have a project-specific impact. Whereas, if the LOS for any roadway element is LOS E or F without the project and the project adds traffic to this location, causing the delay to increase by 5% or more, then this would be characterized as a cumulative impact.

For unsignalized intersections, the project is determined to have a significant cumulative impact when it adds traffic to a study location that includes a controlled approach that operates at an unacceptable level (i.e., LOS E or F). If the addition of project traffic causes an unsignalized intersection to degrade from LOS D or better to LOS E or F, then the impact is considered project-specific.

The County of Maui does not publish impact criteria for pedestrian, bicycle, and transit impacts. However, these impacts are generally evaluated based on whether a proposed project would: 1) conflict with existing or planned pedestrian, bicycle, or transit facilities, or 2) create walking, bicycling, or transit use demand without providing adequate and appropriate facilities for non-motorized mobility. The existing amenities for pedestrians, bicycles, and transit users were inventoried to evaluate the quality of the facilities in place today. Planning documents affecting future non-motorized transportation in the study area, including the draft *Federal-Aid Highways 2035 Transportation Plan for the District of Maui,* the *Central Maui Pedestrian and Bicycle Master Plan for 2030,* and the *Bike Plan Hawaii*, were reviewed to assess the compatibility of the project with planned future conditions for non-automobile modes.

REPORT ORGANIZATION

The remainder of this report is divided into six chapters, including this Introduction. The existing transportation system serving the project site and the current operating conditions of the key intersections are described in **Chapter 2** Existing Conditions. **Chapter 3** summarizes the methodologies used to forecast future cumulative and project traffic volumes and the resultant forecasts. **Chapter 4** presents an assessment of future traffic impacts at intersections in the surrounding area and identifies mitigation measures to address both cumulative and project-specific impacts. **Chapter 5** contains an assessment of the potential effect of the project on future transit, bicycle, and pedestrian facilities and discusses the project's site access and circulation. Finally, **Chapter 6** summarizes the conclusions of the study.

3. EXISTING CONDITIONS

A comprehensive data collection effort was undertaken to identify existing transportation conditions in the vicinity of the proposed project. The assessment of existing conditions relevant to this study includes an inventory of the street and highway system, traffic volumes on these facilities, and operating conditions at key intersections. Existing public transit service and bicycle and pedestrian facilities are also described.

EXISTING TRANSPORTATION FACILITIES

This section describes the significant roadway facilities in the study area, as well as the existing transit, bicycle, and pedestrian facilities.

EXISTING STREET SYSTEM

Primary regional access to the area is provided by Honoapiilani Highway, which traverses directly through the middle of the project site, and by Kuihelani Highway, which is located east of the project site. The key roadways providing access to the site are described below. **Figure 1** illustrates the proposed project location and the surrounding roadway system.

Honoapiilani Highway (Highway 30) provides regional access around the western side of Maui and links West Maui with Central Maui. The roadway is initially classified as a principal arterial in downtown Wailuku and as it extends south to Waikapu and Maalaea. As the roadway runs through Lahaina in West Maui, it transitions into a minor arterial. Through the regions of Kapalua and Honolua, it is classified as a collector roadway, and ends in Honokohau Bay, where it becomes Kahekili Highway. In the project area, this undivided arterial runs north-south and provides two travel lanes (one in each direction) with separate lanes for left and right turns at many intersections. Parking is not permitted on most segments of Honoapiilani Highway, and sidewalks are not provided. The posted speed limit ranges between 30 to 45 miles per hour (mph).

Kuihelani Highway (Highway 380) is a north-south, four-lane divided arterial with a posted speed limit of 45 or 55 mph in the study area. The roadway begins at its intersection with Puunene Avenue and Dairy Road in Kahului and extends southward until it terminates at its intersection with Honoapiilani Highway north of Maalaea Harbor.

Waiale Road is a north-south, undivided collector road that starts as an extension of Lower Main Street and terminates at Waiko Road. The roadway provides two travel lanes (one in each direction) and serves

as the only access road for residents of the Waikapu Gardens neighborhood located between Kuikahi Drive and Waiko Road. The posted speed limit is 20 mph.

Kuikahi Drive is an east-west, undivided collector road with two travel lanes (one in each direction). West of its intersection of Honoapiilani Highway, Kuikahi Drive passes through the Wailuku Heights Development until it terminates at a cul-de-sac. Approximately 1,000 feet east of its intersection with Honoapiilani Highway, the roadway terminates at its intersection with Waiale Road and Maui Lani Parkway. The posted speed limit is 20 to 30 mph in the study area.

Kamehameha Avenue is a north-south collector road with two travel lanes (one in each direction). Kamehameha Avenue begins at its intersection of Hana Highway and extends southward through the Maui Lani development until it terminates just south of Pomakai Elementary School. In the project study area, sidewalks are provided along most segments and the posted speed limit is 20 mph.

Maui Lani Parkway is an east-west, divided collector road with two travel lanes (one in each direction) and a raised median. Maui Lani Parkway begins as the east leg of where Kuikahi Drive intersects with Waiale Road and extends eastward until it terminates at its intersection with Kuihelani Highway. The posted speed limit is 20 mph.

Waiko Road is an east-west, undivided collector road with two travel lanes (one in each direction). Waiko Road begins in a residential neighborhood west of Honoapiilani Highway and traverses through mostly residential and industrial uses until it terminates when it intersects Kuihelani Parkway. In the project area, Waiko Road is a narrow, winding 20 to 30 mph road with no sidewalks provided and limited street parking opportunities.

EXISTING TRANSIT FACILITIES

The Maui Bus service, operated by Roberts Hawaii, provides public transit service around the island with 13 bus routes. Each route operates seven days a week, including holidays.

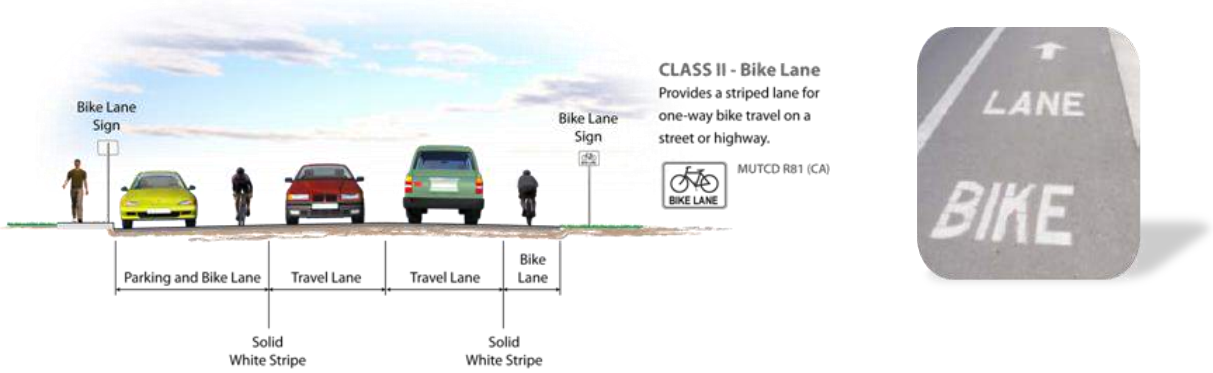
The Lahaina Islander Route (#20) is the only Maui Bus that serves the Waikapu area, which provides hourly service between the Wharf Cinema Center in Lahaina, Maia'aea Harbor Village, and Waikapu, before it originates and terminates at the Queen Ka'ahumanu Center in Kahului. In the study area, this route operates along Honoapiilani Highway with a bus stop approximately 2,000 feet north of the project site at the intersection of Honoapiilani Highway and Waiko Road.

EXISTING BICYCLE FACILITIES

Bicycle facilities generally consist of three types of facilities, which are outlined below:

- *Bike or Shared Use Paths* provide a completely separate right-of-way and is designated for the exclusive use of bicycles and pedestrians with vehicle and pedestrian cross-flow minimized. Generally, the recommended pavement width for a two-directional shared use path is ten (10) feet.

- *Bike Lanes* provide a restricted right-of-way and is designated for the use of bicycles with a striped lane on a street or highway. Bicycle lanes are generally five (5) feet wide. Adjacent vehicle parking and vehicle/pedestrian cross-flow are permitted.



- *Bike Route or Signed Shared Roadways* provide for a right-of-way designated by signs or pavement markings for shared use with pedestrians or motor vehicles.

In 2003, the HDOT released the *Bike Plan Hawaii* to provide a blueprint for integrating bicycle facilities into the State's transportation system and enhancing the bicycle environment for its residents and visitors. *Bike Plan Hawaii* is the most current document that presents a comprehensive existing bicycle facility inventory for Maui. The *Bike Plan Hawaii* (2003) reported the island of Maui has 37.8 miles of bicycle facilities that are signed shared roads, 21.6 miles of bicycle lanes, and one mile of shared use path.

In March 2012 the State of Hawaii's Department of Health, Healthy Hawaii Initiative prepared a bicycle and pedestrian master plan for Central Maui, entitled *Central Maui Pedestrian & Bicycle Master Plan for 2030*. The report documents existing pedestrian and bicycle facilities within the region, current gaps in these facilities, and a detailed capital improvements program to significantly increase walking and bicycling. The Plan's major recommendations include:

- Initiating a comprehensive signage and striping program;
- Establishing a "bicycle" district within Kahului that emphasizes separating pedestrians and bicyclists from traffic by installing separated cycle/pedestrian tracks along Papa and Wakea Avenues and calming traffic along residential streets;
- Establishing "pedestrian" districts that emphasizes mixed-use development, wide sidewalks and pedestrian amenities within the core commercial districts of Wailuku and Kahului;
- Establishing a pedestrian/bicycle esplanade along the Kahului Beach Road; and
- Installing a separated pedestrian and bike path along the Waiale Road and Waiale Bypass to link Wailuku, Maui Lani, and Waikapu.

The Plan is being used by the County's Department of Public Works for its pedestrian and bicycle planning. Under existing conditions, the WCT site comprises of mostly vacant parcels and so there are no bicycle facilities. However, in the vicinity of the project site and in the greater study area, there are limited existing bicycle facilities. Honoapiilani Highway is a signed shared road facility that provides access between Waiale Road and Fleming Beach Park. In the study area, striped bicycle lanes have been identified along some north and south segments of Honoapiilani Highway. Waiale Road provides a bicycle facility that provides a ½-mile designated bicycle lane from the start of Waiale Road to the Maui Correctional Center. Maui Lani Parkway provides a ½-mile bicycle lane from Kamehameha Avenue and Kuihelani Highway.

EXISTING PEDESTRIAN FACILITIES

Pedestrian facilities consist of sidewalks, crosswalks, and pedestrian signals at signalized intersections. Pedestrian facilities do not currently exist within the WCT site and existing pedestrian facilities are limited in the major roadways that serve the project study area. For example, sidewalks are not provided on either side of Honoapiilani Highway, Kuihelani Highway, Waiko Road, and Waiale Road, while sidewalks are provided only on one side of Kuikahi Drive and most portions of Maui Lani Parkway.

Pedestrian facilities at the existing study intersections are described below. Five of the eight existing study intersections are marked with high visibility crosswalks on at least two of the legs.

- Intersection 1: Honoapiilani Highway (Highway 30) & Kuikahi Drive
    - Signalized with marked crosswalks and pedestrian signals on all four legs
- Intersection 2: Waiale Road & Kuikahi Drive
    - Signalized with marked crosswalks and pedestrian signals on all four legs
- Intersection 3: S. Kamehameha Avenue/Maui Lani Parkway
    - All-way stop-controlled with marked crosswalks on three legs
- Intersection 4: Kuihelani Parkway (Highway 380) & Maui Lani Parkway
    - Signalized with no marked crosswalks and pedestrian signals at all four legs
- Intersection 5: Honoapiilani Highway (Highway 30) & Waiko Road
    - Signalized with marked crosswalks and pedestrian signals on three legs
- Intersection 6: Waiale Road & Waiko Road
    - Side-street stop-controlled with no marked crosswalks on all legs
- Intersection 8: Kuihelani Highway (Highway 380) & Waiko Road
    - Signalized with marked crosswalks and pedestrian signals on two legs
- Intersection 14: Honoapiilani Highway (Highway 30) & Kuihelani Highway (Highway 380)
    - Signalized with no marked crosswalks and pedestrian signals at all four legs

EXISTING INTERSECTION VOLUMES AND LANE CONFIGURATIONS

The operations of the eight existing study intersections were evaluated during weekday morning (6:00 to 9:00 AM) and evening (3:00 to 6:00 PM) peak-period conditions. Traffic counts were collected during the weekday AM and PM peak periods at the study intersections in September 2013, when local schools were in session. Existing lane configurations and signal controls were obtained through field observations. **Figure 3** presents the existing AM and PM peak-hour turning movement volumes, corresponding lane configurations and traffic control devices. Traffic count data sheets are provided in **Appendix A**.

EXISTING INTERSECTION LEVELS OF SERVICE

Existing peak-hour volumes and lane configurations were used to calculate levels of service for each of the study intersections. The results of the existing LOS analysis are presented in **Table 3** and the corresponding LOS calculation sheets are included in **Appendix B**.

TABLE 3 – EXISTING INTERSECTION LEVEL OF SERVICE

Intersection	Traffic Control	Peak Hour	Delay (sec/veh)[1]	LOS[2,3]
1. Honoapiilani Highway (Highway 30) / Kuikahi Drive	Signalized	AM	25.2	C
		PM	23.3	C
2. Waiale Road / Kuikahi Drive	Signalized	AM	26.4	C
		PM	24.7	C
3. S. Kamehameha Avenue / Maui Lani Parkway	AWSC	AM	48.3	**E**
		PM	54.4	**F**
4. Kuihelani Highway / Mauilani Parkway	Signalized	AM	21.4	C
		PM	21.9	C
5. Honoapiilani Highway (Highway 30) / Waiko Road	Signalized	AM	13.3	B
		PM	11.9	B
6. Waiale Road / Waiko Road	SSSC	AM	12.4	B
		PM	10.9	B
7. S. Kamehameha Avenue / Waiko Road[4]	N/A	AM	Does not exist	
		PM		
8. Kuihelani Highway (Highway 380) / Waiko Road	Signalized	AM	14.5	B
		PM	11.2	B
9. Honoapiilani Highway (Highway 30) / Main Street[4]	N/A	AM	Does not exist	
		PM		
10. Waiale Road / Main Street[4]	N/A	AM	Does not exist	
		PM		
11. Honoapiilani Highway / East-West Residential Street[4]	N/A	AM	Does not exist	
		PM		
12. North-South Residential Street / Waiale Road[4]	SSSC	AM	Does not exist	
		PM		
13. Honoapiilani Highway (Highway 30) / Waiale Road[4]	N/A	AM	Does not exist	
		PM		
14. Honoapiilani Highway (Highway 30) / Kuihelani Highway (Highway 380)	Signalized	AM	15.2	B
		PM	12.4	B

Source: Fehr & Peers, 2014.

Notes:

** Indicated oversaturated conditions. Delay cannot be calculated

AWSC = All-way stop-controlled intersection

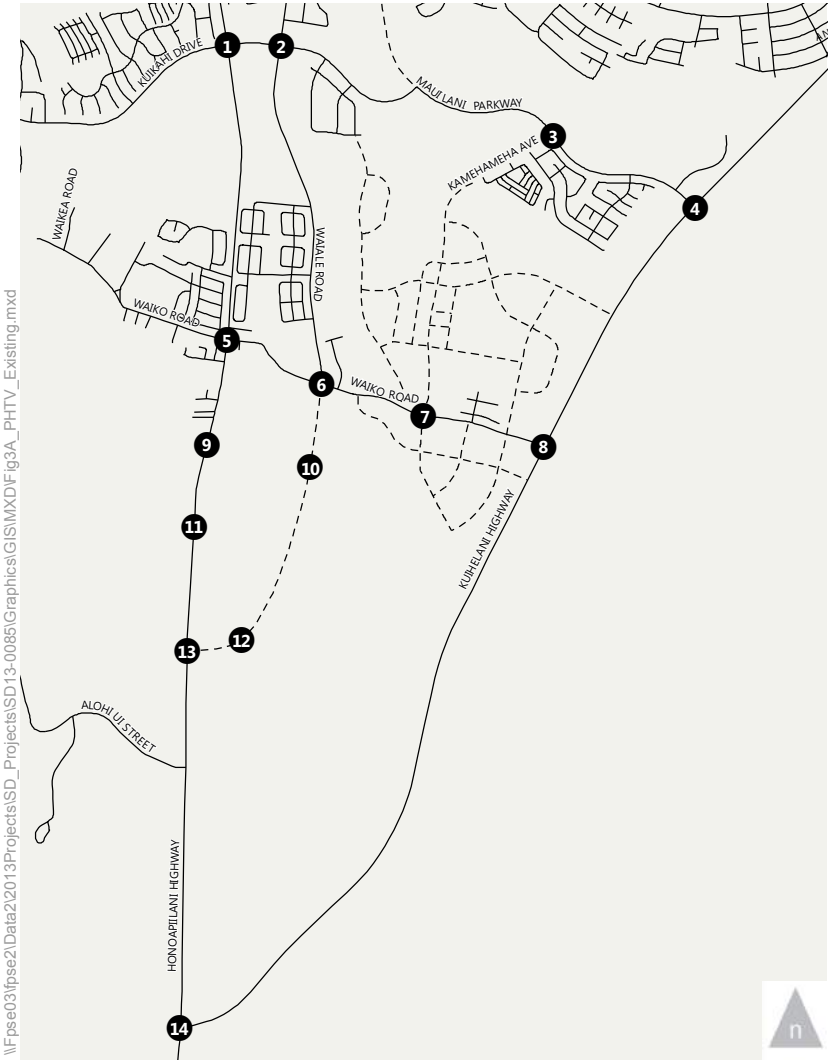
SSSC = Side-street stop-controlled intersection

[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized and all-way stop-controlled intersections. The vehicular delay for the worst movement is reported for side street stop-controlled intersections.

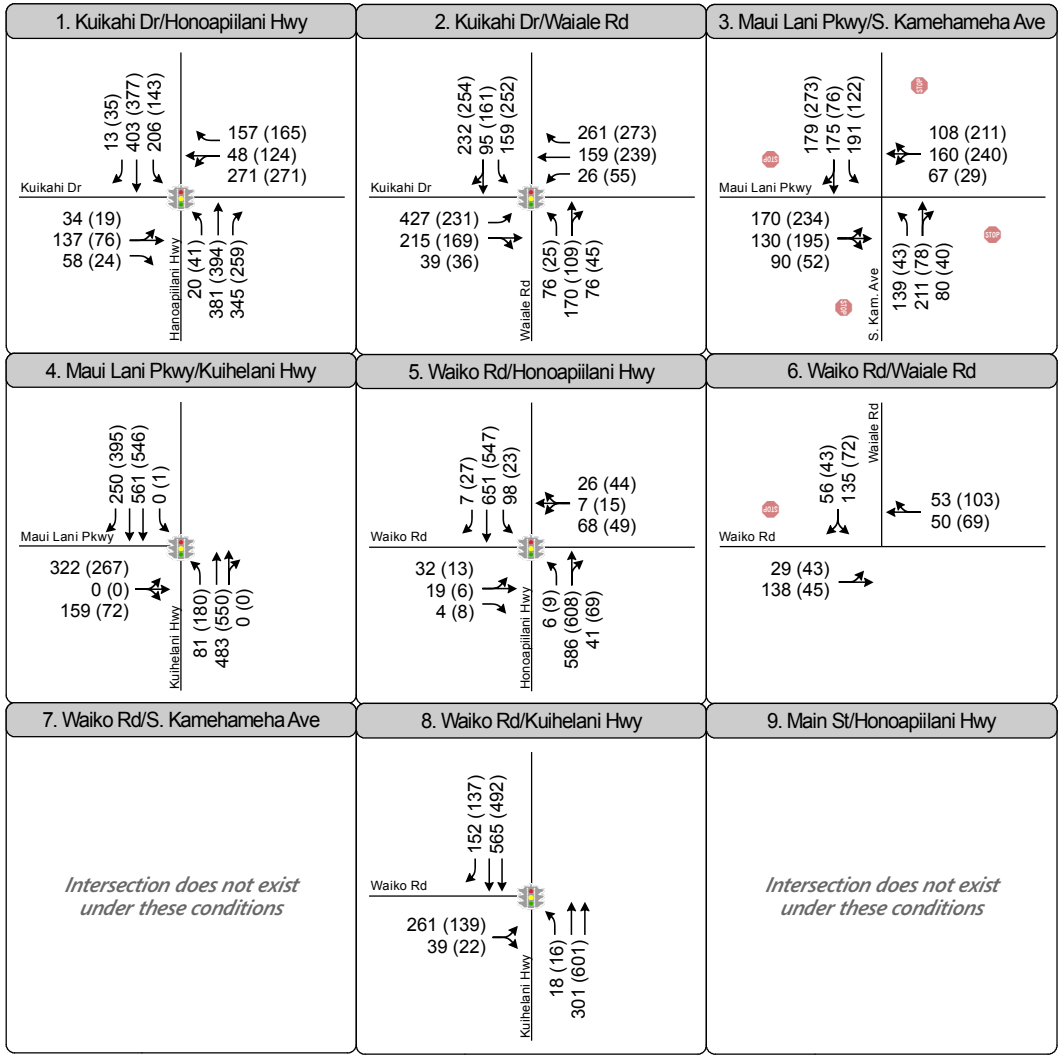
[2] LOS calculations performed using the *2000 Highway Capacity Manual (HCM)* method.

[3] Undesirable LOS highlighted in **bold.**

[4] Future intersection



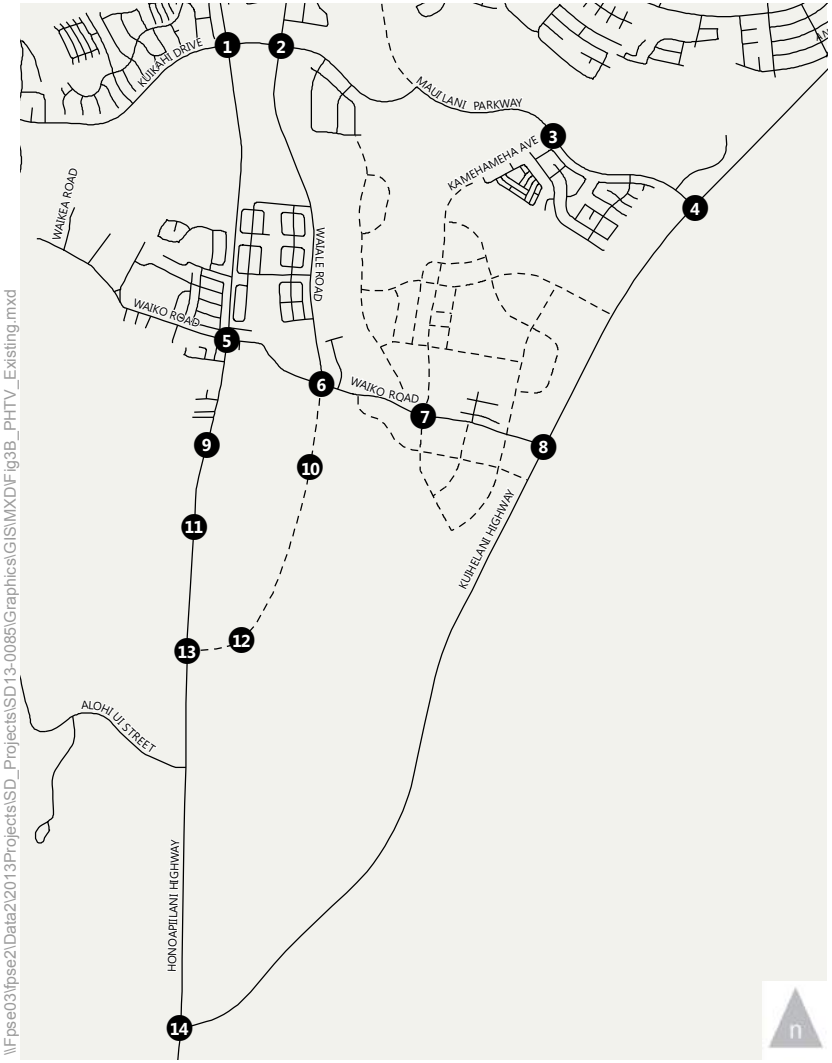
\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig3A_PHTV_Existing.mxd



#	Study Intersection		Traffic Signal
	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume	---	Proposed Roadway

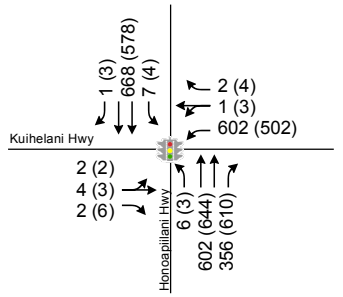
Figure 3A

Peak Hour Traffic Volumes and Lane Configurations - Existing (2013) Conditions



\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig3B_PHTV_Existing.mxd

10. Main St/Waiale Rd	11. E-W Residential St/Honoapiilani Hwy	12. Waiale Rd/N-S Residential St
Intersection does not exist under these conditions	*Intersection does not exist under these conditions*	*Intersection does not exist under these conditions*

13. Waiale Rd/Honoapiilani Hwy	14. Kuihelani Hwy/Honoapiilani Hwy
Intersection does not exist under these conditions	

#	Study Intersection		Traffic Signal
	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume		Proposed Roadway

Figure 3B

Peak Hour Traffic Volumes and Lane Configurations - Existing (2013) Conditions

The results of the LOS calculations indicate that all of the existing study intersections operate at an overall acceptable service level (LOS D or better), with the exception of the following location:

- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway (LOS E – AM peak hour and LOS F – PM peak hour)
    - The all-way stop-control and high eastbound and westbound volumes traversing through a shared left/through/right configuration contribute to the relatively high eastbound and westbound approach delays and overall poor operating peak levels of service at this intersection.

4. FUTURE TRAFFIC PROJECTIONS

To evaluate the potential impact of traffic generated by the proposed project on the surrounding street system, it was necessary to develop estimates of future traffic conditions in the area both with and without the project. Future traffic conditions without the proposed project reflect traffic increases due to general regional growth and development, as well as traffic increases generated by other specific developments near the project site. These conditions are referred to as the cumulative base condition (i.e., no project conditions). The sum of the cumulative base and project-generated traffic represents the cumulative plus project conditions. Development of these future traffic scenarios is described in this chapter.

CUMULATIVE BASE TRAFFIC PROJECTIONS

The cumulative base traffic projections include two elements: 1) model forecasts of future traffic volumes that take into account the expected changes in traffic over the existing traffic volumes caused by traffic generated by specific cumulative projects located in the study area and overall regional growth; and 2) by roadway network changes and street system improvements.

Although the anticipated completion year of the first phase of the WCT development is 2021, the analysis used 2022 for the horizon year for Phase 1 to be consistent with the planned completion of large background projects in the area, such as the Waiale development and the Waiale Bypass, providing a more conservative cumulative forecast against which to assess potential project impacts.

AREAWIDE TRAFFIC GROWTH AND CUMULATIVE DEVELOPMENT PROJECTS

Information was obtained from the County of Maui on approved, planned, and proposed development projects throughout Central Maui. This information was used to estimate future traffic volumes for the study area, since the growth and changes in traffic caused by anticipated projects in the Kahului, Wailuku and Waikapu areas could affect conditions on the streets around WCT. **Table 4** is a compiled list of future cumulative projects in the Central Maui vicinity. **Appendix C** provides a more detailed list with available project descriptions for residential projects that the County is monitoring, as well as maps of other residential and non-residential development projects in Central Maui that have come to the attention of the Department of Planning.

TABLE 4 – CENTRAL MAUI FUTURE CUMULATIVE PROJECT LIST [1,2]

Project Name	
• `Aina o Kane Condos	• Kehalani (C-9)
• Alternative Care Services, Inc.	• Kehalani Commercial Center
• Central Maui Regional Park	• Maui Beach Hotel Addition
• Central Maui Senior Housing	• Maui Lani Church
• Civil Defense Center	• Maui Lani Homes 1
• Consolidated Baseyards	• Maui Lani Lot 4
• Habitat For Humanity Condos	• Maui Lani Lot 7B
• Hale Ho`omalu Mental Health Kokua	• Maui Lani MF7 Condos
• Hale Mua	• Maui Lani Parkway Commercial
• Hale Kapili Project	• Maui Lani The Parkways
• Ka Lima O Maui Affordable Housing	• Maui Lani Village
• Kahawai Condos	• MEO B.E.S.T. House
• Kahului Harbor Improvements	• Mission Street Affordable Apts.
• Kahului Town Center Redevelopment	• Na Leo Pulama O Maui Hawaiian School Hale Hou
• Kehalani (C-12)	• Pi`ihana Project District 2
• Kehalani (C-13)	• Pu`unani Residences
• Kehalani (C-14)	• Valley Isle Fellowship Condos
• Kehalani (C-18)	• Wai`ale
• Kehalani (C-19)	• Wai'ale Affordable Homes
• Kehalani (C-3)	• Waiehu Mauka Affordable Townhomes
• Kehalani (C-6)	• Waikapu Gardens II
• Kehalani (C-7)	• Waikapu Light Industrial Park
• Kehalani (C-8)	• Waikapu Rural Village

Notes:

[1]The list above of development projects in Central Maui were pulled from multiple sources, including: conversations with County staff, a residential project list for Central Maui provided by the County of Maui in December 2013, available and relevant environmental assessments or impact studies available on the State's website for Maui, and the 2011 Central Maui Development Project maps and Development Project GIS layer available on the County website.

[2]During the related project review process, the socioeconomic and land use data in the interim year and long-term year No Build models was consistent with the future cumulative projects listed above.

By 2022 and by 2026, the WCT study area will have experienced significant residential growth and development of new commercial, industrial, business, and institutional land uses, primarily because of the following projects:

- ***Waiale,*** located along Waiko Road, south of the Maui Lani development, east of Waiale Road, and directly west of Kuihelani Highway, is assumed to be completed by 2022.[1] The planned mixed-use community will include 2,550 single-family and multi-family dwellings, commercial and light industrial land uses, as well as a middle school.
- ***Maui Lani Development*** is partially complete and assumed to be fully completed by 2026. This master planned community along Mauilani Parkway between Waiale Road and Kuihelani Highway, comprises of a mixture of residential subdivisions that total approximately 1,000 single-family and multi-family households and commercial uses. Specifically, the development includes the Maui Lani Village Center, which will be about 540,000 square feet or 79 lots available for commercial, business, or medical office uses.
- ***Kehalani Development*** is partially complete and assumed to be fully completed by 2026. This master planned community of 2,400 homes is located north of Kuikahi Drive, south of Iao Valley Road, east of the West Maui Mountains, and primarily west of Honoapiilani Highway.[2]
- ***Puunani Residences*** is located on the southwest quadrant of the intersection of Honoapiilani Highway & Kuikahi Drive. It is assumed that 20% and 40% of the project would be completed by both 2022 and 2026, respectively. Kuikahi Drive and Honoapiilani Highway are planned to provide access to the 600-home neighborhood.

Traffic generated by the above related projects and other developments were projected using the Maui Travel Demand Forecasting Model (TDFM)[3] and the trip generation methodology. The TDFM assigns land use and socioeconomic data provided by the County of Maui in 2007 to Traffic Analysis Zones (TAZs). These attributes were further used to generate and assign traffic across the roadway network for the base and horizon years, respectively.

[1] The TIAR for the Waiale development analyzed the project with Base Year 2022 conditions (Austin, Tsutsumi, and Associates, Inc., 2011).

[2] Source: http://www.kehalani.org/

[3] The base 2007 model, the interim horizon 2020 No Build model, and the long-term horizon 2035 No Build model were obtained from HDOT. The socioeconomic and land use data supplied by Maui County in 2007 was used to calibrate the TDFM.

BASELINE STREET SYSTEM IMPROVEMENTS

Discussions were held with County and State agency staff regarding the roadway improvements in or near the study area planned for completion by 2022. These improvements, whether the result of local capital improvement programs or in connection with planned or approved projects, would result in dramatically improved mobility options for residents and visitors as well as capacity changes at various locations throughout the study area as discussed below.

Based on the information received from agency staff, the review of planning documents related to the nearby projects, and the review of the roadway network changes between the base and horizon year models, the proposed transportation system changes that are projected to occur between 2007 and 2022 are included in the cumulative base traffic network of each horizon year No Build model.[4] The improvements are listed in detail below. The study area for transportation analysis purposes is generally bounded by Kuikahi Drive/Maui Lani Parkway to the north, Honoapi`ilani Highway to the west, Kuihelani Highway to the east, and the intersection of Honoapi`ilani Highway and Kuihelani Highway to the south. The street system improvements denoted with an asterisk (*) are outside of the WCT study area:

- Hana Highway Widening * – The 2020 and 2035 roadway networks of the TDFM includes the widening of Hana Highway from a four-lane to a six-lane divided highway from Kaahumanu Avenue to the vicinity of the also proposed Kahului Airport Access Road.

- Honoapiilani Highway Widening * – The 2020 and 2035 roadway networks of the TDFM includes the widening of Honoapiilani Highway between Lahainaluna Road and Aholo Road in West Maui from being a two-lane roadway to a four-lane roadway.

- Kahului Airport Access Road * – This four-lane bypass will be constructed from Puunene Avenue to Hana Highway. The purpose of this road is to provide an alternative route to congested existing routes (i.e., Dairy Road) to Kahului Airport. This roadway improvement project is assumed in the 2020 and 2035 roadway networks of the TDFM.

- Kamehameha Avenue Extension – To support the Waiale development and related traffic, it is assumed that Kamehameha Avenue will extend southward from its existing terminus near its intersection with Maui Lani Parkway to intersect Waiko Road and eventually to intersect with the Waiale project site Road B.

[4] Per HDOT, No Build scenarios are considered baseline conditions, which includes socioeconomic forecasts but without implementing projects, such as major roadway improvements and some private developments. At the time the model files were obtained, HDOT was currently working on the build scenario that modeled future projects. Because some of the roadway improvements listed in the TIAR were absent from both the 2020 No Build model and 2035 No Build model roadway networks, the roadway network for each model horizon year was updated to ensure these future facility improvements are appropriately modeled.

- Intersection 7: Kamehameha Avenue & Waiko Road – This future side street stop-controlled, four-legged intersection will consist of one left-turn lane and one shared through/right-turn lane on all approaches. This intersection is assumed to be constructed under cumulative base conditions, as it would provide access to portions of the Waiale mixed-use community.

- Lahaina Bypass * – This two-lane highway will be located in West Maui and will extend between Launiupoko south of Lahaina and Honokowai to the north. This roadway improvement project was added to the 2020 and 2035 roadway networks of the TDFM.

- Maui Lani Parkway Extension – To support the Maui Lani developments and related traffic, it is assumed that Maui Lani Parkway will extend and connect Waiinu Street and Kuikahi Drive. It is assumed that the extension will provide one lane in each direction.

- Puunene Avenue Widening * – The 2020 and 2035 roadway networks of the TDFM includes the widening of Puunene Avenue from two to four lanes from Wakea Avenue to Kuihelani Highway.

- Roadway Detailing for Waiale – To support the Waiale project and related traffic, the construction of the following roadways are assumed within the Waiale project site: Road A, Kamehameha Avenue extension, Road C, and Road B. These roadways are assumed to be constructed under cumulative base conditions, as it would provide access to various areas of the Waiale mixed-use community.

- Waiale Bypass – Waiale Road would extend from its existing terminus at Waiko Road to intersect Honoapiilani Highway approximately one mile south of Honoapiilani Highway/ Waiko Road. It is assumed that the bypass would be constructed as a two-way, two-lane roadway and left-turn pockets will be provided at key intersections, including the two future study intersections (discussed below).

- Intersection 6: Waiale Road & Waiko Road – This intersection will become a four-legged intersection under cumulative base conditions and the fourth (south) leg will be constructed as part of the Waiale Bypass. It is assumed that the reconfigured intersection will consist of one left-turn lane and one shared through/right-turn lane at the eastbound and southbound approaches, while the northbound and westbound approaches are assumed to consist of one left-turn lane, one through lane, and one right-turn lane. This existing, unsignalized intersection is assumed to become signalized as part of the construction of the Waiale Bypass.

- Intersection 13: Honoapi`ilani Highway & Waiale Road – This future intersection will consist of a northbound approach that provides one through lane and one free right-turn lane, a southbound approach that provide one through lane and one left-turn lane, and a westbound approach with

one left-turn lane and one right-turn lane. This intersection is assumed to be signalized and constructed as part of the Waiale Bypass project under cumulative base conditions.

Cumulative Base Traffic Projection Methodology

Related projects were checked against the model growth between the base year (2007) and each of the horizon years (2020 and 2035) to see if the land use and socioeconomic attributes included the known related projects, such as those listed in **Table 4**. Since the horizon year models obtained from HDOT were No Build scenarios,[5] some of the major projects planned in the vicinity of the WCT study area were noticeably absent in the TDFM's projections; therefore, in order to appropriately model these future projects, the respective land use and socioeconomic attributes were adjusted for the corresponding horizon year the related projects are anticipated to be completed by. The changes in land use and socioeconomic assumptions between the updated 2020 and 2035 model were then used to interpolate the land use and socioeconomic data for the scaled 2022 and 2026 models, which were used to forecast cumulative base traffic volumes for 2022 and 2026, respectively.

After the land use and socioeconomic data adjustments were completed, trips generated by the related projects were estimated and assigned by the model to the future roadway system based on their locations and anticipated distribution patterns. The geographic distribution of traffic generated by new development depends on several factors, such as the type and density of the proposed land uses, the geographic distribution of the population from which employees and/or patrons may be drawn, the geographic distribution of activity centers (employment, commercial, and other) to which residents of proposed residential projects may be drawn, and the location of those developments in relation to the surrounding future street system.

Between 2013[6] and 2026, the TDFM anticipates an aggregate, island-wide growth of approximately 17,000 households and about 24,000 employees for Maui. Additionally, after land use and socioeconomic data adjustments were completed for the 2026 model, the TDFM projected an approximate 20% increase in demand over existing conditions along Honoapiilani Highwy between Kuikahi Drive and Kuihelani Highway. The TDFM also projected an approximate 30% increase in demand along Kuihelani Highway over existing conditions between Maui Lani Parkway and Honoapiilani Highway. [7]

[5] Ibid.

[6] The Base Year (2007) for the TDFM was adjusted to include known socioeconomic changes up to 2013 (See Appendix C for specific projects). Therefore, the updated Base Year TDFM used in this analysis reflects land use and employment updates between 2007 and 2013.

[7] The overall percentage increase in traffic demand was based on averaging the calculated percentage increase in each of the PM peak hour roadway segment volumes between the updated base year and 2026 horizon year models.

CUMULATIVE BASE TRAFFIC VOLUMES

The resulting cumulative base traffic volumes and the anticipated lane configurations, representing future conditions without the project for year 2022 and 2026, are presented in **Figure 4** and **Figure 5**, respectively. These future projections take into account the estimated overall growth in the surrounding area without the addition of traffic generated by the proposed Waikapu Country Town Project. To analyze level of service, post-processed model volumes for the 2022 cumulative base and the 2026 cumulative base were loaded into Synchro 8.0.

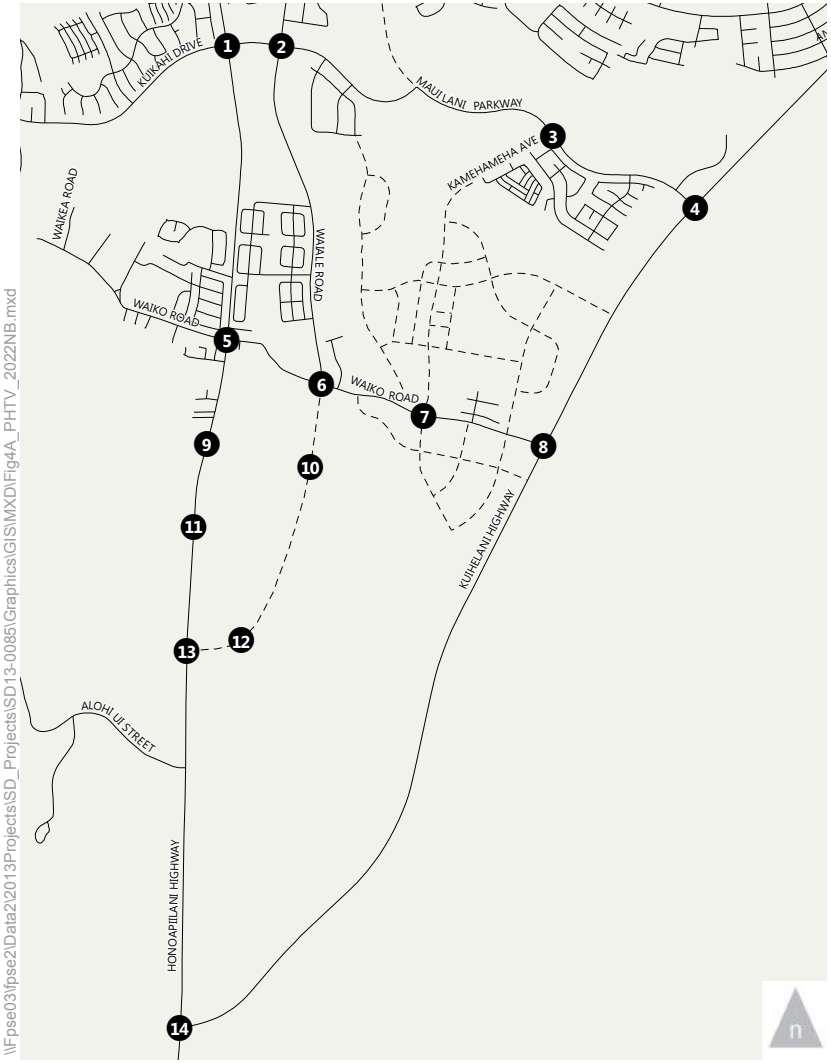
PROJECT TRAFFIC PROJECTIONS

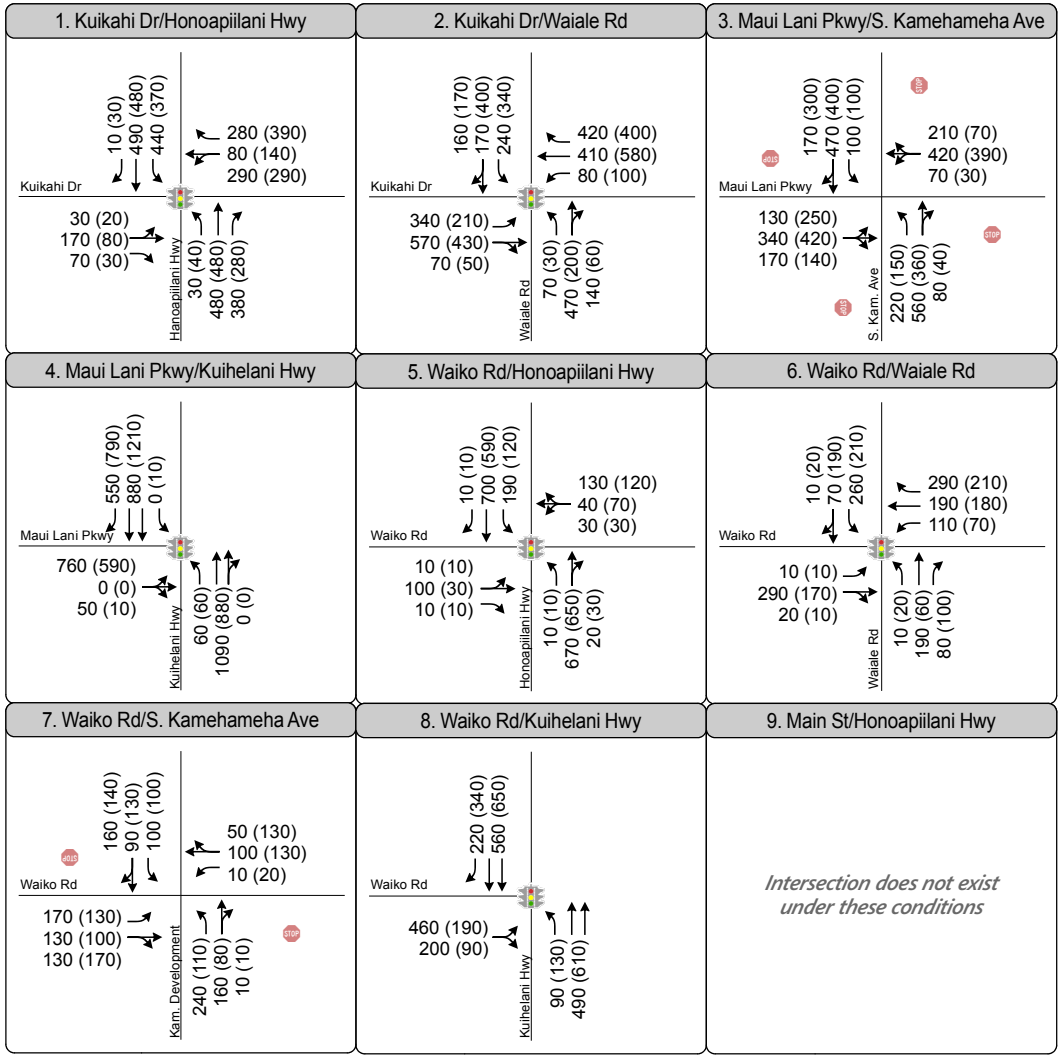
Development of future traffic projections related to the amount of traffic added to the roadway system by WCT is estimated using a three-step process: (1) project trip generation, (2) trip distribution, and (3) trip assignment. The first step estimates the amount of project-generated traffic will be added to the roadway network. The second step estimates the direction of travel to and from the project site. The new trips are assigned to specific street segments and intersection turning movements during the third step. This process is described in more detail in the following sections.

PROJECT STREET SYSTEM IMPROVEMENTS

Based on feedback from agency staff and review of the proposed street network, the proposed transportation system changes described previously are anticipated to occur between 2013 and 2022/2026 and are therefore included in the cumulative base traffic network. Additional improvements will be made as part of the proposed project and are listed below:

- Intersection 9: Honoapiilani Highway & Main Street – This future intersection will be constructed as part of the Year 2022 Conditions (Phase 1) of the proposed project. The intersection is assumed to be configured with northbound and southbound approaches that provide one left-turn lane, one through lane, and one right-turn lane and eastbound and westbound approaches that provide one left-turn lane and one shared through/right-turn lane.



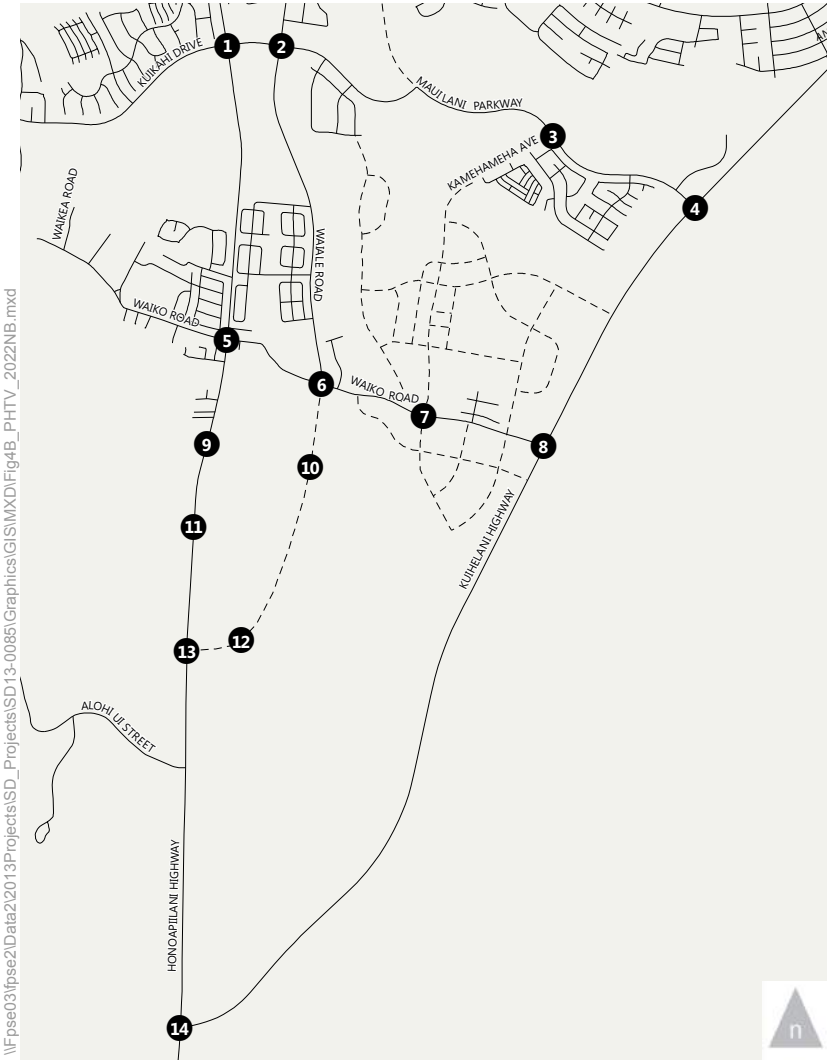


\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig4A_PHTV_2022NB.mxd

#	Study Intersection		Traffic Signal
	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume		Proposed Roadway

Figure 4A

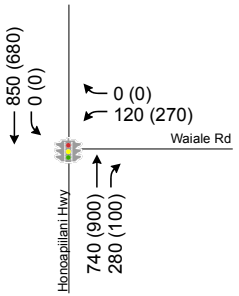
Peak Hour Traffic Volumes and Lane Configurations - Year 2022 No Project Conditions



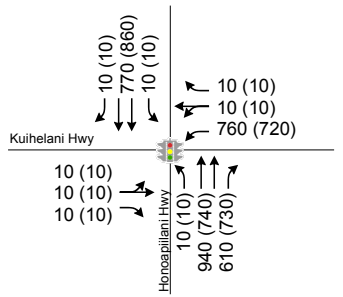
\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig4B_PHTV_2022NB.mxd

10. Main St/Waiale Rd	11. E-W Residential St/Honoapiilani Hwy	12. Waiale Rd/N-S Residential St
Intersection does not exist under these conditions	*Intersection does not exist under these conditions*	*Intersection does not exist under these conditions*

13. Waiale Rd/Honoapiilani Hwy



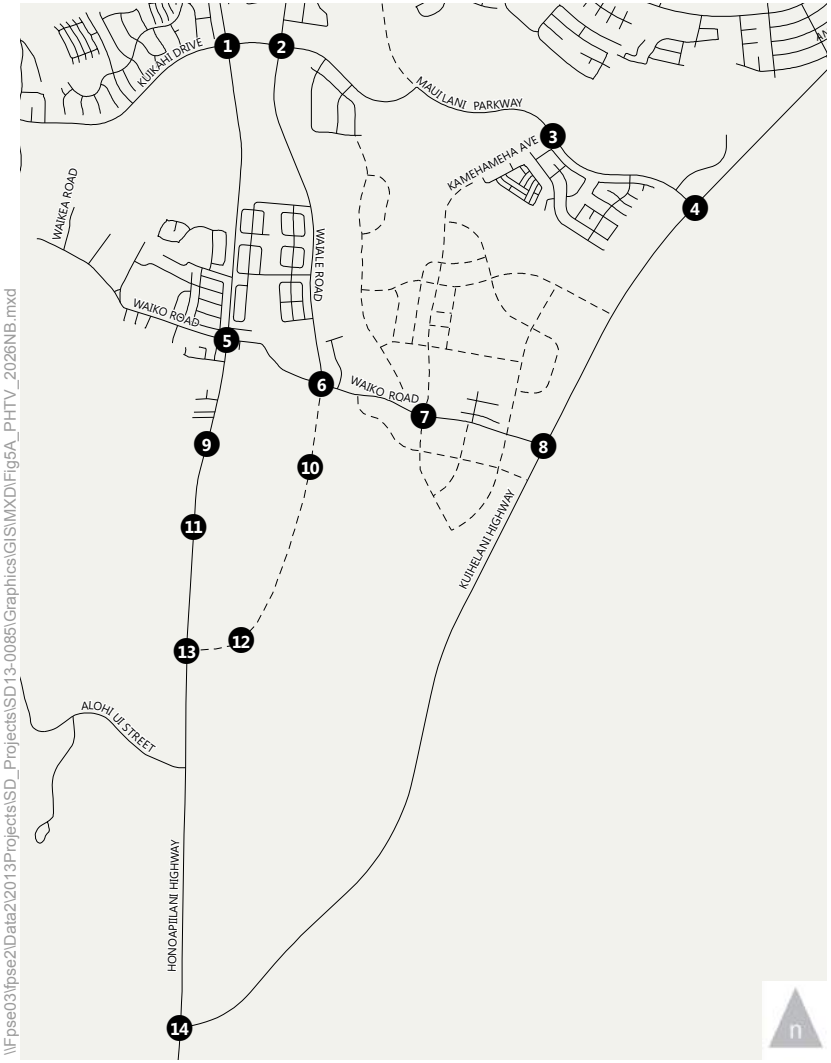
14. Kuihelani Hwy/Honoapiilani Hwy



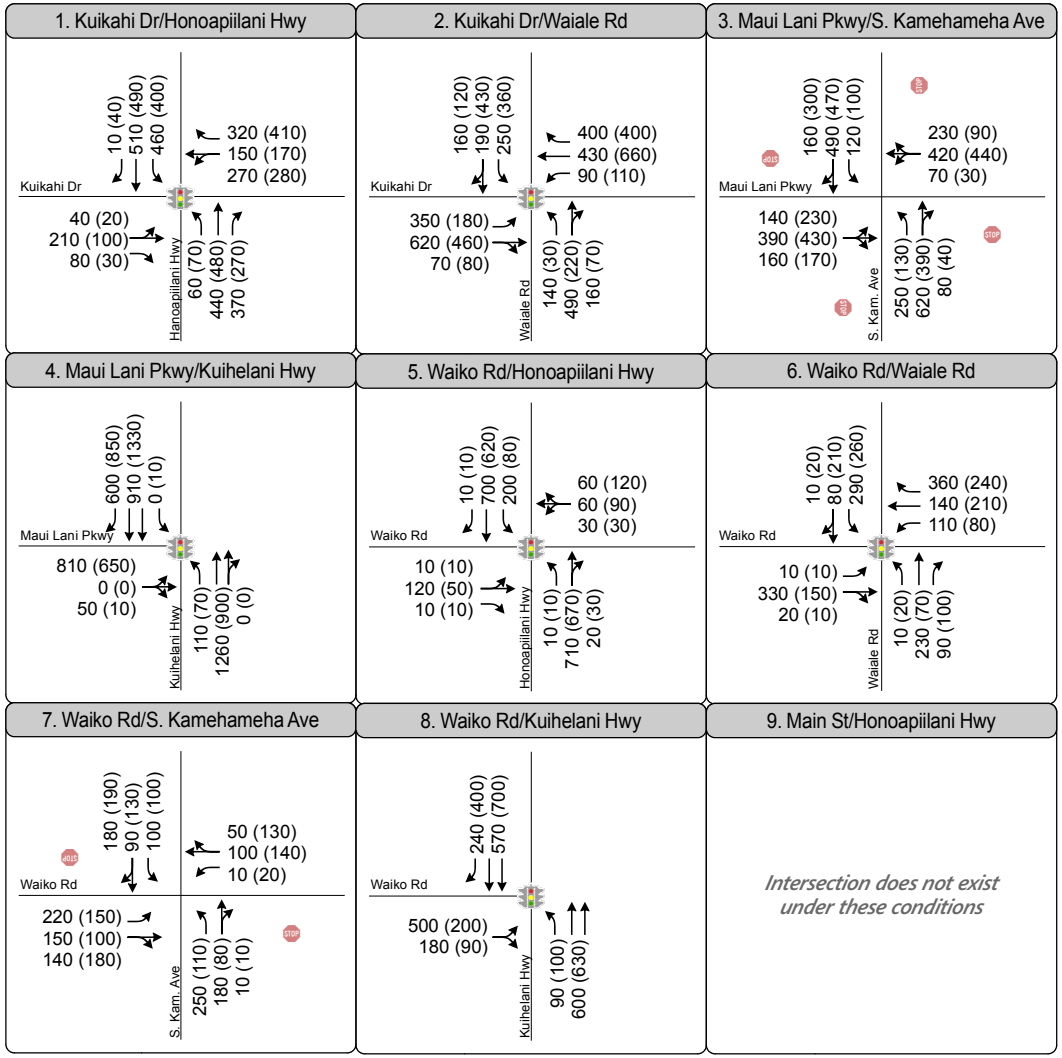
#	Study Intersection		Traffic Signal
	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume		Proposed Roadway

Figure 4B

Peak Hour Traffic Volumes and Lane Configurations - Year 2022 No Project Conditions



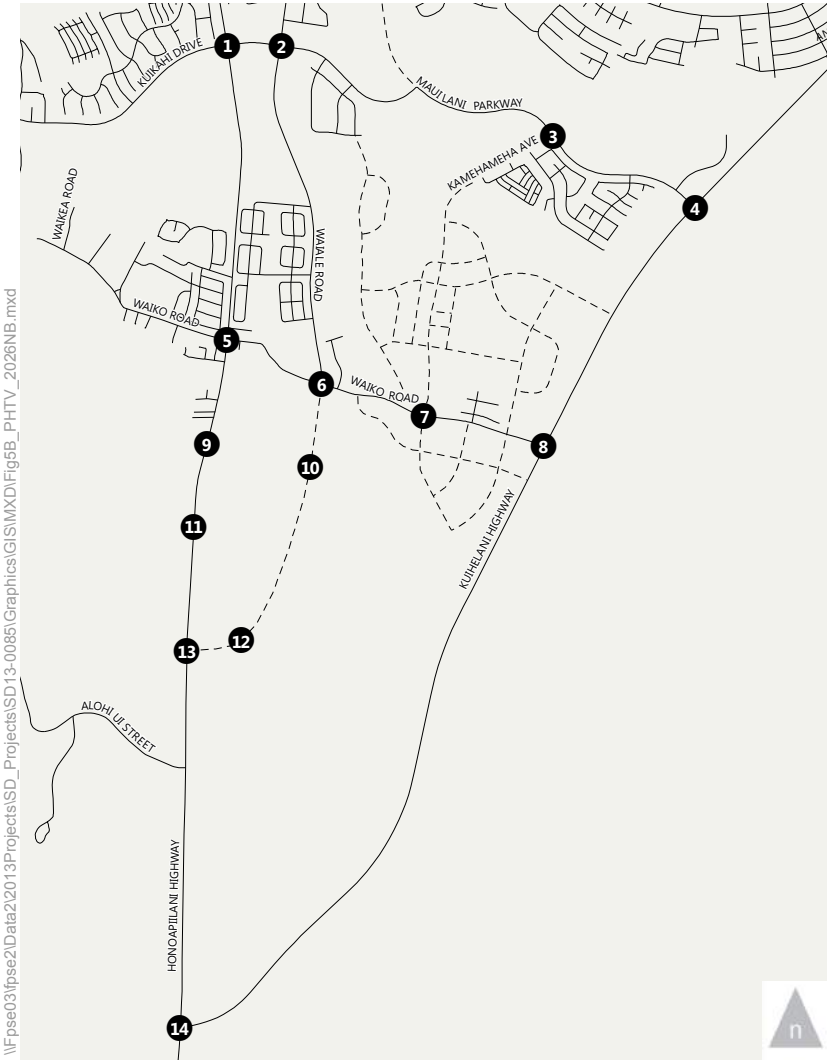
\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig5A_PHTV_2026NB.mxd



#	Study Intersection		Traffic Signal
	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume		Proposed Roadway

Figure 5A

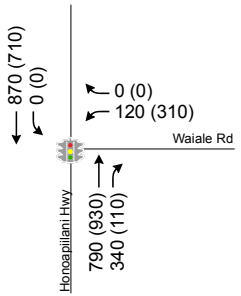
Peak Hour Traffic Volumes and Lane Configurations - Year 2026 No Project Conditions



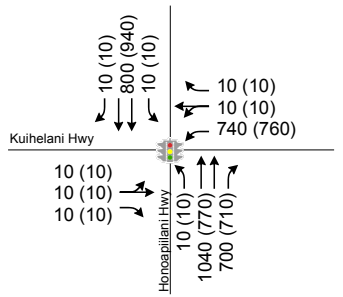
\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig5B_PHTV_2026NB.mxd

10. Main St/Waiale Rd	11. E-W Residential St/Honoapiilani Hwy	12. Waiale Rd/N-S Residential St
Intersection does not exist under these conditions	*Intersection does not exist under these conditions*	*Intersection does not exist under these conditions*

13. Waiale Rd/Honoapiilani Hwy



14. Kuihelani Hwy/Honoapiilani Hwy



#	Study Intersection		Traffic Signal
	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume		Proposed Roadway

Figure 5B

Peak Hour Traffic Volumes and Lane Configurations - Year 2026 No Project Conditions

Additionally, the intersection is proposed to be signalized.[8] If the intersection was side-street stop-controlled under future conditions, the side-street approaches would operate at undesirable LOS and drivers at the side streets would experience significantly long delays due to the heavy projected through volumes along the Honoapiilani Highway.

- Intersection 10: Waiale Road & Main Street – This future intersection will be constructed as part of the Year 2022 Project Conditions (Phase 1). It is assumed to be configured as a four-legged, single-lane roundabout, where vehicles must yield for a gap in the circulating flow before entering the circle. The east leg of the intersection is assumed to provide access to consolidated County and public facilities, light industrial uses, a regional park, fire station, and emergency management center.[9]

- Intersection 11: Honoapiilani Highway & East-West Residential Street – This future intersection will be constructed as part of the proposed project. The intersection is assumed to be configured as a four-legged intersection with northbound and southbound approaches that provide one left-turn lane, one through lane, and one right-turn lane and eastbound and westbound approaches that provide one left-turn lane and one shared through/right-turn lane.

  Additionally, it should be noted that the intersection is proposed to be signalized under full buildout conditions of the project.[8] If the intersection was side-street stop-controlled under future conditions, the side-street approaches would operate at undesirable LOS and drivers at the side streets would experience significantly long delays due to the heavy projected through volumes along the Honoapiilani Highway.

- Intersection 12: Waiale Road & North-South Residential Street – This future intersection will be constructed as part of the Year 2026 with Project Conditions (Phase 2). It is assumed to be configured as a three-legged, side-street stop-controlled intersection with an eastbound approach that provides a shared through/left-turn lane, a westbound approach that provides a

[8] Prior to the installation of a traffic signal, it is recommended that a full warrant analysis be conducted based on field-measured traffic data and a thorough study of traffic and roadway conditions by an experienced engineer. Furthermore, the decision to install a signal should not be based solely on the warrants because the installation of signals can lead to certain types of collisions. The responsible state or local agency should undertake regular monitoring of actual traffic conditions and collision data and conduct a timely re-evaluation of the full set of warrants to prioritize and program intersections for signalization.

[9] Based on consultations with the County, approximately 100 acres will be dedicated to consolidated facilities for water, parks, environmental management, and public works departments. The primary access to these uses is planned to be via Kuihelani Highway, however, some vehicles and maintenance trucks will likely access these uses via the Waiale Bypass. This analysis assumes that such mauka access will be via the east leg of Intersection 10: Waiale Road & Main Street. Additionally, the fire station, emergency management center, and regional park access will be through the east leg of Waiale Road & Main Street. Based on the best available data, traffic projections for theses uses have been estimated and applied to the intersection analysis.

shared through/right-turn lane, and a stop-controlled southbound approach that provides a shared left-turn/right-turn lane.

- Intersection 13: Honoapiilani Highway & Waiale Road – This signalized intersection will be a three-legged intersection under cumulative base conditions. The fourth (west) leg will be constructed as part of the Year 2026 Conditions (Phase 2) of the proposed project, resulting in a northbound approach that provides one left-turn lane, one through lane, and one free right-turn lane, a southbound approach that provides one left-turn lane, one through lane, and one right-turn lane, and eastbound and westbound approaches that provide one left-turn lane and one shared through/right-turn lane.

PROJECT TRIP GENERATION ESTIMATES

Vehicle trip rates presented in *Trip Generation 9th Edition* (Institute of Transportation Engineers, 2012) were used to estimate number of trips to and from the proposed project. The trip generation rates used in this study and the estimated new numbers of trips generated by the proposed project in 2026 are summarized in **Table 5**.

Project trip generation estimates are commonly developed using Institute of Transportation Engineers (ITE) rates. However, ITE rates are typically obtained from isolated, suburban developments generally not sensitive to the trip-making characteristics of mixed-use developments such as WCT. In fact, few methodologies are available to estimate the unique trip generation characteristics of mixed-use and infill developments. One of the most commonly used methods is to use trip generation rates or equations from *Trip Generation* and apply reductions from the mixed-use internalization spreadsheet from *Trip Generation Handbook, 2nd Edition* (ITE, 2004). This method has some shortcomings in that it is based on a limited sample of six mixed-use sites in Florida, it is limited to three land use types (residential, retail, and office), and it does not take into account the influence of nearby land uses.

More comprehensive analyses of mixed-use and infill trip generation were developed and presented in the following research studies: *Traffic Generated by Mixed-Use Developments – A Six-Region Study Using Consistent Built Environmental Measures* (Reid Ewing et al., September 2008) and *National Cooperative Highway Research Program Report 684: Enhancing Internal Trip Capture Estimation for Mixed-Use Developments* (Bochner et al., March 2011). The two studies examined over 260 mixed-use development sites throughout the U.S. and, using different approaches, developed new quantification methods. Fehr & Peers has reviewed the two methods, including the basis, capabilities, and appropriate uses of each, to produce a new method (MXD+) that combines the strengths of the two individual advances to best practice. MXD+ recognizes that traffic generation by mixed-use and other forms of sustainable development relate closely to the density, diversity, design, destination accessibility, transit proximity, and scale of development. MXD+ improves the accuracy of impact estimation and trip internalization and

gives planners a tool to rationally balance land use mix and to incorporate urban design, context compatibility, and transit orientation to create lower-impact development.

Accordingly, the MXD+ process was used to estimate more appropriate internalization and non-motorized trip reductions to apply to the ITE-based automobile trip generation for WCT. The MXD reductions for full buildout of WCT ranged from 22% to 27% during the peak hours and 15% for daily. Using the MXD+ process to inform and refine the internalization and non-motorized trip reduction estimate used for the project trip generation, it was determined that the application of a 15% daily reduction and a 25% AM and PM peak hour reduction were appropriate to account for the infill and mixed-use nature of the land use plan where vehicle trips would be linked (i.e. residential-school-retail interplay) and/or replaced with walk and bicycle trips to nearby land uses. The MXD+ model inputs and results are provided in **Appendix D.**

As shown in **Table 5**, by 2026 and completion of both Phase 1 and Phase 2 of WCT, the project full buildout is estimated to generate approximately 19,000 daily trips, including about 1,200 AM peak hour trips (409 inbound and 746 outbound) and about 1,500 PM peak hour trips (852 inbound and 633 outbound).

The MXD+ process was also used to estimate more appropriate internalization and non-motorized trip reductions to apply to the ITE-based automobile trip generation for just WCT Phase 1. The MXD reductions for partial buildout of WCT ranged from 26% to 35% during the peak hours and 17% for daily. The variation in reductions related to internal capture and non-motorized trips between the full buildout reductions are because a smaller portion of the makai and mauka side of the WCT project will be developed and less residential units will be constructed by Phase 1. Using the MXD+ process to inform and refine the internalization and non-motorized trip reduction estimate to be used for the Year 2022 project trip generation, it was determined that the application of a 15% daily reduction and a 25% AM and PM peak hour reduction would still be the appropriate, conservative approach.

With the application of the reductions to the WCT Phase 1 trip estimates, the partial buildout of the project is expected to generate approximately 13,100 daily trips, including about 700 trips during the AM peak hour (306 inbound and 427 outbound) and about 1,000 trips during the PM peak hour (552 inbound and 460 outbound). These WCT Phase 1 trip estimates were then used to conduct the traffic analysis for the Year 2022 with Partial Development Conditions. **Appendix E** provides the vehicle trip generation estimates for Phase 1 and **Appendix D** provides the corresponding MXD+ model inputs and outputs.

TABLE 5 – TRIP GENERATION RATE AND ESTIMATES

SUMMARY OF RATES

Land Use	ITE#	Rate	Daily	AM Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
Single-Family Housing	210	per Dwelling Unit	[a]	25%	75%	[a]	63%	37%	[a]
Apartments	220	per Dwelling Unit	[a]	20%	80%	[a]	65%	35%	[a]
Retail	820	per 1,000 square feet	[a]	62%	38%	[a]	48%	52%	[a]
Parks	412	per acre	2.28	61%	39%	0.02	61%	39%	0.09
Elementary School	520	per student	1.29	55%	45%	0.45	49%	51%	0.15
Quality Restaurant	931	per 1,000 square feet	89.95	82%	18%	0.81	67%	33%	7.49

Source: *ITE Trip Generation Manual,* 9th Edition, 2012.

VEHICLE TRIP ESTIMATES

Land Use	ITE#	Quantity	Unit	Daily	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
Phase 1 & 2 (2017-2026)										
Single-Family Housing	210	1,050	DU[1]	9,136	186	559	745	549	323	872
Apartments [b]	220	529	DU[1]	3,329	53	210	263	201	108	309
Retail [c]	820	169.597	KSF[2]	9,573	133	82	215	410	444	854
Parks	412	32.440	Acres	74	1	0	1	2	1	3
Elementary School [d]	520	750	Students	968	186	152	338	55	58	113
Internal Capture or Non-motorized Trips (15% Daily; 25% AM and PM) [e]				*-3,462*	*-140*	*-251*	*-391*	*-304*	*-234*	*-538*
Pass-by Reduction (10% Daily and AM; 20% PM) [f]				*-813*	*-10*	*-6*	*-16*	*-61*	*-67*	*-128*
Total Net New External Vehicle Trips (Phase 1 & 2)				**18,805**	**409**	**746**	**1,155**	**852**	**633**	**1,485**

Source: Fehr & Peers, 2014; Waikapu Country Town Conceptual Land Use Plan by Planning Consultants Hawaii, LLC. (October 2014)

Notes:

[1] Dwelling Unit = DU

[2] 1,000 square feet = ksf

[a] Fitted curve equations were used to derive AM peak hour, PM peak hour, and daily trip generation.

[b] The country town mixed-use residential units and the multi-family residential units were all analyzed as apartments for conservative trip generation analysis purposes.

[c] Does not include the 29,250 square feet of existing commercial uses located in the same area as the "village center," which will remain.

[d] Elementary school student body assumed based on information provided in the latest Waikapu Country Town Land Use Plan dated March 3, 2014 and further consultation with the Planning Consultants Hawaii, LLC and Hawaii Department of Education, Facilities.

[e] Reductions related to internal trip capture and non-motorized trips are due to residential-school-retail interplay. An estimated 15% reduction of daily trips and 25% reductions of the AM and PM peak hour trips were made to account for the mixed-use nature of the site, where vehicle trips can be linked and/or replaced with non-motorized trips. The MXD process was used to confirm and refine the initial reduction estimate. The MXD+ estimates peak hour internalization at 22% to 27%.

[f] Based on the ITE Trip Generation Handbook, 2nd Edition, 2004, the estimated pass-by trip credit (assuming all WCT commercial space is for retail) is about 33%. However, because some space is expected to be service-oriented or small office, and to provide a more conservative analysis it is estimated that the pass-by credit is 10% and 20% of the net daily and net AM and PM peak hour retail trips, respectively.

Figure 6 illustrates the net new 2022 Phase 1 project-generated traffic volumes for the AM and PM peak hours at each of the study intersections. **Figure 7** illustrates the net new 2026 project-generated traffic volumes with Phase 1 and Phase 2 project-generated traffic volumes for the AM and PM peak hours at each of the study intersections. The project trips shown on these figures reflect the inclusion of pass-by trips at some of the project intersections.

PROJECT TRIP DISTRIBUTION AND ASSIGNMENT

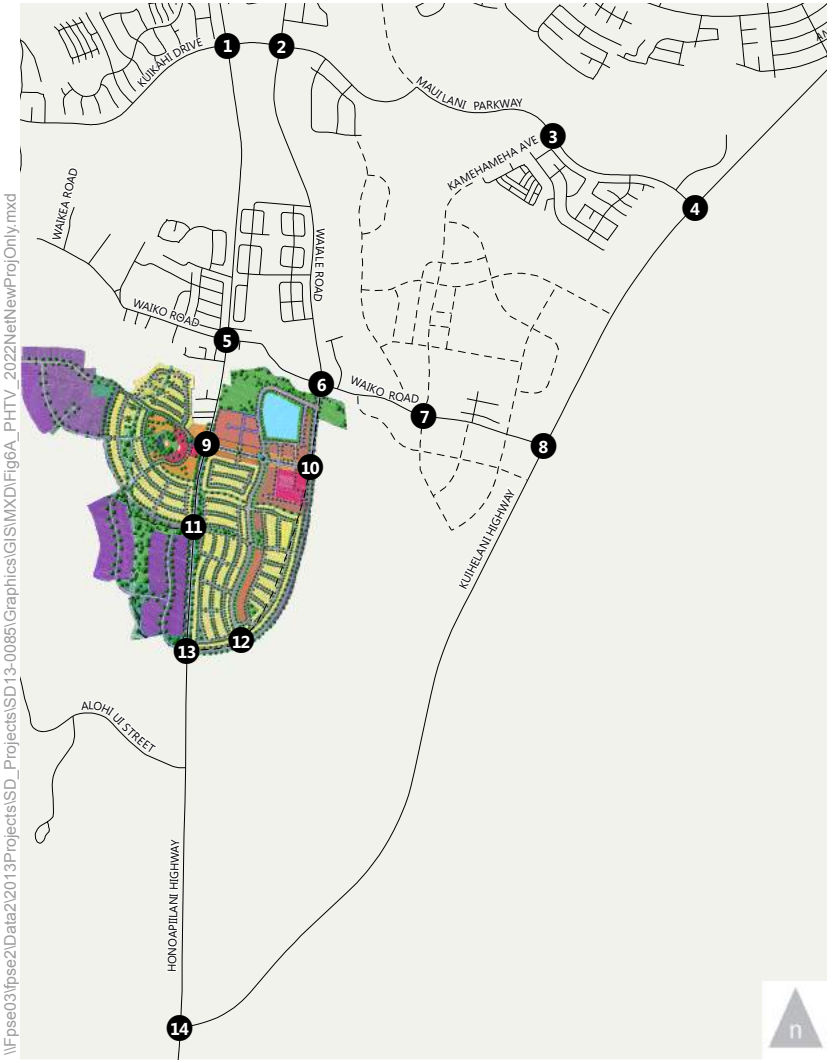
The trip distribution pattern was informed by a select zone analysis of the project site using the TDFM. Based on the model data and other refinements (i.e., adjustments based locations of complementary land uses), the following overall trip distribution pattern was estimated for the project-generated traffic:

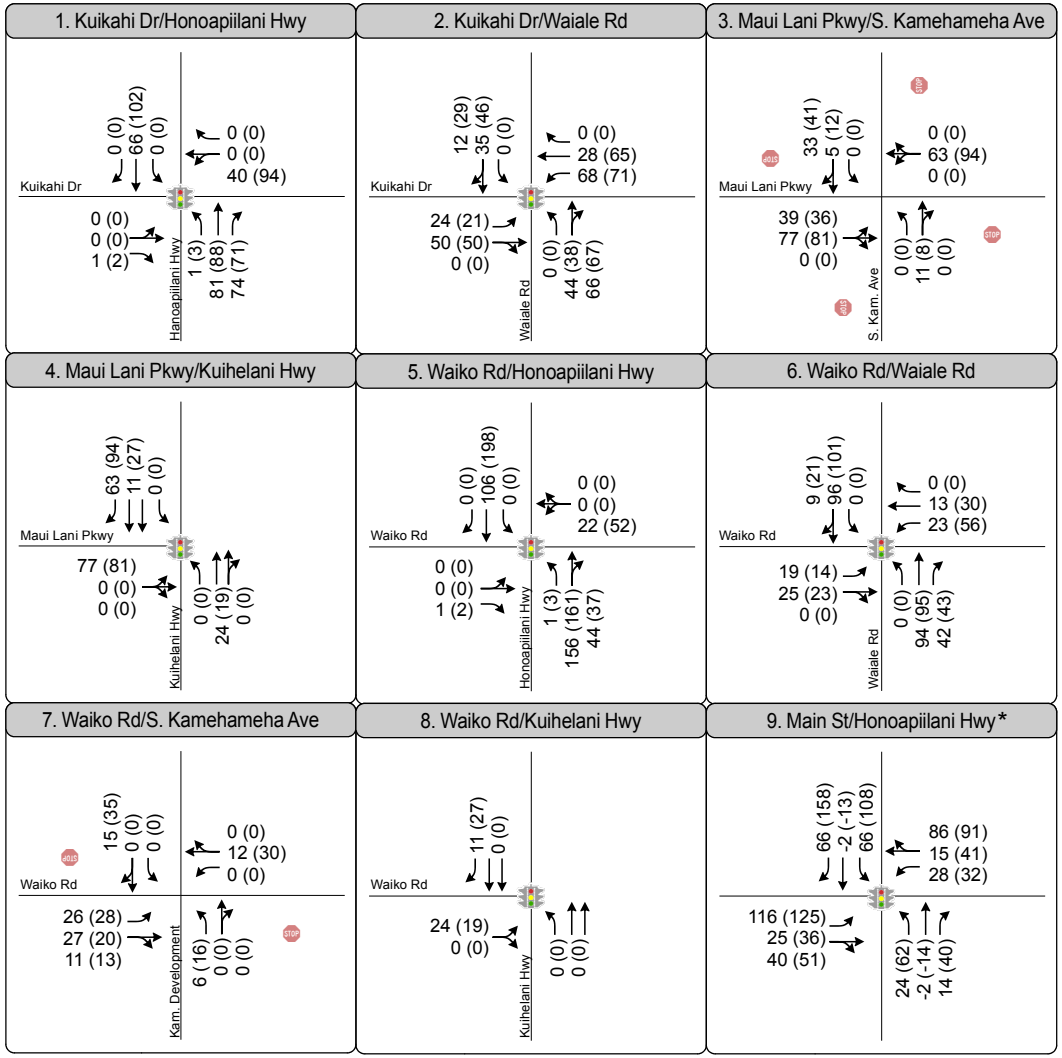
- 2% to/from the west for employment based trips
- 25% to/from the south for household based trips and 30% to/from the south for employment based trips
- 65% to/from the north for household based trips and 58% to/from the north for employment based trips
- 100% to/from the north for school-related external trips
- 10% to/from nearby developments or mixed-use communities for both household and employment based trips

Based on the trip distribution pattern discussed above, the estimated project trips were assigned to the future roadway network that will be in place by 2022 and 2026, the horizon years in which buildout of Phases 1 and 2 of WCT are planned to be completed, respectively. As discussed, this analysis assumes that the Waiale Bypass would be in place to serve project-related and other traffic.

CUMULATIVE PLUS PROJECT TRAFFIC PROJECTIONS

The project-generated traffic volumes were added to the cumulative base traffic projections to develop the cumulative plus project traffic forecasts for 2022 and 2026. **Figure 8** illustrates the anticipated lane configurations and projected Year 2022 with Partial Development AM and PM peak hour traffic volumes at each of the study intersections. **Figure 9** illustrates the anticipated lane configurations and the Year 2026 with Project AM and PM peak hour traffic volumes at each of the study intersections. At a few locations, differences in the future roadway network with Phase 1 and with Phase 2 of the project will result in slightly different trip assignments.





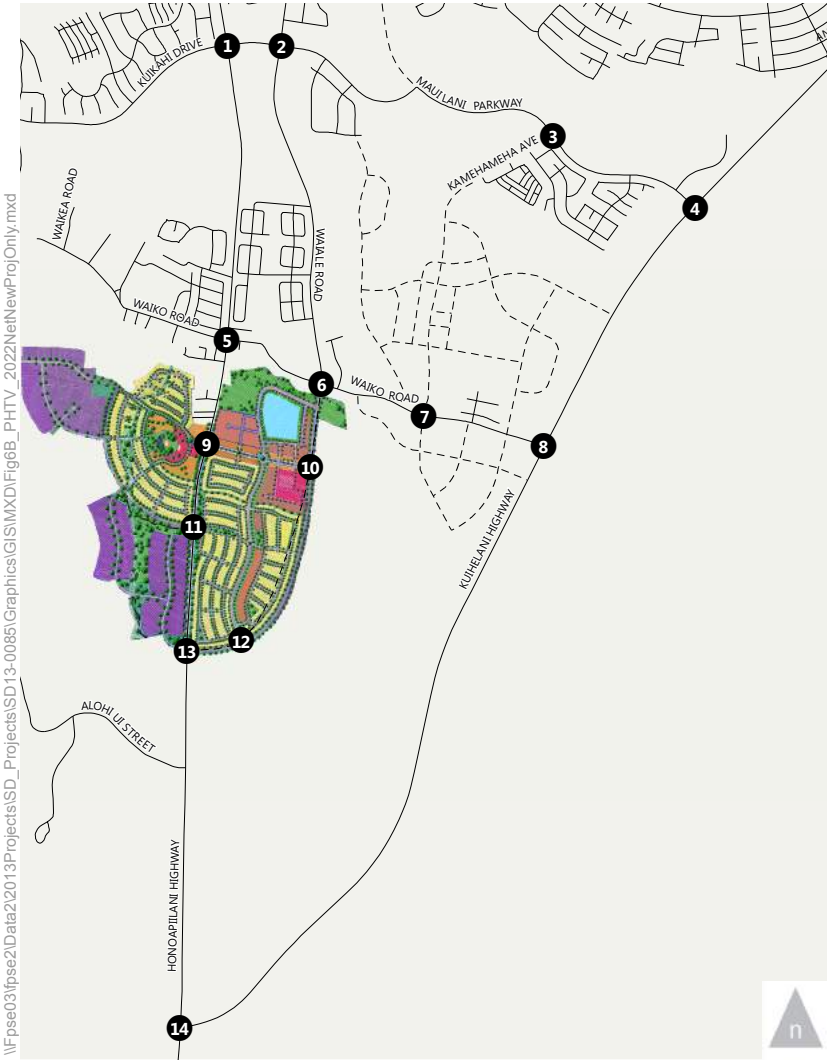
\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig6A_PHTV_2022NetNewProjOnly.mxd

#	Study Intersection		Traffic Signal
→	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume	- - -	Proposed Roadway
*	Includes Pass-by Trips		

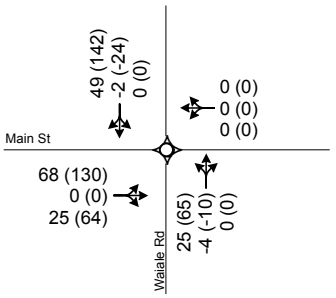
Note: Under Phase 1, only the northern portion of both the mauka and makai sides of the project site are developed. Therefore, the negative volumes reported at some movements indicate that the traffic shifts caused by pass-by trips were greater than forecasted project volumes traversing through these movements.

Figure 6A

Peak Hour Traffic Volumes and Lane Configurations - Net New Project Only, Phase 1 (2022)



10. Main St/Waiale Rd *



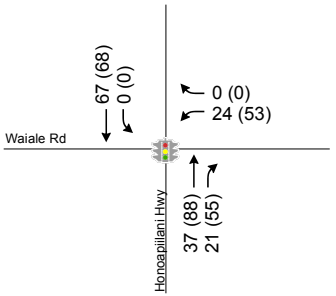
11. E-W Residential St/Honoapiilani Hwy

Intersection does not exist under these conditions

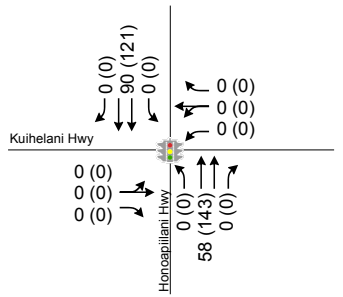
12. Waiale Rd/N-S Residential St

Intersection does not exist under these conditions

13. Waiale Rd/Honoapiilani Hwy



14. Kuihelani Hwy/Honoapiilani Hwy

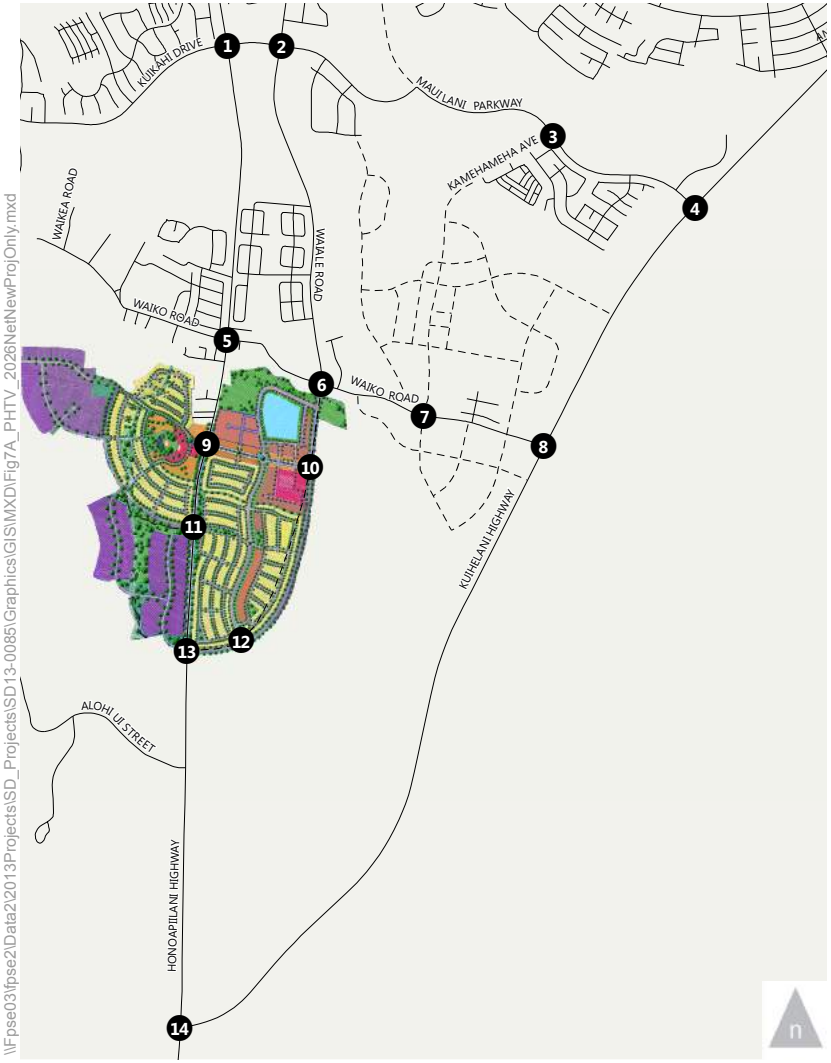


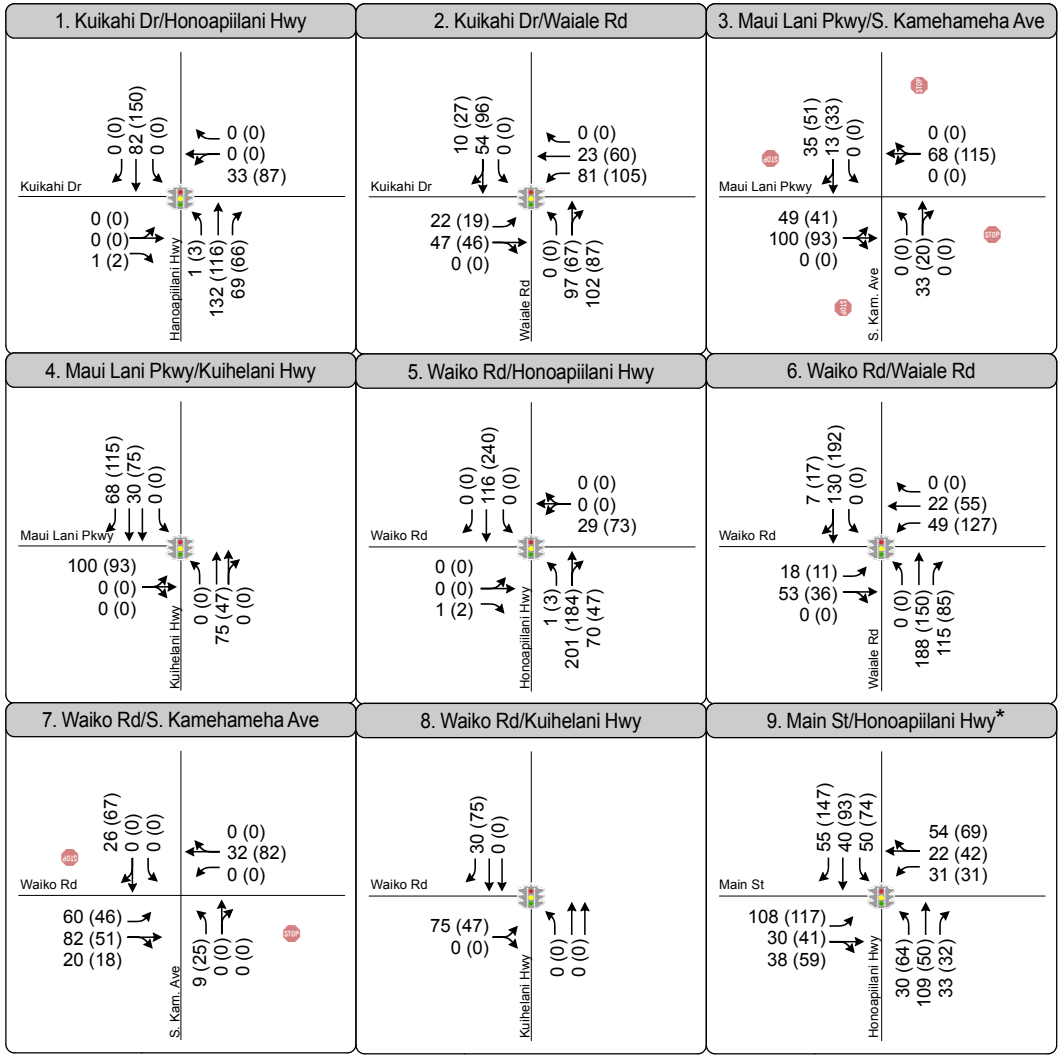
#	Study Intersection		Traffic Signal
	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume		Proposed Roadway
*	Includes Pass-by Trips		Roundabout

Note: Under Phase 1, only the northern portion of both the mauka and makai sides of the project site are developed. Therefore, the negative volumes reported at some movements indicate that the traffic shifts caused by pass-by trips were greater than forecasted project volumes traversing through these movements.

Figure 6B

Peak Hour Traffic Volumes and Lane Configurations - Net New Project Only, Phase 1 (2022)



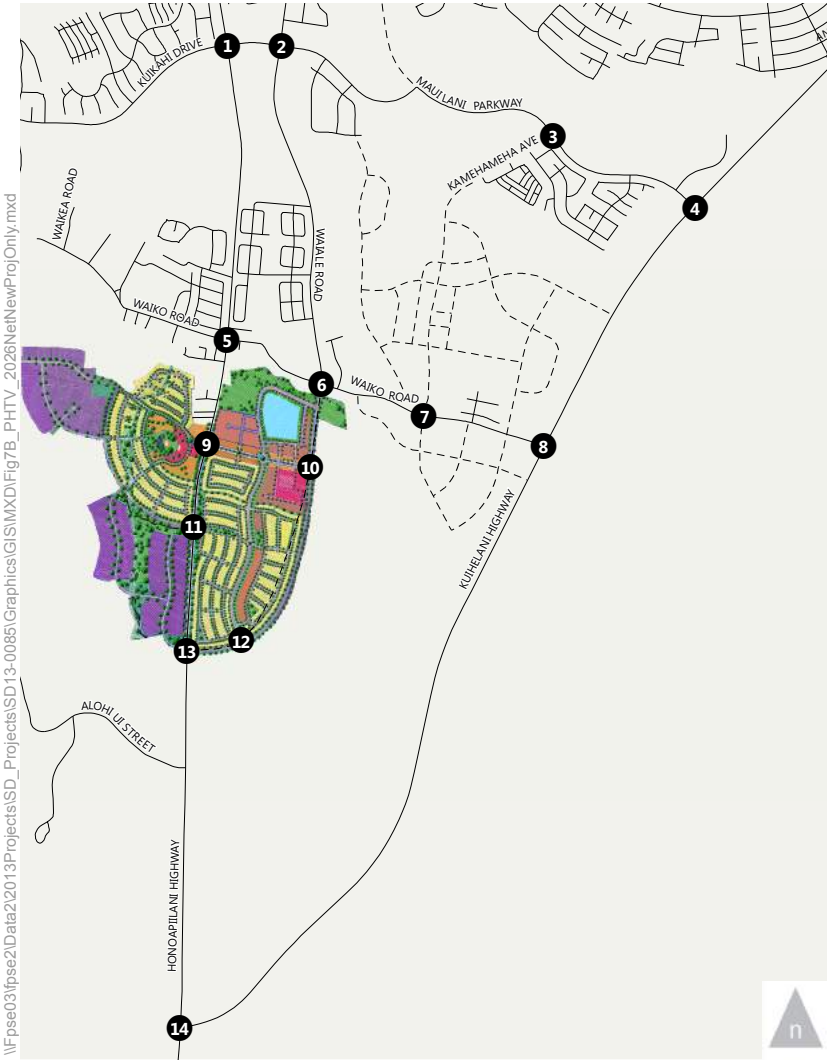


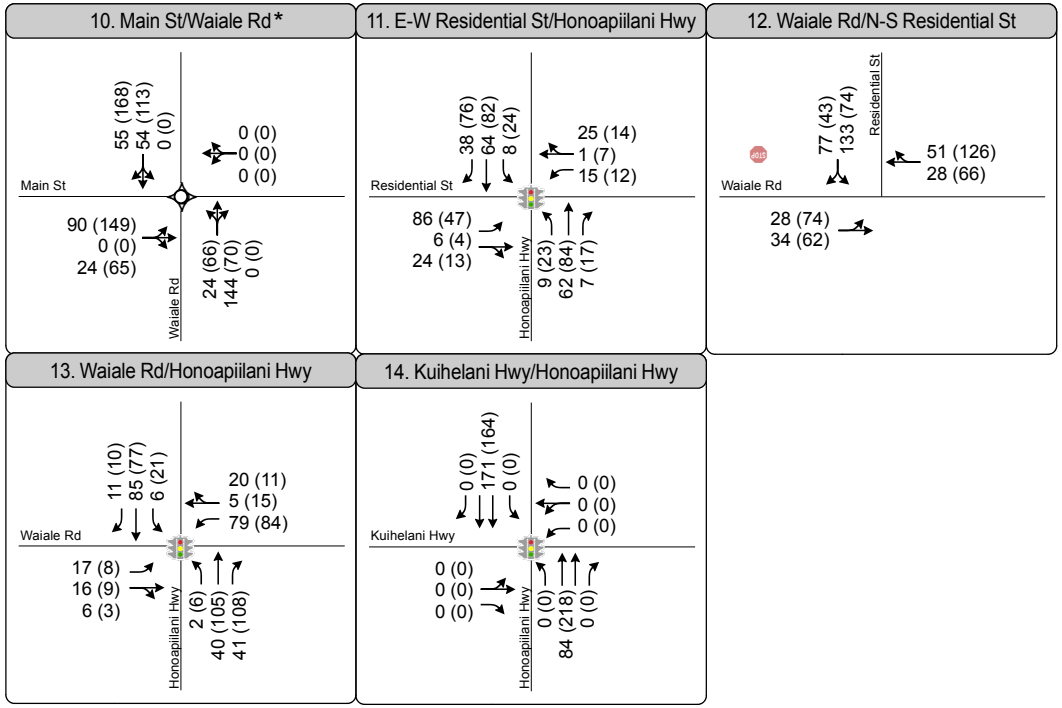
\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig7A_PHTV_2026NetNewProjOnly.mxd

#	Study Intersection		Traffic Signal
→	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume	---	Proposed Roadway
*	Includes Pass-by Trips		

Figure 7A

Peak Hour Traffic Volumes and Lane Configurations - Net New Project Only, Phase 1 & 2 (2026)



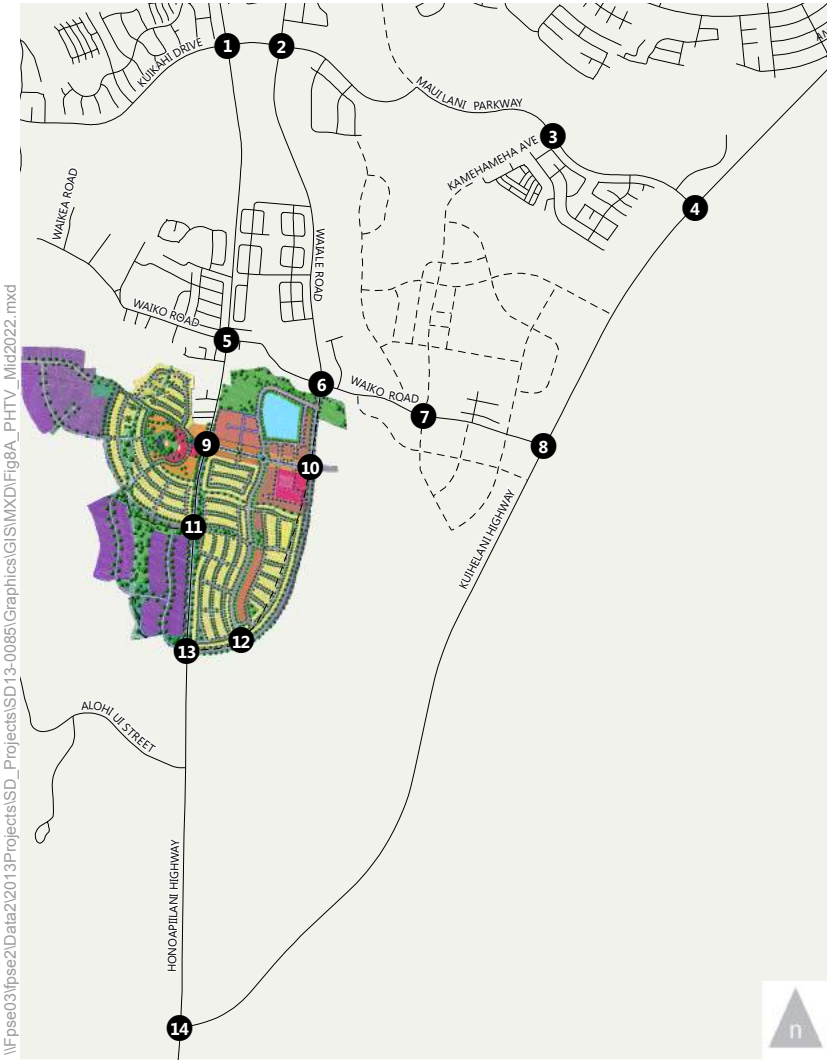


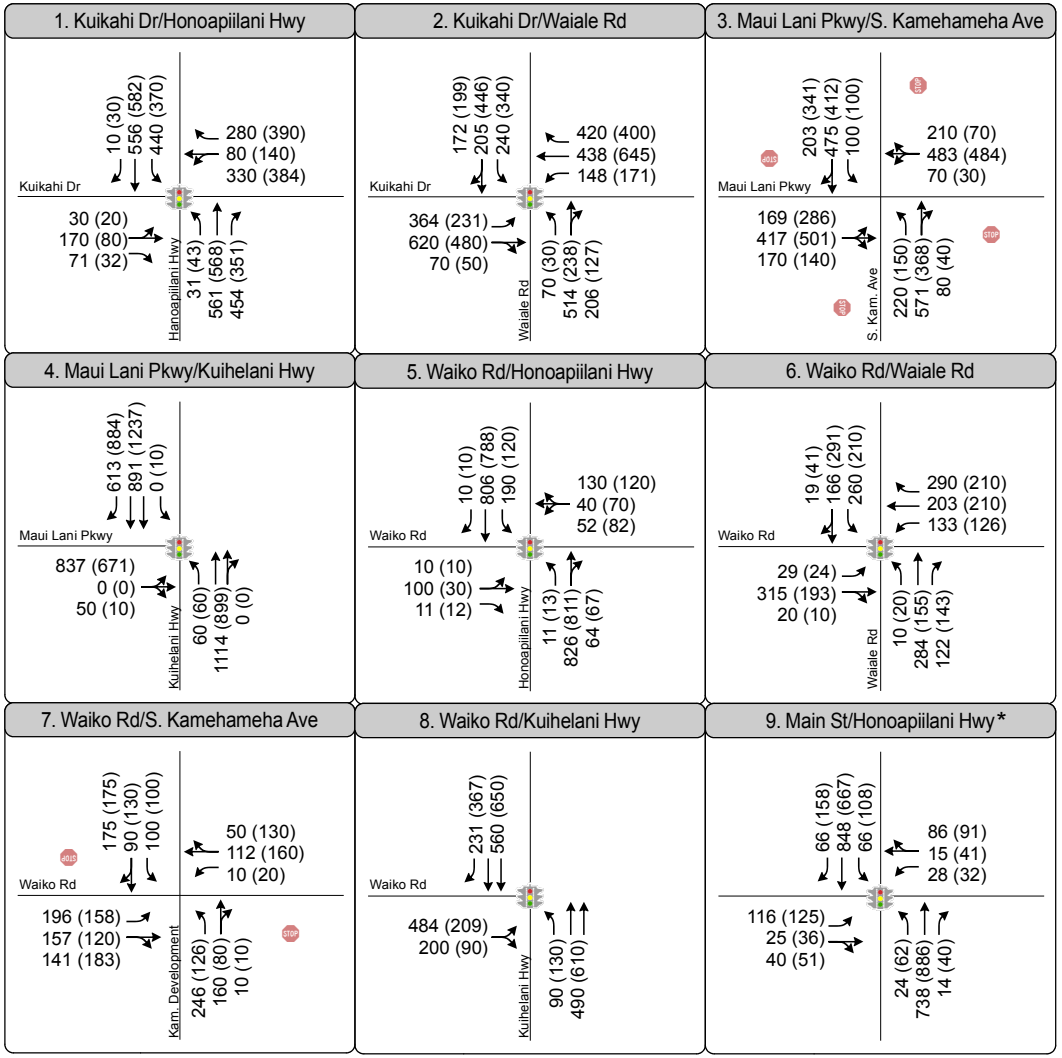
\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig7B_PHTV_2026NetNewProjOnly.mxd

#	Study Intersection		Traffic Signal
	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume		Proposed Roadway
*	Includes Pass-by Trips		Roundabout

Figure 7B

Peak Hour Traffic Volumes and Lane Configurations - Net New Project Only, Phase 1 & 2 (2026)



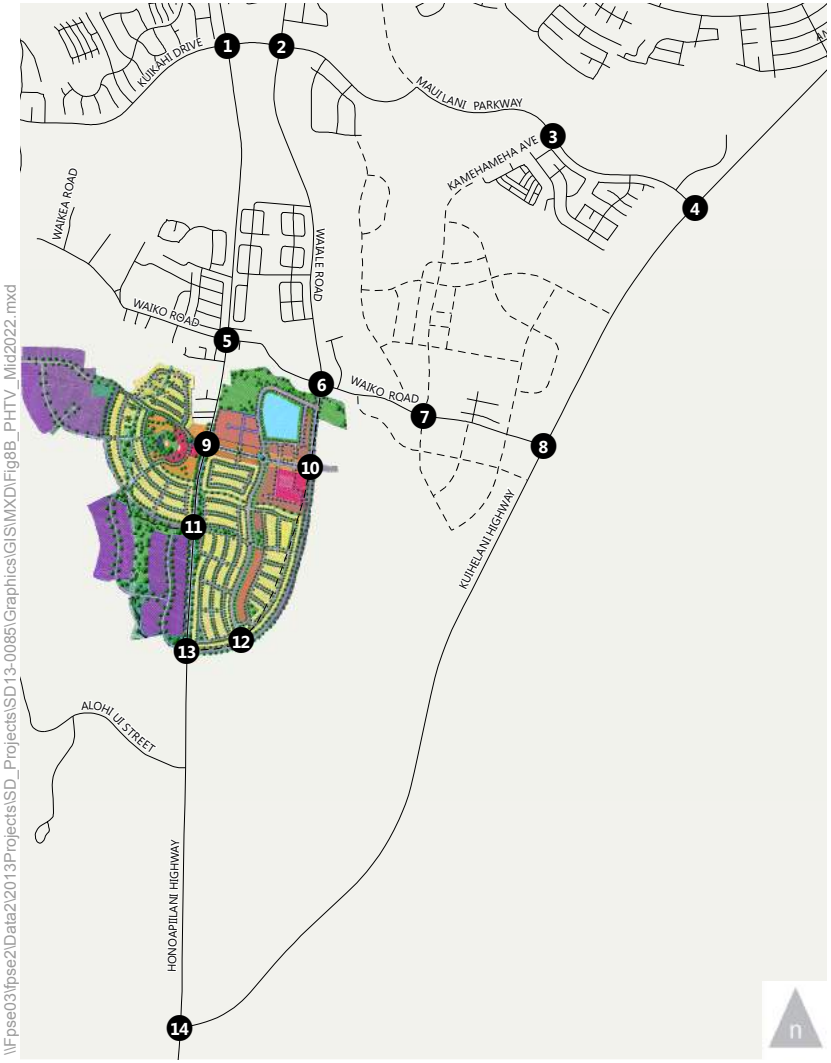


\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig8A_PHTV_Mid2022.mxd

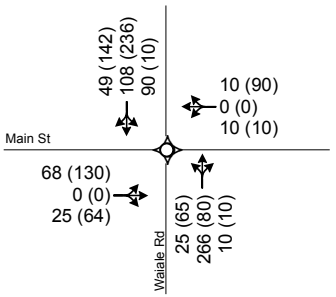
#	Study Intersection		Traffic Signal
→	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume	---	Proposed Roadway
*	Includes Pass-by Trips		

Figure 8A

Peak Hour Traffic Volumes and Lane Configurations - Year 2022 with Partial Development - Phase 1 Conditions



10. Main St/Waiale Rd *



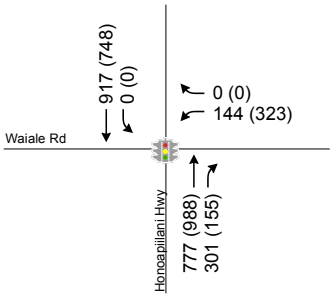
11. E-W Residential St/Honoapiilani Hwy

Intersection does not exist under these conditions

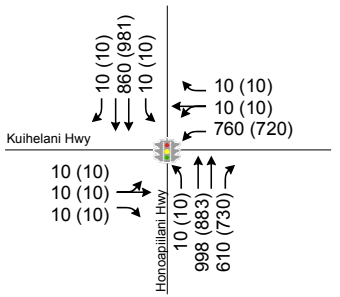
12. Waiale Rd/N-S Residential St

Intersection does not exist under these conditions

13. Waiale Rd/Honoapiilani Hwy



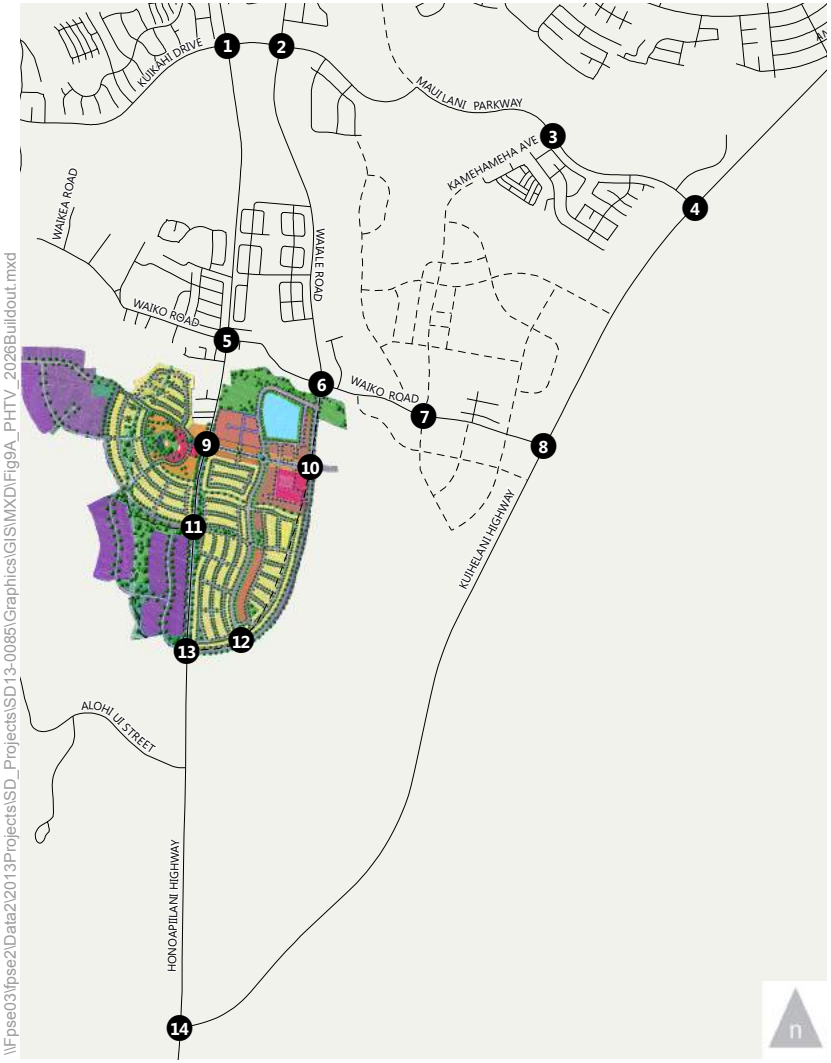
14. Kuihelani Hwy/Honoapiilani Hwy

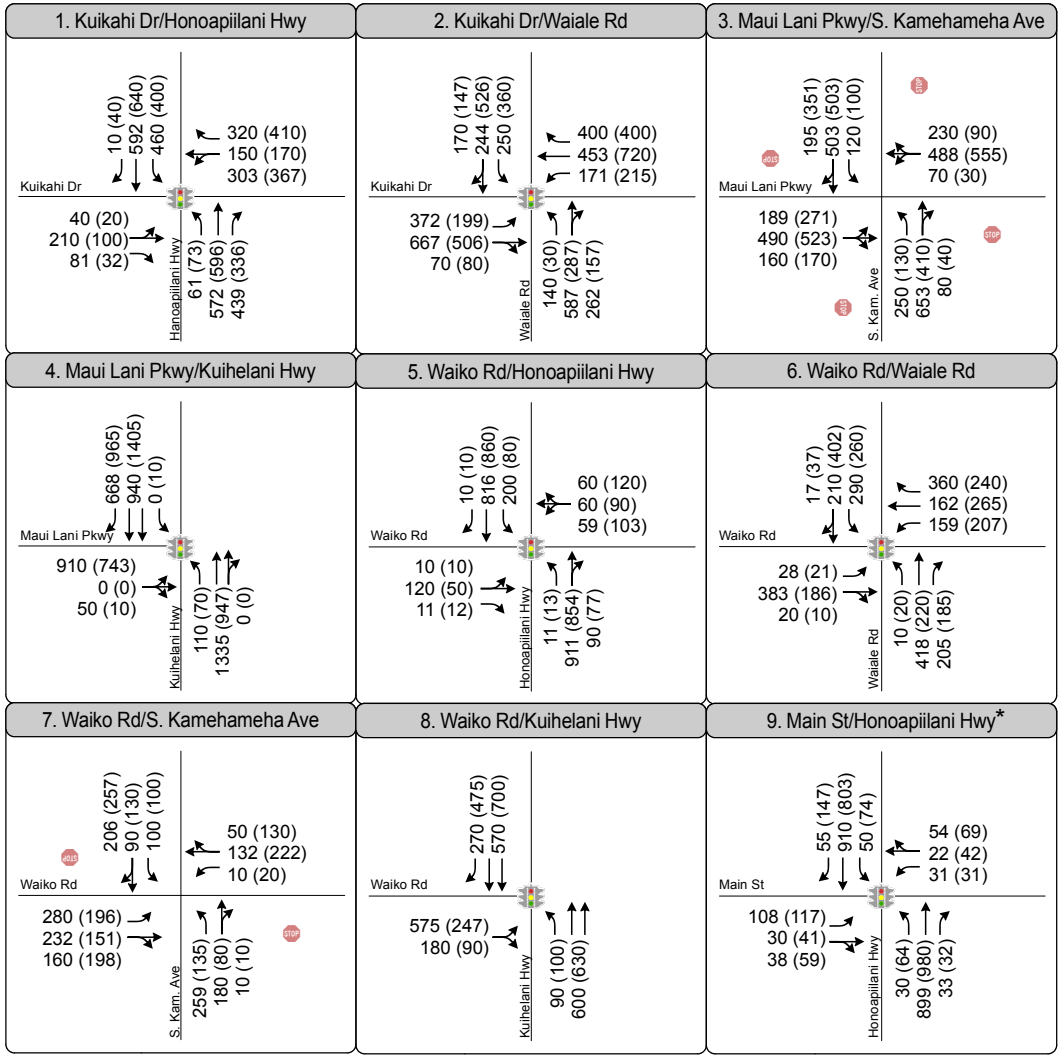


#	Study Intersection		Traffic Signal
	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume		Proposed Roadway
*	Includes Pass-by Trips		Roundabout

Figure 8B

Peak Hour Traffic Volumes and Lane Configurations - Year 2022 with Partial Development - Phase 1 Conditions



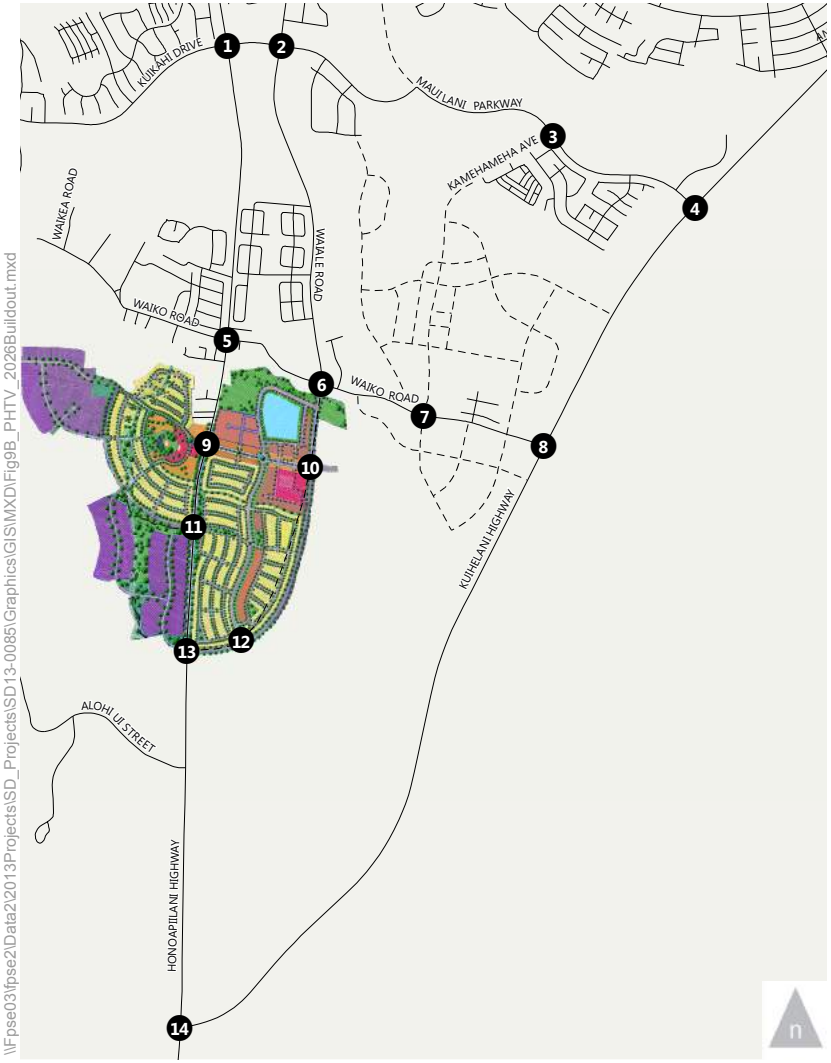


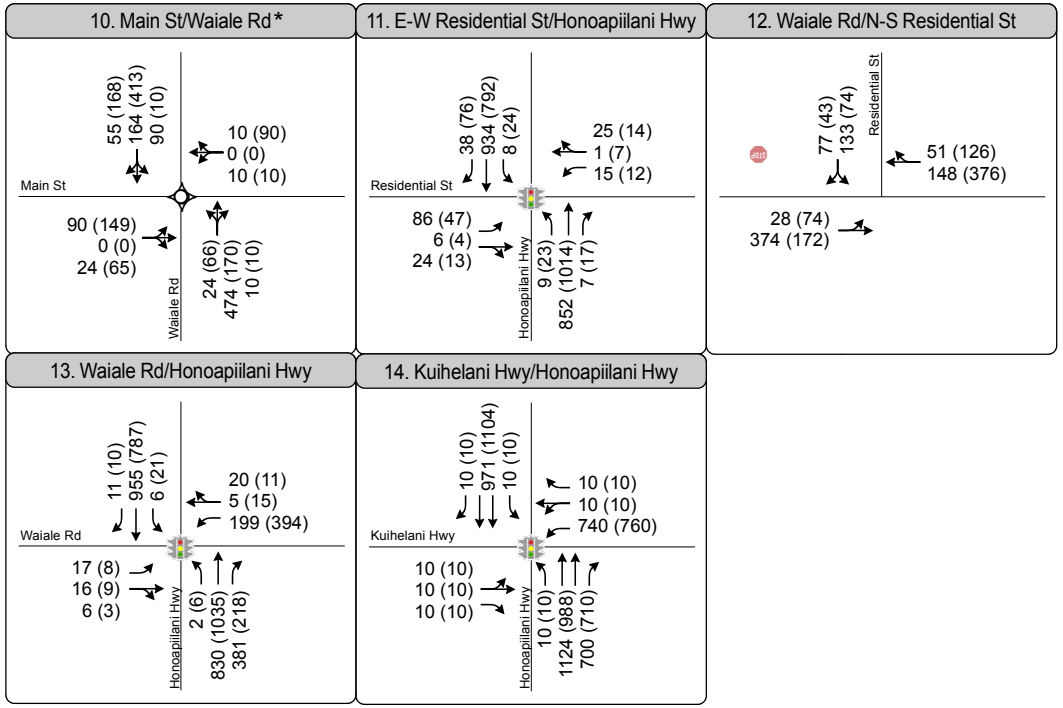
\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\GIS\MXD\Fig9A_PHTV_2026Buildout.mxd

#	Study Intersection		Traffic Signal
	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume		Proposed Roadway
*	Includes Pass-by Trips		

Figure 9A

Peak Hour Traffic Volumes and Lane Configurations - Year 2026 with Project Conditions - Phase 1 & 2 Conditions





#	Study Intersection		Traffic Signal
	Turn Lane	STOP	Stop Sign
AM (PM)	Peak Hour Traffic Volume		Proposed Roadway
*	Includes Pass-by Trips		Roundabout

Figure 9B

Peak Hour Traffic Volumes and Lane Configurations - Year 2026 with Project Conditions - Phase 1 & 2 Conditions

5. INTERSECTION ANALYSIS

This chapter presents an analysis of the potential impacts on the roadway system due to projected increases in traffic, including traffic generated by WCT, under partial and full buildout. The analysis compares the projected levels of service at each study intersection under cumulative conditions for 2022 and 2026 both with and without the proposed project to determine potential project impacts.

YEAR 2022 NO PROJECT TRAFFIC CONDITIONS

This section presents an analysis of potential future traffic conditions projected for the Year 2022. The Year 2022 No Project or cumulative base traffic volumes projected in Chapter 3 were analyzed using the methodologies described in Chapter 1 to forecast cumulative base peak hour LOS at the study intersections. The first few columns in **Table 6** summarize the results of this analysis and the corresponding LOS calculation sheets are included in **Appendix B**.

The results of the LOS calculations indicate that all of the future study intersections operate at an overall acceptable service level (LOS D or better) in 2022, with the exception of the following locations:

- Intersection 1: Honoapiilani Highway (Highway 30) & Kuikahi Drive (LOS E – AM peak hour)
- Intersection 2: Waiale Road & Kuikahi Drive (LOS E – AM peak hour)
- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway (LOS F – AM peak hour and PM peak hour)
- Intersection 4: Kuihelani Highway (Highway 380) & Maui Lani Parkway (LOS E – AM peak hour and PM peak hour)
- Intersection 7: S. Kamehameha Avenue & Waiko Road (LOS F – AM peak hour and PM peak hour)

The remaining five study intersections are expected to continue operating at an overall desirable LOS (LOS D or better) during both peak hours.

YEAR 2022 WITH PARTIAL DEVELOPMENT TRAFFIC CONDITIONS

The Year 2022 with Partial Development or cumulative plus project Phase 1 peak hour traffic volumes illustrated in **Figure 8**, were analyzed to determine 2022 operating conditions with the addition of project-related Phase 1 traffic. The results of the Year 2022 with Partial Development analysis is presented in **Table 6** and the corresponding LOS calculation sheets are included in **Appendix B**.

TABLE 6 – YEAR 2022 LEVELS OF SERVICE – WAIKAPU COUNTRY TOWN PARTIAL DEVELOPMENT (PHASE 1)

Intersection	Traffic Control	Peak Hour	Year 2022 No Project Conditions		Year 2022 with Partial Development (Phase 1) Conditions		Delay Change	Mitigation Required?	Mitigated to: Pre-Project or Better Conditions (≤ LOS D)		Mitigated to: LOS D or Better Conditions	
			Del/Veh[1]	LOS[2,3]	Del/Veh[1]	LOS[2,3]			Del/Veh[1]	LOS[2,3]	Del/Veh[1]	LOS[2,3]
1. Honoapiilani Highway / Kuikahi Drive	Signal	AM	67.3	**E**	92.5	**F**	25.2	**YES**	43.2	D	Same as Pre-Project Mitigation	
		PM	38.6	D	66.1	**E**	27.5	**YES**	35.2	D		
2. Waiale Road / Kuikahi Drive	Signal	AM	73.5	**E**	108.2	**F**	34.7	**YES**	61.9	**E**	39.8	D
		PM	48.6	D	73.6	**E**	25.0	**YES**	34.8	C	31.3	C
3. S. Kamehameha Avenue / Maui Lani Parkway[6]	AWSC	AM	> 180	**F**	> 180	**F**	**	**YES**	131.5	**F**	30.5	C
		PM	> 180	**F**	> 180	**F**	**	**YES**	133.1	**F**	36.0	D
4. Kuihelani Highway / Maui Lani Parkway	Signal	AM	78.0	**E**	101.6	**F**	23.6	**YES**	22.7	C	Same as Pre-Project Mitigation	
		PM	57.9	**E**	79.9	**E**	22.0	**YES**	26.4	C		
5. Honoapiilani Highway / Waiko Road	Signal	AM	18.6	B	34.5	C	15.9	NO	No Mitigation Required			
		PM	17.5	B	29.8	C	12.3	NO				
6. Waiale Road / Waiko Road[4,9]	Signal	AM	8.1	A	8.8	A	0.7	NO	No Mitigation Required			
		PM	7.3	A	7.5	A	0.2	NO				
7. S. Kamehameha Avenue / Waiko Road[6,7]	SSSC	AM	> 180	**F**	> 180	**F**	**	**YES**	8.1	A	Same as Pre-Project Mitigation	
		PM	169.9	**F**	> 180	**F**	**	**YES**	7.4	A		
8. Kuihelani Highway / Waiko Road	Signal	AM	38.7	D	43.2	D	4.5	NO	No Mitigation Required			
		PM	17.9	B	18.6	B	0.7	NO				
9. Honoapiilani Highway / Main Street[5,8]	Signal	AM	Only built with project		9.0	A	9.0	NO	No Mitigation Required			
		AM			10.4	B	10.4	NO				
10. Waiale Road / Main Street[5]	Roundabout	AM	Only built with project		6.6	A	6.6	NO	No Mitigation Required			
		PM			7.1	A	7.1	NO				
11. Honoapiilani Highway / East-West Residential Street	N/A	AM	Only built with Phase 2 of project									
		PM										
12. North-South Residential Street / Waiale Road	N/A	AM	Only built with Phase 2 of project									
		PM										
13. Honoapiilani Highway / Waiale Road[9]	Signal	AM	5.9	A	7.4	A	1.5	NO	No Mitigation Required			
		PM	12.9	B	17.9	B	5.0	NO				
14. Honoapiilani Highway / Kuihelani Highway	Signal	AM	22.2	C	23.1	C	0.9	NO	No Mitigation Required			
		PM	20.3	C	22.2	C	1.9	NO				

Source: Fehr & Peers, 2014

Notes:

** Indicated oversaturated conditions. Delay cannot be calculated.

AWSC = All-way stop-controlled intersection

SSSC = Side-street stop-controlled intersection

[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized and all-way stop-controlled intersections. The vehicular delay for the worst movement is reported for side street stop-controlled intersections.

[2] LOS calculations performed using the 2000 Highway Capacity Manual (HCM) method.

[3] Unacceptable LOS highlighted in **bold.**

[4] With the construction of the Waiale Bypass under future conditions, the intersection will include a fourth (south) leg and is assumed to be signalized.

[5] Intersection provides access to the project site.

[6] The proposed mitigation measure at this location is signalization and the delay and LOS displayed under this condition is based on the average control delay for the intersection as a whole.

[7] Intersection is or is assumed to be controlled by stop signs on the minor approach(es).

[8] The project intersection is assumed to be signalized in 2022.

[9] Intersection assumed to be signalized as part of the Waiale Bypass project.

As shown in Table 6, the proposed project would contribute to cumulative impacts (LOS E or F conditions) during one or both peak hours at five study intersections:

- Intersection 1: Honoapiilani Highway (Highway 30) & Kuikahi Drive (LOS F – AM peak hour)
- Intersection 2: Waiale Road & Kuikahi Drive (LOS F – AM peak hour and LOS E – PM peak hour)
- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway (LOS F – AM peak hour and PM peak hour)
- Intersection 4: Kuihelani Highway (Highway 380) & Maui Lani Parkway (LOS F – AM peak hour and LOS E – PM peak hour)
- Intersection 7: S. Kamehameha Avenue & Waiko Road (LOS F – AM peak hour and PM peak hour)

In addition, a project-specific impact has been identified at Intersection 1: Honoapiilani Highway & Kuikahi Drive during the PM peak hour, where the addition of project-generated traffic would cause the overall intersection operations to degrade from LOS D to LOS E.

YEAR 2026 NO PROJECT TRAFFIC CONDITIONS

This section presents an analysis of potential future traffic conditions projected for the Year 2026. The Year 2026 No Project or cumulative base traffic volumes projected in Chapter 3 were analyzed using the methodologies described in Chapter 1 to forecast cumulative base peak hour LOS at the study intersections. The first few columns in **Table 7** summarize the results of this analysis and the corresponding LOS calculation sheets are included in **Appendix B**.

The results of the LOS calculations indicate that all of the future study intersections operate at an overall acceptable service level (LOS D or better) in 2026, with the exception of the following locations:

- Intersection 1: Honoapiilani Highway (Highway 30) & Kuikahi Drive (LOS E – AM peak hour)
- Intersection 2: Waiale Road & Kuikahi Drive (LOS F – AM peak hour and LOS E – PM peak hour)
- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway (LOS F – AM peak hour and PM peak hour)
- Intersection 4: Kuihelani Highway (Highway 380) & Maui Lani Parkway (LOS F – AM peak hour and LOS E – PM peak hour)
- Intersection 7: S. Kamehameha Avenue & Waiko Road (LOS F – AM peak hour and PM peak hour)

The remaining five study intersections are expected to continue operating at an overall desirable LOS (LOS D or better) during both peak hours.

TABLE 7 – YEAR 2026 LEVELS OF SERVICE - WAIKAPU COUNTRY TOWN FULL DEVELOPMENT (PHASE 1 & 2)

Intersection	Traffic Control	Peak Hour	Year 2026 No Project Conditions		Year 2026 with Phase 1&2 Conditions		Delay Change	Mitigation Required?	Mitigated to: Pre-Project or Better Conditions (≤ LOS D)		Mitigated to: LOS D or Better Conditions	
			Del/Veh[1]	LOS[2,3]	Del/Veh[1]	LOS[2,3]			Del/Veh[1]	LOS[2,3]	Del/Veh[1]	LOS[2,3]
1. Honoapiilani Highway / Kuikahi Drive	Signal	AM	75.3	**E**	111.1	**F**	35.8	**YES**	50.3	D	Same as Pre-Project Mitigation	
		PM	46.3	D	77.0	**E**	30.7	**YES**	37.7	D		
2. Waiale Road / Kuikahi Drive	Signal	AM	87.8	**F**	149.2	**F**	61.4	**YES**	81.8	**F**	46.6	D
		PM	55.3	**E**	99.4	**F**	44.1	**YES**	41.5	D	33.3	C
3. S. Kamehameha Avenue / Maui Lani Parkway[6]	AWSC	AM	> 180	**F**	> 180	**F**	**	**YES**	> 180	**F**	30.2	C
		PM	> 180	**F**	> 180	**F**	**	**YES**	167.9	**F**	19.4	B
4. Kuihelani Highway / Maui Lani Parkway	Signal	AM	105.0	**F**	139.5	**F**	34.5	**YES**	27.2	C	Same as Pre-Project Mitigation	
		PM	75.9	**E**	100.1	**F**	24.2	**YES**	31.2	C		
5. Honoapiilani Highway / Waiko Road	Signal	AM	18.6	B	46.9	D	28.3	NO	No Mitigation Required			
		PM	18.5	B	37.8	D	19.3	NO				
6. Waiale Road / Waiko Road[4,9]	Signal	AM	9.0	A	15.0	B	6.0	NO	No Mitigation Required			
		PM	7.5	A	8.9	A	1.4	NO				
7. S. Kamehameha Avenue / Waiko Road[6,7]	SSSC	AM	**	**F**	**	**F**	**	**YES**	10.1	B	Same as Pre-Project Mitigation	
		PM	> 180	**F**	**	**F**	**	**YES**	8.1	A		
8. Kuihelani Highway / Waiko Road	Signal	AM	41.6	D	58.2	**E**	16.6	**YES**	25.2	C	Same as Pre-Project Mitigation	
		PM	17.1	B	19.7	B	2.6	NO	15.6	B		
9. Honoapiilani Highway / Main Street[5,8]	Signal	AM	Only built with project		9.8	A	9.8	NO	No Mitigation Required			
		AM			11.6	B	11.6	NO				
10. Waiale Road / Main Street[5]	Roundabout	AM	Only built with project		9.9	A	9.9	NO	No Mitigation Required			
		PM			10.3	B	10.3	NO				
11. Honoapiilani Highway / East-West Residential Street[5,8]	Signal	AM	Only built with project		8.3	A	8.3	NO	No Mitigation Required			
		PM			6.1	A	6.1	NO				
12. North-South Residential Street / Waiale Road[5,7]	SSSC	AM	Only built with project		17.4	C	17.4	NO	No Mitigation Required			
		PM			19.2	C	19.2	NO				
13. Honoapiilani Highway / Waiale Road[5,9]	Signal	AM	6.0	A	12.9	B	6.9	NO	No Mitigation Required			
		PM	15.5	B	30.2	C	14.7	NO				
14. Honoapiilani Highway / Kuihelani Highway	Signal	AM	22.5	C	24.0	C	1.5	NO	No Mitigation Required			
		PM	22.4	C	25.2	C	2.8	NO				

Source: Fehr & Peers, 2014

Notes:

** Indicated oversaturated conditions. Delay cannot be calculated. AWSC = All-way stop-controlled intersection; SSSC = Side-street stop-controlled intersection.

[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized and all-way stop-controlled intersections. The vehicular delay for the worst movement is reported for side street stop-controlled intersections.

[2] LOS calculations performed using the 2000 Highway Capacity Manual (HCM) method.

[3] Unacceptable LOS highlighted in **bold.**

[4] With the construction of the Waiale Bypass under future conditions, the intersection will include a fourth (south) leg and is assumed to be signalized.

[5] Intersection provides access to the project site.

[6] The proposed mitigation measure at this location is signalization and the delay and LOS displayed under this condition is based on the average control delay for the intersection as a whole.

[7] Intersection is or is assumed to be controlled by stop signs on the minor approach(es).

[8] The project intersection is assumed to be signalized in 2026.

[9] Intersection assumed to be signalized as part of the Waiale Bypass project.

YEAR 2026 WITH PROJECT TRAFFIC CONDITIONS

The Year 2026 with Project or cumulative plus project Phase 1 & 2 peak hour traffic volumes illustrated in **Figure 9**, were analyzed to determine 2026 operating conditions with the addition of project-related traffic. The results of the Year 2026 with Project analysis is presented in **Table 7** and the corresponding LOS calculation sheets are included in **Appendix B**.

The proposed project would contribute to cumulative impacts (LOS E or F conditions) during one or both peak hours at six study intersections:

- Intersection 1: Honoapiilani Highway (Highway 30) & Kuikahi Drive (LOS F – AM peak hour)
- Intersection 2: Waiale Road & Kuikahi Drive (LOS F – AM peak hour and PM peak hour)
- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway (LOS F – AM peak hour and PM peak hour)
- Intersection 4: Kuihelani Highway (Highway 380) & Maui Lani Parkway (LOS F – AM peak hour and PM peak hour)
- Intersection 7: S. Kamehameha Avenue & Waiko Road (LOS F – AM peak hour and PM peak hour)

In addition, project-specific impacts have been identified at intersections where the addition of project-generated traffic would cause their overall intersection operations to degrade below LOS D in the peak hours. The project-related impacts identified are:

- Intersection 1: Honoapiilani Highway (Highway 30) & Kuikahi Drive (cumulative and project-specific impact)
- Intersection 8: Kuihelani Highway (Highway 380) & Waiko Road (LOS E – AM peak hour)

POTENTIAL TRAFFIC IMPROVEMENTS

Potential traffic improvements were developed to increase the capacity and/or efficiency of the roadway system at the locations where the addition of project-related traffic would cause or contribute to poor operating conditions. The emphasis was to identify physical and/or operational improvements that could be implemented within the existing or planned roadway rights-of-way. The potential intersection improvement measures are illustrated in **Appendix F**. **Table 6** and **Table 7** summarize the projected LOS in 2022/2026 at the impacted locations with these proposed measures in place.

The potential measures to address the identified traffic impacts are described later in this chapter. Each of the identified impacts would be reduced such that future operations would be at the minimum desired LOS (LOS D) for the overall intersection with the project in place. Although HDOT also strives to maintain

LOS D or better conditions at the movement level, measures to improve turning movement conditions would only be proposed where feasible and appropriate from a traffic engineering perspective since adding lanes just to achieve the desired LOS for a particular movement also has secondary negative impacts to the environment and to active transportation modes.

The scope of corresponding improvements for this type of mitigation process can be well beyond the project's actual impact, and could effectively eliminate existing or cumulative deficiencies, which should not be the project's responsibility consistent with State of Hawaii law. Therefore, in addition to developing improvements that will result in LOS D or better operations, measures that only return operations to pre-project levels have also been identified (i.e., under Year 2022 No Project Conditions and Year 2026 No Project Conditions). This is especially important where the addition of project traffic alone would not degrade operations below LOS D, but would contribute to projected poor levels of service caused by the addition of traffic from other cumulative developments (e.g., Puunani Residences, Waiale Development, etc.).

The full range of improvements that address both project-related and/or cumulative traffic impacts are discussed in detail below. The specific improvements that are proposed to be fully implemented by WCT are specified in a subsequent section.

- Intersection 1: Honoapi`ilani Highway & Kuikahi Drive (Year 2022 & 2026) – The impact at this intersection could be reduced by widening the westbound approach from a shared through/left-turn lane and right-turn lane to a left-turn lane, a through lane, and a right-turn lane, and widening the southbound approach from a left-turn lane, a through lane, and a right-turn lane to two left-turn lanes, a through lane, and a right-turn lane. Additionally, to complement the addition of a second southbound left-turn lane, the east leg would need to be widened to provide a second departure lane and the northbound and southbound left-turn phasing would need to be converted to protected left turns. This improvement would result in LOS D operations, and no other measure is feasible that would only mitigate the operations to pre-project levels.

  Although the measures described above would improve the Year 2022 AM and PM peak hour impacts at the overall intersection level, half of the left-turn movements are projected to continue to operate at LOS E or F in both peak hours. The volumes and V/C ratios for the left-turn movements are as follows:

  - AM Peak Hour
    - Westbound: single left-turn lane with 330 vehicles and a V/C ratio of 1.09
    - Southbound: dual left-turn lanes with 440 vehicles and a V/C ratio of 0.98

- PM Peak Hour
  - Westbound: single left-turn lane with 384 vehicles and a V/C ratio of 0.98
  - Southbound: dual left-turn lanes with 370 vehicles and a V/C ratio of 0.94

The HCM recommends considering the provision of double left-turn lanes when the volume exceeds 300 vehicles. In the case of the southbound approach, the left-turn movement already has two left-lanes and from a volume standpoint does not warrant a third left-turn lane and the V/C ratios are within the acceptable range. Therefore, no further improvements are proposed for the southbound approach.

Although the westbound approach, is projected to warrant the provision of double left-turn lanes from a volume standpoint during both peak hours and the V/C ratio is greater than 1.0 during the AM peak hour, these movements and approaches were already operating below LOS D in pre-project conditions. Thus, proposing dual westbound left-turn lanes would be well beyond the project's actual impact. Additionally, implementing a second westbound left-turn lane would require more widening on the east leg, and widening of the south leg of Honoapiilani Highway to provide a second receiving lane to accommodate the left-turn movement. Therefore, no further project improvements are recommended for the westbound approach.

Similarly, the measures would only reduce the Year 2026 AM and PM peak hour impacts at the overall intersection level. During the AM and PM peak hour, three of the four left-turn movements are projected to continue to operate at LOSE or F. The volumes and V/C ratios for the left-turn movements are as follows:

- AM Peak Hour
  - Westbound: single left-turn lane with 303 vehicles and a V/C ratio of 1.08
  - Northbound: single left-turn lane with 61 vehicles and a V/C ratio of 0.99
  - Southbound: dual left-turn lanes with 460 vehicles and a V/C ratio of 1.01

- PM Peak Hour
  - Westbound: single left-turn lane with 367 vehicles and a V/C ratio of 1.02
  - Northbound: single left-turn lane with 73 vehicles and a V/C ratio of 0.90
  - Southbound: dual left-turn lanes with 400 vehicles and a V/C ratio of 0.92

In the case of the southbound approach, the left turn movement already has two left-lanes and from a volume standpoint does not warrant a third left-turn lane and the V/C ratios are mostly within the acceptable range. For the northbound left-turn lanes, the deficient lane operations are

not a result of capacity constraints, but rather signal operations. Therefore, no further improvements are proposed for both the southbound and northbound approaches.

Although the westbound approach, is projected to warrant the provision of double left-turn lanes from a volume standpoint and the V/C ratios are greater than 1.0 during both peak hours, these movements and approaches were already operating below LOS D in pre-project conditions. Thus, proposing dual westbound left-turns would be well beyond the project's actual impact. Additionally, implementing a second westbound left-turn lane would require more widening on the east leg, and widening of the south leg of Honoapiilani Highway to provide a second receiving lane to accommodate the left-turn movement. Therefore, no further project improvements are recommended for the westbound approach.

Additionally, under Year 2026 with Project Conditions the northbound through movement is projected to operate at LOS E in the AM peak hour with a V/C ratio of 0.97. However, because the 572 vehicles traveling through do not necessarily warrant an additional through lane and the improvement would require right-of-way acquisition along Honoapiilani Highway, no further physical improvements are proposed for this approach.

- Intersection 2: Waiale Road & Kuikahi Drive (Year 2022 & 2026) – The pre-project improvement includes widening the eastbound and westbound approaches to provide a left-turn lane, two through lanes, and a right-turn lane. To complement the widening of the eastbound and westbound approaches, both the eastbound and westbound departures would also need to be widened to each provide a second receiving lane. The LOS D or better measure includes the pre-project improvements plus widening the northbound approach to provide a left-turn lane, a through lane, and a right-turn lane.

  The measures described above would mitigate the Year 2022 PM peak hour impact so that the overall intersection and intersection movements or approaches would operate at acceptable LOS D or better.

  For the Year 2022 AM peak hour, the impact at the overall intersection level would be mitigated; however, two of the four left-turn movements are projected to continue to operate at LOS E or F. The volumes and V/C ratios for the left-turn movements are as follows:

  - AM Peak Hour
    - Eastbound: single left-turn lane with 364 vehicles and a V/C ratio of 1.04
    - Southbound: single left-turn lane with 240 vehicles and a V/C ratio of 1.00

The HCM recommends considering the provision of double left-turn lanes when the volume exceeds 300 vehicles. In the case of the southbound approach, the left turn movement does not warrant the provision of a second left-turn lane from a volume standpoint and the V/C ratios is within the acceptable range. Therefore, no further improvements are proposed for the southbound approach.

Although the eastbound approach is projected to warrant the provision of double left-turn lanes from a volume standpoint and the V/C ratio is greater than 1.0, this movement and approach were already operating below LOS D in pre-project conditions. Thus, proposing dual eastbound left-turns would be well beyond the project's actual impact at the approach-level. Additionally, implementing a second eastbound left-turn lane would require more widening on the west leg, and widening of the north leg of Waiale Road to provide a second receiving lane to accommodate the left-turn movement. Therefore, no further project improvements are recommended for the eastbound approach.

Similarly, the measures described would mitigate the Year 2026 PM peak hour impact so that the overall intersection and intersection movements or approaches would operate at acceptable LOS D or better.

For the Year 2026 AM peak hour, the impact at the overall intersection level would be mitigated; however, two of the four left-turn movements are projected to continue to operate at LOS F. The volumes and V/C ratios for the left-turn movements are as follows:

- AM Peak Hour
  - Eastbound: single left-turn lane with 372 vehicles and a V/C ratio of 1.07
  - Southbound: single left-turn lane with 250 vehicles and a V/C ratio of 1.15

For the southbound approach, the left turn movement does not warrant the provision of a second left-turn lane from a volume standpoint. Therefore, no further improvements are proposed for the southbound approach.

Although the eastbound approach is projected to warrant the provision of double left-turn lanes from a volume standpoint and the V/C ratio is greater than 1.0, this movement and approach were already operating below LOS D in pre-project conditions. Thus, proposing dual eastbound left-turn lanes would be well beyond the project's actual impact at the approach level. Additionally, implementing a second eastbound left-turn lane would require more widening on the west leg, and widening of the north leg of Waiale Road to provide a second receiving lane to

accommodate the left-turn movement. Therefore, no further project improvements are recommended for the eastbound approach.

Additionally, under Year 2026 with Project Conditions the northbound through movement is projected to operate at LOS E in the AM peak hour with a V/C ratio of 0.98. However, because the 587 vehicles traveling through do not necessarily warrant an additional through lane and the improvement would require right-of-way acquisition along Waiale Road, no further physical improvements are proposed for this approach.

- Intersection 3: S. Kamehameha Avenue/Maui Lani Parkway (Year 2022) – The pre-project improvement is installing a traffic control signal with permitted phasing at all approaches.[10] Although the intersection conditions are better than pre-project conditions with the implementation of a traffic control signal, the intersection would still operate with long delays in excess of 180 seconds during both peak hours in 2022. For LOS D or better operations, not only would the traffic signal need to be installed but the eastbound approach would need to provide a left-turn lane and a shared through/right-turn lane and the westbound approach would need to provide a left-turn lane, a through lane, and a right-turn lane.

  Although the measures described above would mitigate the Year 2022 AM peak hour impact at the overall intersection level, the northbound left-turn movement is projected to operate at LOS F with a V/C ratio of 1.22. Since the volumes at this movement do not warrant the provision of a second left-turn lane based on the HCM recommended provision of dual left-turn lanes, no further improvements are proposed for this approach.

  Similarly, the improvements would also mitigate the PM peak hour impact at the overall intersection level; however, the following left-turn movements are projected to continue to operate at LOS E or F. The volumes and V/C ratios for the left-turn movements are as follows:

  - Eastbound: single left-turn lane with 286 vehicles and a V/C ratio of 1.01
  - Northbound: single left-turn lane with 150 vehicles and a V/C ratio of 0.93

  Since the eastbound and northbound left-turn movements do not warrant the provision of a second left-turn lane from a volume standpoint and the V/C ratios are mostly within the acceptable range, no further improvements are proposed for these movements.

[10] For this location and any other where a new signal is proposed, it is recommended that the need for a traffic signal at this location be monitored as overall development proceeds in the greater study area and that signal installation be dependent on future traffic engineering studies and full warrant analysis.

Additionally, under Year 2022 with Project Conditions the southbound shared through/right-turn lane is projected to operate at LOS E in the PM peak hour with 412 vehicles traveling through and 341 vehicles turning right and a V/C ratio of 1.08. Although the southbound approach does warrant the provision of a separate right-turn lane from a volume standpoint, this approach was already operating below LOS D in pre-project conditions. Thus, proposing dual right-turn lanes would be well beyond the project's actual impact and would require right-of-way acquisition along Kamehameha Avenue. Therefore, no further project improvements are recommended for the southbound approach.

- Intersection 3: S. Kamehameha Avenue/Maui Lani Parkway (Year 2026) – The pre-project improvement is installing a traffic control signal with permitted phasing at all approaches.[10] Although the intersection conditions are better than pre-project conditions with the implementation of the traffic control signal, the intersection would still operate with long delays in excess of 180 seconds during both peak hours in 2026. For LOS D or better operations, not only would the traffic signal need to be installed but the eastbound approach would need to provide a left-turn lane and a shared through/right-turn lane, the westbound approach would need to provide a left-turn lane, a through lane, and a right-turn lane, and the southbound would need to provide a left-turn lane, a through lane, and a right-turn lane.

  The measures described above would mitigate the Year 2026 PM peak hour impact so that the overall intersection and intersection movements or approaches would operate at acceptable LOS D or better.

  For the Year 2026 AM peak hour impact, however, the measures would only mitigate the impact at the overall intersection level. During the AM peak hour, three of the four left-turn movements are projected still operate at LOS E. The volumes and V/C ratios for the left-turn movements are as follows:

  - Northbound: single left-turn lane with 250 vehicles and a V/C ratio of 1.01
  - Southbound: single left-turn lane with 120 vehicles and a V/C ratio of 0.93
  - Eastbound: single left-turn lane with 189 vehicles and a V/C ratio of 0.97

  The HCM recommends considering the provision of double left-turn lanes when the volume exceeds 300 vehicles. Since these movements do not warrant the provision of a second left-turn lane from a volume standpoint and the V/C ratios are mostly within the acceptable range, no further improvements are proposed for these approaches.

- Intersection 4: Kuihelani Highway & Maui Lani Parkway (Year 2022 & 2026) – The impact at this intersection could be reduced by widening the eastbound approach to provide a left-turn lane, a shared through/left-turn lane, and a right-turn lane. In addition to the change in configuration, the eastbound and westbound left-turn phasing would need to be modified to split phasing. This improvement would result in LOS D operations, and no other measure is feasible that would only mitigate operations to pre-project levels.

  Although the measures described above would reduce the Year 2022 AM and PM peak hour impacts at the overall intersection level, under AM peak hour conditions the northbound left-turn movement is projected to continue to operate at LOS F with 60 vehicles and a V/C ratio of 1.00.

  During the Year 2022 PM peak hour, all three left-turn movements are projected to continue to operate at LOS E or F. The volumes and V/C ratios for the left-turn movements are as follows:

  - Eastbound: single left-turn lane and shared through/left lane with 671 vehicles and a V/C ratio of 0.95
  - Northbound: single left-turn lane with 60 vehicles and a V/C ratio of 1.07
  - Southbound: single left-turn lane with 10 vehicles and a V/C ratio of 0.73

  The HCM recommends considering the provision of double left-turn lanes when the volume exceeds 300 vehicles. Since these movements either already have two left-turn lanes or do not warrant the provision of a second left-turn lane from a volume standpoint and the V/C ratios are mostly within the acceptable range, no further improvements are proposed for these approaches. Additionally, the deficient lane operations are not a result of capacity constraints, but rather signal operations.

  The measures described above would mitigate the Year 2026 AM peak hour impact so that the overall intersection and intersection movements or approaches would operate at acceptable LOS D or better.

For the Year 2026 PM peak hour impact, however, the measures would only mitigate the impact at the overall intersection level. During the AM peak hour, three of the four left-turn movements are projected still operate at LOS E or F. The volumes and V/C ratios for the left-turn movements are as follows:

- Eastbound: single left-turn lane and shared through/left lane with 743 vehicles and a V/C ratio of 0.96
- Northbound: single left-turn lane with 70 vehicles and a V/C ratio of 1.00
- Southbound: single left-turn lane with 10 vehicles and a V/C ratio of 1.00

Since these movements either already have two left-lanes or do not warrant the provision of a second left-turn lane from a volume standpoint and the V/C ratios are mostly within the acceptable range, no further improvements are proposed for these approaches. Additionally, the deficient lane operations are not a result of capacity constraints, but rather signal operations.

- Intersection 7: S. Kamehameha Avenue/Waiko Road (2022 & 2026) – This impact at this intersection could be reduced by installing a traffic signal with permitted phasing at all approaches.[10] This improvement would result in LOS D or better operations at both the overall intersection level and the turning movement level. No other measure is feasible that would only improve operations to pre-project levels.

- Intersection 8: Kuihelani Highway/Waiko Road (2026) – This impact at this intersection could be reduced by widening and restriping the eastbound approach to provide a left-turn lane and a right-turn lane. No changes are proposed to the signal timing. No other improvement is feasible that would only mitigate operations to pre-project levels.

  The measure described above would improve the Year 2026 PM peak hour impact so that the overall intersection and intersection movements or approaches would operate at acceptable LOS D or better. For the Year 2026 AM peak hour impacts, however, the measure would only mitigate the impact at the overall intersection level. During the AM peak hour, the northbound left-turn movement is projected to operate at LOS E with 90 vehicles and a V/C ratio of 0.80. Based on HCM provisions for double left-turn lanes, the northbound left-turn movement does not warrant the provision of a second left-turn lane from a volume standpoint and the V/C ratio is within the acceptable range. Therefore, no further improvements are proposed for this approach.

MITIGATION FUNDING

For a project such as WCT that will be constructed in phases over an extended period of time, it is appropriate to identify the proposed project's share for the cost of the intersection improvements. Fair-share calculations for developer contributions were made for the intersections impacted by project-generated traffic. The estimates were developed by calculating the increase in traffic volumes from existing conditions to the Year 2026 with Project conditions. The increase establishes the total amount of projected growth at each location. Next, the WCT project-only volumes are divided by the total volume increase at each impacted intersection. This step determines the amount of traffic that the WCT project is contributing to the intersection and the approximate proportional contribution towards funding each potential proposed improvement.

The fair share calculations were performed for both the AM and PM peak hours, as shown in **Table 8**. For all but one location, the range of maximum project contribution is between 15.4% and 33.8%. At one location, the calculated maximum fair share does not accurately reflect the cause of the impacts at the intersection (i.e., the WCT causes the intersections to degrade from LOS D or better to LOS E or F). Based on the intersection analysis, the impact at Intersection 8: Kuihelani Highway & Waiko Road is project-specific (rather than a cumulative impact to which the project would make a fair-share contribution), and so that WCT should make a 100% contribution at this location.

While the project could make monetary contributions to partly fund the mitigation at all of the impacted locations, those improvements may not be implemented in a timely manner if the remaining funding is not available. Alternatively, HDOT has requested that projects fully fund the design and construction of improvements at selected locations under its jurisdiction that are roughly equal in value to the project's total collective fair-share contribution. While the project's fair-share contributions and the planning-level cost estimates for each element of the recommended mitigation program has not yet been finalized, a potential mitigation program for WCT is presented in the following section.

TABLE 8 – YEAR 2026 PROJECT FAIR SHARE INTERSECTION TRAFFIC CONTRIBUTION

Impacted Intersection	AM Peak Hour					PM Peak Hour					
	Existing Traffic	2026 Projected Traffic	Total New Traffic	Project Only Traffic	Project % of New Traffic	Existing Traffic	2026 Projected Traffic	Total New Traffic	Project Only Traffic	Project % of New Traffic	Maximum Contribution
1. Honoapiilani Highway / Kuikahi Drive**	2,073	3,238	318	1,165	27.3%	1,928	3,184	424	1,256	33.8%	33.8%
2. Waiale Road / Kuikahi Drive*	1,935	3,786	436	1,851	23.6%	1,849	3,627	507	1,778	28.5%	28.5%
3. S. Kamehameha Avenue / Maui Lani Parkway*	1,700	3,428	298	1,728	17.2%	1,593	3,173	353	1,580	22.3%	22.3%
4. Kuihelani Highway / Maui Lani Parkway**	1,856	4,013	273	2,157	12.7%	2,011	4,150	330	2,139	15.4%	15.4%
7. S. Kamehameha Avenue / Waiko Road*	0	1,709	229	1,709	13.4%	0	1,629	289	1,629	17.7%	17.7%
8. Kuihelani Highway / Waiko Road**	1,336	2,285	105	949	11.1%	1,407	2,242	122	835	14.6%	**100%[1]**

Source: Fehr & Peers, 2014
* County of Maui jurisdiction
** State HDOT jurisdiction
[1] Based on Table 7, the impact at this intersection is directly attributable to the project. Therefore, the maximum contribution is assumed for this intersection.

PROPOSED WCT MITIGATION PROGRAM

As discussed, improvements are proposed at intersections identified as significantly impacted under Year 2026 with Project Conditions. In the past, development projects would make a fair share financial contribution for each mitigation measure to the appropriate governing agency (i.e., the County or HDOT). However, simply providing partial funds for a variety of different improvements does not ensure construction of any individual improvement.

More recently, HDOT has indicated a preference for development projects like WCT to fully design and build improvements at a select set of locations to ensure their implementation. Accordingly, a mitigation program for WCT was developed that would require construction of improvements at intersections closer to the project site where the project contributes to, but does not directly cause a significant impact. Note that the mitigation program described below is a preliminary recommendation based on project proximity to intersections and without planning level cost estimates. As such, it is subject to change as the planning process continues.

The project proposes to fully fund mitigation measures that would return operations to pre-project levels at Intersection 1: Honoapi`ilani Highway & Kuikahi Drive and Intersection 8: Kuihelani Highway & Waiko Road. Additionally, although Intersection 13: Honoapiilani Highway & Waiale Road is not significantly impacted under Year 2026 with Project Conditions, the project may also be responsible for funding intersection improvements necessary to provide access to the project site (i.e., a fourth/west leg).

IMPROVEMENTS TO BE IMPLEMENTED BY OTHERS

For the remaining impacted intersections listed below, it is assumed that other development projects that are adjacent or in closer proximity to these impacted locations would be responsible for implementing the necessary intersection improvements:

- Intersection 2: Waiale Road & Kuikahi Drive
- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway
- Intersection 4: Kuihelani Highway & Maui Lani Parkway
- Intersection 7: S. Kamehameha Avenue & Waiko Road

6. ASSESSMENT OF SITE PLAN AND MULTI-MODAL REVIEW

The following section provides a summary of WCT's site access and circulation plan for bicycle, pedestrian, and transit facilities.

ROADWAY NETWORK

The proposed WCT site plan details an extensive internal roadway system which allows community residents and visitors to have multiple options for accessing neighborhoods, employment centers, and commercial and institutional uses. At full buildout of the project, access to mauka and makai land uses are provided along Honoapiilani Highway at four-legged, controlled intersections with Main Street, East-West Residential Street, and Waiale Road. Additional access to the makai land uses are provided along the Waiale Bypass at a roundabout with Main Street and a three-legged intersection with the major North-South Residential Street. Overall, the proposed WCT would provide sufficient vehicular connectivity to varying project uses and the multiple site access points help to better distribute traffic entering and exiting the community.

Proposed intersection spacing along Honoapiilani Highway in this area averages about every 2,100 feet. The distance from Waiko Road to the future Main Street is about 2,400 feet, from the future Main Street to the future East-West Road is about 1,600 feet, and from the future East-West Road to the southern terminus of the future Waiale Bypass is about 2,400 feet. Although spacing is less than ½ a mile between these intersections, which is HDOT's recommended and desired spacing on major arterials, the project site lies within the urbanized area of Maui rather than a rural area, and so more closely-spaced intersections are reasonable in this project setting, even for a major arterial. Furthermore, intersection level of service analysis results under Year 2022 and 2026 conditions demonstrated that each of these intersections would operate at acceptable levels during the peak hours.

ROUNDABOUT ANALYSIS

Roundabouts are not recommended at any of the study intersections along Honoapiilani Highway. The rationale of this recommendation is based on the review of the HDOT's roundabout guidelines. According to the *Hawaii Department of Transportation Modern Roundabout Policy Guideline* (HDOT, 2008):

- *Modern roundabouts involve low speeds for entering and circulating traffic and would need to be designed so that speeds of all vehicles is restricted to 35 mph or less within the roundabout.*

- *In situations where traffic volumes on both roadways are high and well balanced and/or where turning movements are relatively high, roundabouts provide better overall intersection operations and greater capacity than conventional intersection layouts.*

- *When the volumes on the major road are heavier than that on the minor road, the equal treatment of approaches may increase delay to the major road. Also, if the major road carries a heavy stream of through traffic, the lack of adequate gaps in the dominant flow may deter the minor flow from entering the roundabout during peak periods. Unless there are compelling reasons to do so, modern roundabouts need not be considered when less than 10% of the traffic enters the intersection from the minor roadway.*

- *No pedestrian activities take place across the circulating roadway or within the center island.*

- *Pedestrians and bicyclists may have difficulty finding the proper route through a modern roundabout due to unfamiliarity with operations.*

Along Honoapiilani Highway the projected northbound and southbound volumes are considerably higher than the volumes on the cross streets, and since the traffic flow through roundabouts is limited only by the availability of gaps in the circulating flow, this minor street-major street volume imbalance could lead to potential greater delay experienced at the side streets trying to access Honoapiilani Highway. In particular, at Honoapiilani Highway & East-West Residential Street (Intersection 11) the minor roadway does not comprise more than 10% of the total intersection volume in either the AM or the PM peak hour under both 2022 and 2026 conditions. Thus, based on HDOT's factors to consider for modern roundabouts, none of the proposed intersections along Highway 30 (Intersections 9, 11, and 13) appear suitable for roundabout installation.

PEDESTRIAN NETWORK

The Waikapu Country Town Project follows new urbanist design principles that include compact, higher-density, mixed-uses, and an emphasis on walkability and connectivity through extensive pedestrian and bicycle networks on the project site. These characteristics by nature reduce vehicle trip making and promote use of non-motorized modes. Consistent with State of Hawaii and County of Maui policies on Complete Streets, the transportation facilities for the residential and commercial districts will be developed to form a balanced multi-modal network designed to provide mobility choices and to meet the needs of the community and all roadway users.

A primary objective of the project is to develop a community where walking and biking are the preferred modes of transportation for short commutes. Therefore, approximately eight miles of hiking, biking and walking trails will be incorporated into the project site along with one or two pedestrian/bicycle bridges

over Waiko Stream to the north. Also, the development makai of the highway will focus on a pedestrian oriented "main street" close to an elementary school and parks. A principal objective of the project's active transportation plan is to separate pedestrians and bicyclists from automobiles through the use of multi-use cycle tracks and trails. Such facilities will link the project's mauka and makai neighborhoods with the project's commercial areas, civic, and recreational facilities.

All of the project's streets will emphasize traffic calming and street scape beautification. The use of residential roundabouts at key intersections, landscape planting strips to buffer pedestrians from traffic and linear greenways will serve to beautify the project while providing motivation for residents to walk and bike more. The project's pedestrian and bicycle facilities will be designed to make walking and bicycling safe, accessible and an enjoyable activity for all age groups. Within the project's residential neighborhoods, sidewalks will be provided on both sides of the street and traffic calming will encourage on-street bicycle riding. **Figure 10** shows the project's non-motorized network of multi-use trails, pedestrian and bicycle facilities.

BIKE NETWORK

According to *Bike Plan Hawaii,* there will be more future bicycle facilities provided in the Wailuku-Kahului area, where the project site is located, based on its list of proposed facilities. Listed below are the proposed facilities in the project study area:

- Kamehameha Avenue between Papa Avenue and Maui Lani Parkway is planned to provide 0.7 miles of bicycle lane.
- Waiale Road is planned to become a signed shared road for a length of 4.0 miles between Maui Lani and Honoapiilani Highway.
- Also 5.3 miles of Kuihelani Highway is planned to become a signed shared road or path from Puunene Avenue to Honoapiilani Highway.

The *Central Maui Pedestrian and Bicycle Master Plan for 2030* (State of Hawaii – Department of Health-Healthy Hawaii Initiative, 2012) further highlights that Waiale Road/Drive has significant unused ROW that could be used to create a separated pedestrian and bicycle path that will be an important link in connecting future growth in Waikapu to Kahului and Wailuku. The specific vision for this Waikapu-Waiale Road Connector is to connect Waikapu to Wailuku and Kahului by the Waiale Road Bikeway and provide a safe and convenient commute between communities. The Waiale Road Bikeway will be a contiguous bike path or cycle track between Kuikahi Drive and Waiko Road, which would then transition into a separated bike path, or at a minimum a bike lane with signage to Waiinu Road, and eventually transition into a multi-use path with a two-way bikeway and possible pedestrian path that would connect Waiinu Road or

\\Fpse03\fpse2\Data2\2013Projects\SD_Projects\SD13-0085\Graphics\Figure 10\Fig10.mxd

Figure 10

Waikapu County Town
Pedestrian and Bicycle Facility Network

the Sandhills residential area with Lower Main Street or Wailuku. A local example of such a bikeway is in Kihei along Liola Drive between Waipuilani Road and Lipoa Street. The WCT project provides an opportunity to develop a major segment of this bikeway and to integrate it into the new community.

Additionally, the *Final Environmental Assessment for the Proposed Waiale Road Extension and East Waiko Road Improvements* (County of Maui, 2014) states that the Waiale Bypass will include a 10-foot bicycle/pedestrian path on the west side of the roadway.

TRANSIT NETWORK

Under existing conditions, the Honoapiilani & Waiko bus stop is the only bus stop located in the project vicinity. While the Maui Bus has no immediate plans to expand service in this area, as the WCT site develops, the project allows for the introduction of public transit to the site, and service to the Waikapu Country Town should be considered as the County plans future expansion of public transit service in this area. Additionally, enhancements and amenities (i.e., benches or covered shelter) could be installed at the existing bus stop and any new bus stops to support future transit riders in this area.

APPENDIX A: TRAFFIC COUNT DATA

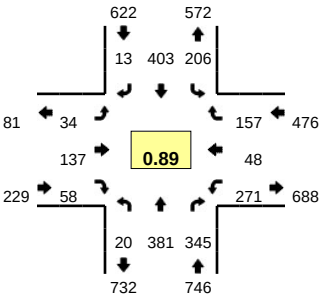
Type of peak hour being reported: Intersection Peak

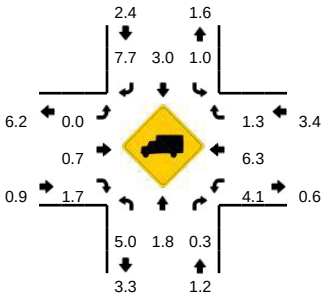
Method for determining peak hour: Total Entering Volume

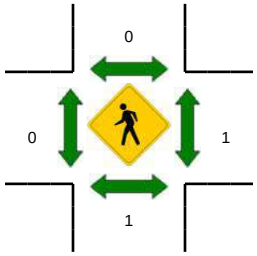
LOCATION: Honoapiilani Hwy (Hwy-30) -- Kuikahi Dr
CITY/STATE: Wailuku, HI

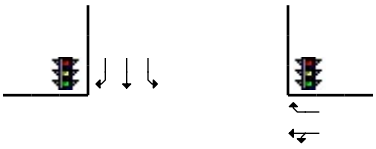
QC JOB #: 11217001
DATE: Wed, Sep 11 2013

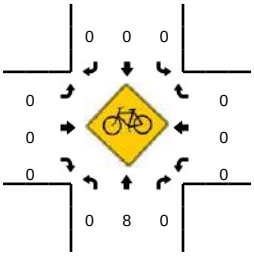
Peak-Hour: 6:50 AM -- 7:50 AM
Peak 15-Min: 7:20 AM -- 7:35 AM

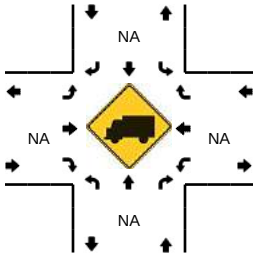


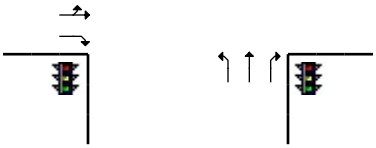


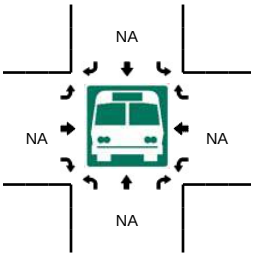












5-Min Count Period Beginning At	Honoapiilani Hwy (Hwy-30) (Northbound)				Honoapiilani Hwy (Hwy-30) (Southbound)				Kuikahi Dr (Eastbound)				Kuikahi Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:20 AM	1	10	12	0	5	25	1	0	2	7	3	0	11	1	12	0	90	
6:25 AM	0	11	14	0	4	31	1	0	5	8	5	0	10	1	5	0	95	
6:30 AM	1	10	18	0	6	29	0	0	3	10	4	0	12	0	5	0	98	
6:35 AM	1	13	19	0	10	30	1	0	1	5	7	0	14	0	6	0	107	
6:40 AM	1	15	29	0	8	37	0	0	3	9	3	0	6	3	10	0	124	
6:45 AM	2	18	28	0	11	27	0	0	3	13	0	0	10	2	8	0	122	
6:50 AM	2	14	24	0	19	37	0	0	0	15	3	0	30	2	7	0	153	
6:55 AM	2	20	28	0	11	22	1	0	3	16	3	0	15	9	5	0	135	1210
7:00 AM	4	20	24	0	7	36	1	0	1	11	5	0	24	4	13	0	150	1305
7:05 AM	3	26	26	0	16	25	0	0	2	9	5	0	14	5	13	0	144	1378
7:10 AM	0	35	27	0	15	44	0	0	4	13	6	0	21	5	15	0	185	1479
7:15 AM	2	34	31	0	17	25	1	0	3	15	11	0	20	5	12	0	176	1579
7:20 AM	0	36	27	0	17	36	3	0	4	13	7	0	21	1	19	0	184	1673
7:25 AM	1	54	38	0	21	36	1	0	2	8	3	0	21	2	16	0	203	1781
7:30 AM	0	39	36	0	17	43	2	0	2	10	4	0	23	3	19	0	198	1881
7:35 AM	2	41	28	0	17	27	2	0	4	10	6	0	27	2	14	0	180	1954
7:40 AM	0	37	30	0	23	34	1	0	6	8	1	0	16	2	14	0	172	2002
7:45 AM	4	25	26	0	26	38	1	0	3	9	4	0	39	8	10	0	193	2073
7:50 AM	2	25	26	0	25	36	1	0	0	4	1	0	17	3	13	0	153	2073
7:55 AM	0	32	22	0	11	22	1	0	2	8	5	0	18	4	8	0	133	2071
8:00 AM	2	26	16	0	10	27	0	0	1	9	1	0	22	1	11	0	126	2047
8:05 AM	4	28	15	0	8	25	1	0	2	4	1	0	13	3	6	0	110	2013
8:10 AM	1	25	21	0	8	31	0	0	2	8	3	0	12	8	11	0	130	1958
8:15 AM	0	20	18	0	11	22	1	0	1	5	2	0	9	2	5	0	96	1878

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	4	516	404	0	220	460	24	0	32	124	56	0	260	24	216	0	2340
Heavy Trucks	0	8	0		4	24	0		0	0	0		0	0	0		36
Pedestrians		0				0				0				0			0
Bicycles	0	1	0		0	0	0		0	0	0		0	0	0		1
Railroad Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

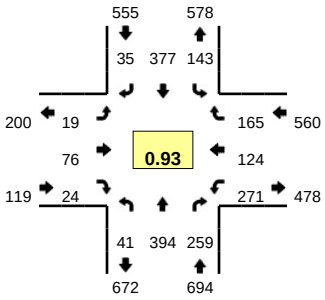
Method for determining peak hour: Total Entering Volume

LOCATION: Honoapiilani Hwy (Hwy 30) -- Kuikahi Dr

CITY/STATE: Wailuku, HI

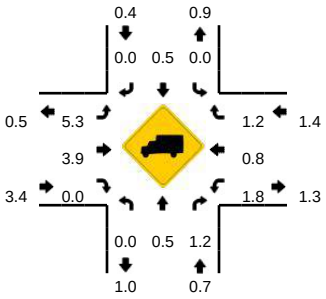
QC JOB #: 11217002

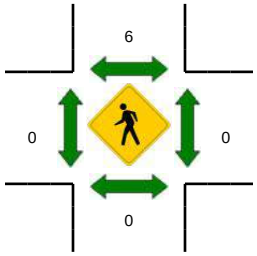
DATE: Wed, Sep 11 2013

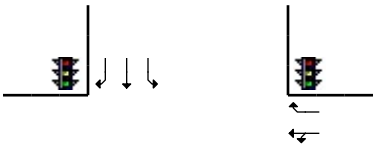


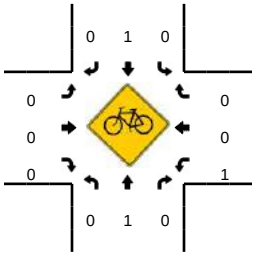
Peak-Hour: 4:25 PM -- 5:25 PM

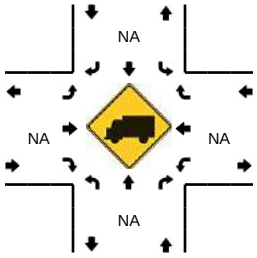
Peak 15-Min: 4:35 PM -- 4:50 PM

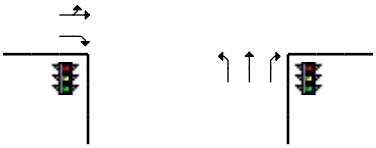


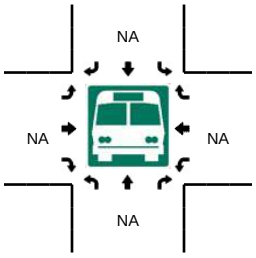












5-Min Count Period Beginning At	Honoapiilani Hwy (Hwy 30) (Northbound)				Honoapiilani Hwy (Hwy 30) (Southbound)				Kuikahi Dr (Eastbound)				Kuikahi Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:55 PM	0	29	17	0	14	22	1	0	0	7	2	0	30	8	15	0	145	1658
4:00 PM	0	30	18	0	13	25	0	0	4	3	3	0	20	13	15	0	144	1696
4:05 PM	1	25	25	0	10	31	1	0	0	6	1	0	21	11	18	0	150	1735
4:10 PM	4	37	29	0	13	28	0	0	0	2	1	0	19	15	15	0	163	1749
4:15 PM	3	26	24	0	6	34	0	0	1	5	1	0	15	11	11	0	137	1757
4:20 PM	1	23	17	0	8	27	2	0	0	4	1	0	24	7	17	0	131	1776
4:25 PM	3	39	21	0	13	30	1	0	3	10	1	0	20	8	19	0	168	1798
4:30 PM	4	23	17	0	10	30	7	0	2	3	1	0	25	13	10	0	145	1810
4:35 PM	5	41	22	0	15	31	1	0	0	2	3	0	24	10	15	0	169	1825
4:40 PM	5	20	18	0	13	44	7	0	4	7	1	0	26	10	16	0	171	1828
4:45 PM	3	36	26	0	17	45	1	0	3	6	3	0	18	9	11	0	178	1844
4:50 PM	2	31	24	0	8	20	4	0	0	8	2	0	31	8	6	0	144	1845
4:55 PM	2	29	26	0	12	27	6	0	1	8	2	0	22	7	13	0	155	1855
5:00 PM	1	31	22	0	9	26	3	0	2	4	2	0	23	12	14	0	149	1860
5:05 PM	3	39	24	0	12	34	0	0	1	6	2	0	22	6	12	0	161	1871
5:10 PM	5	31	19	0	11	30	2	0	1	5	1	0	28	16	15	0	164	1872
5:15 PM	7	37	16	0	10	26	3	0	0	8	4	0	17	13	13	0	154	1889
5:20 PM	1	37	24	0	13	34	0	0	2	9	2	0	15	12	21	0	170	1928
5:25 PM	2	28	24	0	8	26	1	0	0	4	2	0	11	16	13	0	135	1895
5:30 PM	3	40	22	0	6	19	4	0	1	10	1	0	9	8	11	0	134	1884
5:35 PM	1	31	27	0	11	31	3	0	0	10	0	0	16	12	14	0	156	1871
5:40 PM	6	25	25	0	10	25	5	0	2	3	0	0	13	10	10	0	134	1834
5:45 PM	2	21	19	0	9	13	3	0	2	4	2	0	19	14	10	0	118	1774
5:50 PM	2	24	11	0	7	23	2	0	4	7	1	0	13	4	12	0	110	1740

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	52	388	264	0	180	480	36	0	28	60	28	0	272	116	168	0	2072
Heavy Trucks	0	4	0		0	4	0		0	0	0		8	0	4		20
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	1	0		0	0	0		0	0	0		1
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

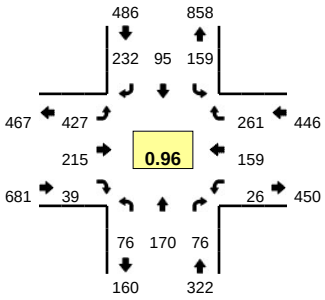
Method for determining peak hour: Total Entering Volume

LOCATION: Waiale Rd -- Kuikahi Dr/Mauilani Pkwy

QC JOB #: 11217003

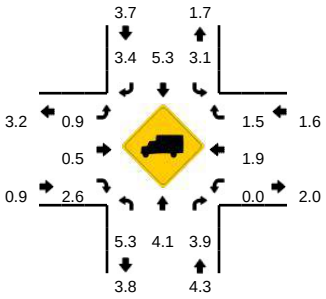
CITY/STATE: Wailuku, HI

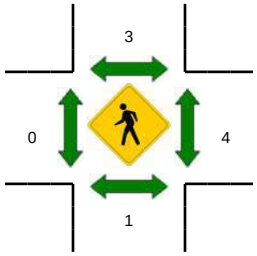
DATE: Wed, Sep 11 2013

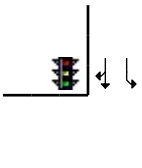


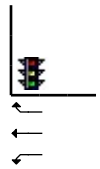
Peak-Hour: 6:50 AM -- 7:50 AM

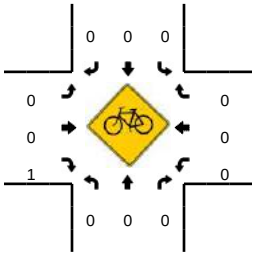
Peak 15-Min: 7:35 AM -- 7:50 AM

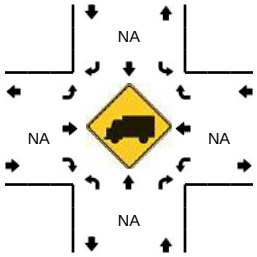


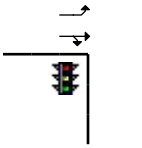


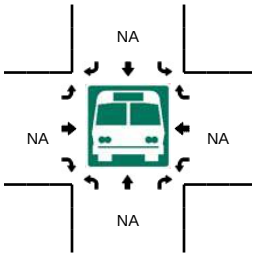












5-Min Count Period Beginning At	Waiale Rd (Northbound)				Waiale Rd (Southbound)				Kuikahi Dr/Mauilani Pkwy (Eastbound)				Kuikahi Dr/Mauilani Pkwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:20 AM	1	9	5	0	7	4	9	0	8	13	2	0	2	14	6	0	80	
6:25 AM	2	5	2	0	18	5	9	0	16	5	1	0	3	5	11	0	82	
6:30 AM	2	10	3	0	10	3	9	0	26	9	1	0	1	5	8	0	87	
6:35 AM	2	5	6	0	23	8	11	0	23	13	0	0	4	7	13	0	115	
6:40 AM	3	13	5	0	10	2	5	0	25	14	1	0	3	14	21	0	116	
6:45 AM	4	10	1	0	17	8	9	0	28	22	1	0	4	10	28	0	142	
6:50 AM	1	9	8	0	18	4	25	0	29	30	2	0	1	15	24	0	166	
6:55 AM	5	10	7	0	14	7	13	0	25	25	1	0	1	16	24	0	148	1199
7:00 AM	7	6	10	0	16	9	18	0	31	17	0	0	4	12	17	0	147	1283
7:05 AM	7	18	5	0	14	14	17	0	21	20	4	0	1	9	12	0	142	1367
7:10 AM	4	11	4	0	17	5	21	0	40	22	3	0	1	17	18	0	163	1455
7:15 AM	13	19	9	0	9	6	21	0	33	20	3	0	4	12	24	0	173	1561
7:20 AM	9	25	10	0	12	5	15	0	41	10	2	0	2	11	26	0	168	1649
7:25 AM	5	10	4	0	10	5	20	0	53	13	4	0	1	9	18	0	152	1719
7:30 AM	9	21	7	0	11	10	18	0	40	11	4	0	2	14	24	0	171	1803
7:35 AM	6	18	3	0	14	7	20	0	45	7	5	0	3	10	15	0	153	1841
7:40 AM	8	15	8	0	15	12	19	0	32	21	2	0	4	18	26	0	180	1905
7:45 AM	2	8	1	0	9	11	25	0	37	19	9	0	2	16	33	0	172	1935
7:50 AM	3	10	3	0	17	8	16	0	30	19	4	0	5	14	34	0	163	1932
7:55 AM	0	5	3	0	17	14	12	0	30	15	6	0	6	18	14	0	140	1924
8:00 AM	1	6	2	0	11	1	18	0	17	12	5	0	1	14	23	0	111	1888
8:05 AM	2	10	0	0	10	5	10	0	11	12	3	0	1	14	16	0	94	1840
8:10 AM	2	4	1	0	17	5	9	0	23	10	0	0	1	11	15	0	98	1775
8:15 AM	1	8	3	0	7	8	11	0	16	17	1	0	0	9	17	0	98	1700

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	64	164	48	0	152	120	256	0	456	188	64	0	36	176	296	0	2020
Heavy Trucks	4	12	8		0	0	8		4	4	0		0	8	4		52
Pedestrians		0				0				0				8			8
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Waiale Rd -- Kuikahi Dr/Mauilani Pkwy

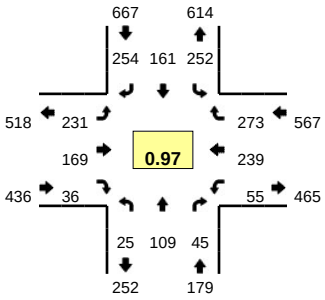
CITY/STATE: Wailuku, HI

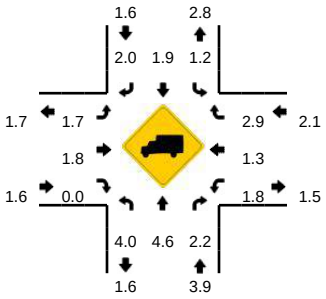
QC JOB #: 11217004

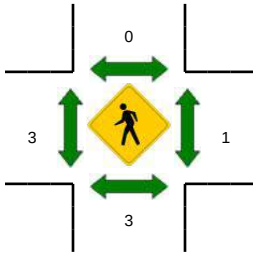
DATE: Wed, Sep 11 2013

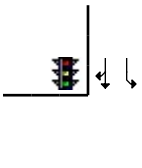
Peak-Hour: 4:15 PM -- 5:15 PM

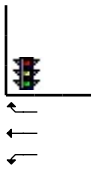
Peak 15-Min: 4:30 PM -- 4:45 PM

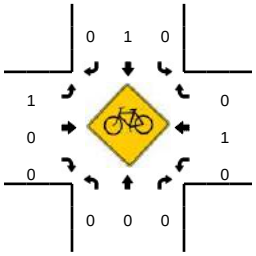


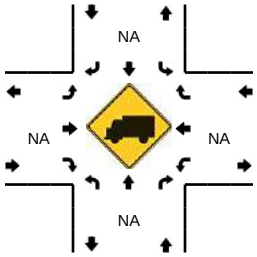


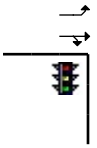


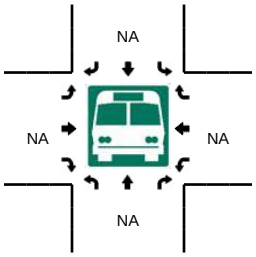












5-Min Count Period Beginning At	Waiale Rd (Northbound)				Waiale Rd (Southbound)				Kuikahi Dr/Mauilani Pkwy (Eastbound)				Kuikahi Dr/Mauilani Pkwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:45 PM	1	6	4	0	22	15	20	0	24	14	5	0	4	27	14	0	156	
3:50 PM	3	9	2	0	22	15	27	0	12	21	2	0	4	17	23	0	157	
3:55 PM	2	10	4	0	13	6	25	0	16	21	3	0	5	19	26	0	150	1695
4:00 PM	4	11	5	0	16	12	10	0	13	15	1	0	5	30	30	0	152	1719
4:05 PM	3	9	2	0	21	12	21	0	13	19	2	0	4	27	24	0	157	1766
4:10 PM	4	12	4	0	19	8	16	0	22	10	6	0	3	21	17	0	142	1786
4:15 PM	5	3	1	0	24	18	13	0	24	8	0	0	6	17	25	0	144	1788
4:20 PM	3	13	5	0	14	13	18	1	17	10	1	0	9	17	26	0	147	1815
4:25 PM	2	6	5	0	24	9	19	0	22	15	6	0	4	23	20	0	155	1825
4:30 PM	1	9	9	0	24	10	25	0	16	12	2	0	6	21	22	0	157	1828
4:35 PM	0	11	2	0	27	14	26	0	9	15	2	0	3	26	20	0	155	1829
4:40 PM	6	6	2	0	31	13	21	0	26	14	6	0	3	17	22	0	167	1839
4:45 PM	0	11	3	0	12	14	17	0	20	20	4	0	5	17	26	0	149	1832
4:50 PM	0	6	2	0	28	15	24	0	22	13	3	0	3	16	20	0	152	1827
4:55 PM	2	9	5	0	14	12	21	0	23	18	4	0	5	21	21	0	155	1832
5:00 PM	2	8	4	0	17	19	25	0	20	12	2	0	4	16	29	0	158	1838
5:05 PM	2	11	4	0	16	12	19	0	23	15	3	0	6	25	20	0	156	1837
5:10 PM	2	16	3	0	20	12	26	0	9	17	3	0	1	23	22	0	154	1849
5:15 PM	2	6	1	0	26	8	17	0	15	13	1	0	3	22	22	0	136	1841
5:20 PM	0	8	6	0	15	9	10	0	19	16	7	0	3	33	25	0	151	1845
5:25 PM	2	3	3	0	19	6	14	0	25	8	2	0	3	16	18	0	119	1809
5:30 PM	1	12	2	0	15	5	7	0	21	18	1	0	8	19	18	0	127	1779
5:35 PM	0	8	3	0	15	11	15	0	23	19	0	0	9	28	18	0	149	1773
5:40 PM	0	8	4	0	28	15	16	0	14	14	1	0	8	15	16	0	139	1745

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	28	104	52	0	328	148	288	0	204	164	40	0	48	256	256	0	1916
Heavy Trucks	0	4	0		8	0	4		0	0	0		0	0	12		28
Pedestrians		8				0				8				0			16
Bicycles	0	0	0		0	1	0		0	0	0		0	0	0		1
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

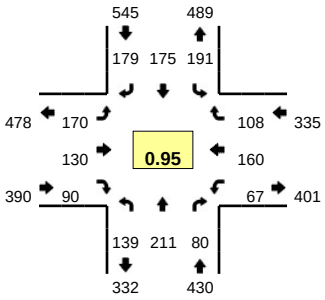
Method for determining peak hour: Total Entering Volume

LOCATION: S Kamehameha Ave -- Mauilani Pkwy

CITY/STATE: Kahului, HI

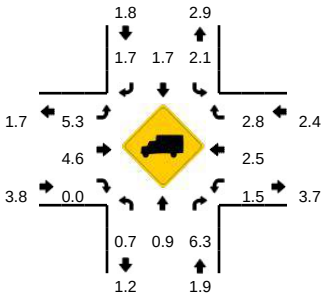
QC JOB #: 11217005

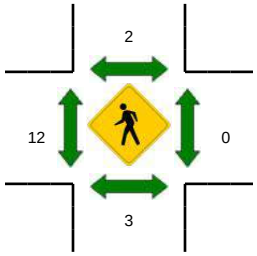
DATE: Wed, Sep 11 2013

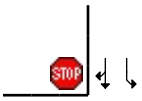


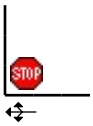
Peak-Hour: 6:55 AM -- 7:55 AM

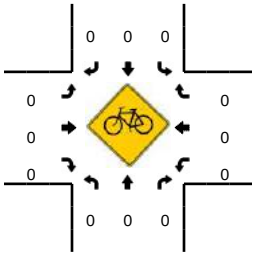
Peak 15-Min: 7:35 AM -- 7:50 AM

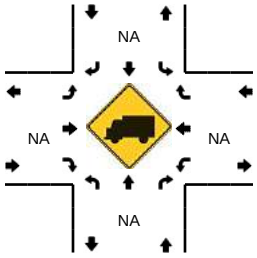


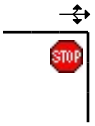


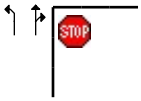


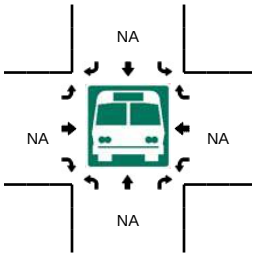












5-Min Count Period Beginning At	S Kamehameha Ave (Northbound)				S Kamehameha Ave (Southbound)				Mauilani Pkwy (Eastbound)				Mauilani Pkwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:25 AM	1	1	2	0	16	1	7	0	10	10	1	0	3	3	2	0	57	
6:30 AM	2	1	4	0	17	2	11	0	7	15	2	0	5	16	7	0	89	
6:35 AM	2	3	2	0	16	4	16	0	7	20	3	0	4	17	6	0	100	
6:40 AM	5	9	1	0	24	6	22	0	12	13	3	0	4	19	9	0	127	
6:45 AM	4	6	2	0	18	3	17	0	13	13	1	0	3	19	16	0	115	
6:50 AM	5	4	2	0	20	9	21	0	15	15	3	0	8	19	9	0	130	
6:55 AM	6	13	3	0	21	7	19	0	21	10	3	0	2	19	5	0	129	1022
7:00 AM	8	6	4	0	35	13	14	0	17	10	10	0	3	8	13	0	141	1117
7:05 AM	6	13	7	0	20	18	15	0	18	7	4	0	9	6	10	0	133	1201
7:10 AM	7	18	7	0	18	15	20	0	19	8	9	0	5	11	9	0	146	1291
7:15 AM	17	20	4	0	15	19	11	0	13	9	8	0	7	8	10	0	141	1368
7:20 AM	4	20	5	0	5	23	11	0	8	12	13	0	8	19	7	0	135	1443
7:25 AM	10	16	6	0	13	18	18	0	9	14	11	0	6	15	10	0	146	1532
7:30 AM	10	26	3	0	11	20	9	0	14	4	12	0	9	8	15	0	141	1584
7:35 AM	23	22	12	0	7	19	6	0	10	9	9	0	9	11	8	0	145	1629
7:40 AM	20	19	12	0	20	14	15	0	9	17	4	0	3	16	7	0	156	1658
7:45 AM	15	23	11	0	12	6	15	0	14	16	3	0	4	20	8	0	147	1690
7:50 AM	13	15	6	0	14	3	26	0	18	14	4	0	2	19	6	0	140	1700
7:55 AM	5	8	3	0	14	3	15	0	10	19	1	0	0	12	7	0	97	1668
8:00 AM	2	3	1	0	10	2	14	0	16	20	3	0	1	10	3	0	85	1612
8:05 AM	4	2	1	0	13	2	18	0	11	11	2	0	0	9	9	0	82	1561
8:10 AM	1	5	3	0	10	6	8	0	6	6	1	0	1	14	1	0	62	1477
8:15 AM	2	3	0	0	15	1	13	0	18	12	1	0	2	16	9	0	92	1428
8:20 AM	2	5	3	0	9	1	12	0	7	8	3	0	0	22	4	0	76	1369

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	232	256	140	0	156	156	144	0	132	168	64	0	64	188	92	0	1792
Heavy Trucks	0	4	0		0	8	4		12	4	0		0	12	0		44
Pedestrians		4				4				16				0			24
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: S Kamehameha Ave -- Mauilani Pkwy

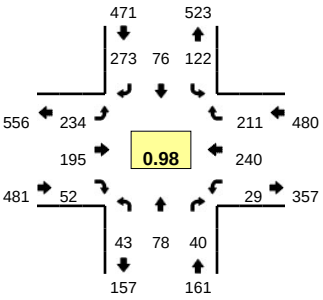
CITY/STATE: Kahului, HI

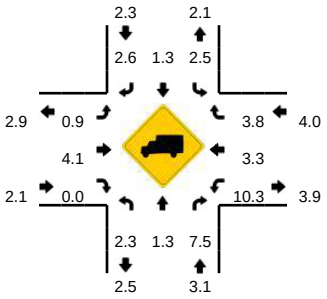
QC JOB #: 11217006

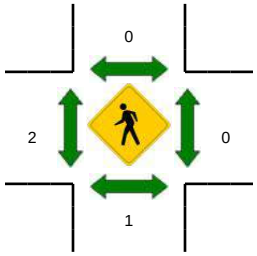
DATE: Wed, Sep 11 2013

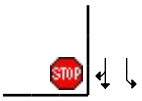
Peak-Hour: 3:30 PM -- 4:30 PM

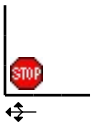
Peak 15-Min: 3:35 PM -- 3:50 PM

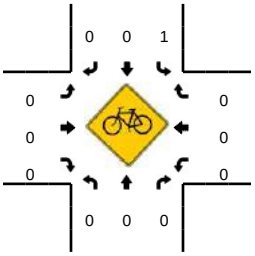


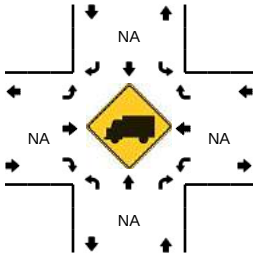


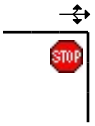


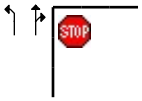


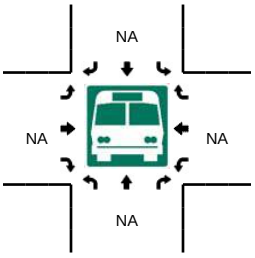












5-Min Count Period Beginning At	S Kamehameha Ave (Northbound)				S Kamehameha Ave (Southbound)				Mauilani Pkwy (Eastbound)				Mauilani Pkwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	6	5	2	0	10	0	17	0	6	8	4	0	2	17	15	0	92	
3:05 PM	1	3	0	0	12	4	11	0	18	19	4	0	4	20	13	0	109	
3:10 PM	2	2	4	0	9	6	21	0	15	11	0	0	3	17	16	0	106	
3:15 PM	2	5	3	0	4	7	19	0	16	18	7	0	2	18	18	0	119	
3:20 PM	5	5	1	0	8	4	17	0	15	14	3	0	3	18	10	0	103	
3:25 PM	5	7	2	0	12	5	21	0	22	13	4	0	1	14	7	0	113	
3:30 PM	4	5	5	0	12	5	18	0	11	21	6	0	3	22	19	0	131	
3:35 PM	5	4	6	0	11	4	16	0	20	20	7	0	3	19	21	0	136	
3:40 PM	2	9	7	0	16	4	26	0	21	13	3	0	2	17	15	0	135	
3:45 PM	1	5	2	0	10	8	23	0	23	16	4	0	1	26	15	0	134	
3:50 PM	2	10	4	0	7	7	25	0	17	20	4	0	3	20	14	0	133	
3:55 PM	3	6	0	0	10	10	26	0	16	17	4	0	4	21	15	0	132	1443
4:00 PM	4	10	2	0	5	3	30	0	20	17	5	0	2	19	18	0	135	1486
4:05 PM	3	4	2	0	10	8	15	0	19	22	3	0	3	24	17	0	130	1507
4:10 PM	4	6	4	0	9	5	21	0	25	11	4	0	4	21	16	0	130	1531
4:15 PM	11	7	3	0	12	9	20	0	21	9	5	0	1	14	23	0	135	1547
4:20 PM	3	5	1	0	11	10	30	0	16	18	3	0	3	20	15	0	135	1579
4:25 PM	1	7	4	0	9	3	23	0	25	11	4	0	0	17	23	0	127	1593
4:30 PM	4	5	3	0	9	7	21	0	13	18	6	0	2	20	22	0	130	1592
4:35 PM	0	8	1	0	14	6	18	0	26	15	3	0	1	21	16	0	129	1585
4:40 PM	2	4	1	0	10	12	24	0	18	18	7	0	2	18	25	0	141	1591
4:45 PM	2	13	5	0	12	3	25	0	13	18	5	0	1	15	19	0	131	1588
4:50 PM	2	6	3	0	9	7	18	0	22	15	4	0	2	15	23	0	126	1581
4:55 PM	4	7	4	0	19	7	20	0	21	10	7	0	2	16	20	0	137	1586

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	32	72	60	0	148	64	260	0	256	196	56	0	24	248	204	0	1620
Heavy Trucks	0	4	8		8	4	8		4	4	0		8	8	8		64
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

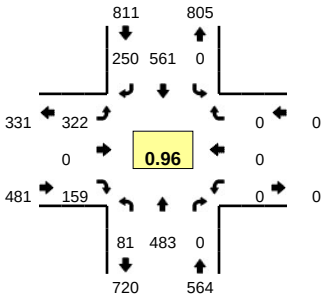
Type of peak hour being reported: Intersection Peak

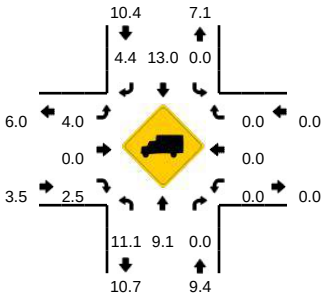
Method for determining peak hour: Total Entering Volume

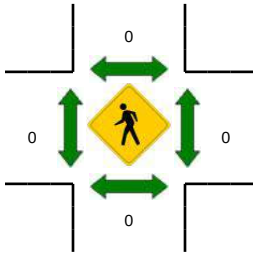
LOCATION: Kuihelani Hwy (Hwy 380) -- Mauilani Pkwy
CITY/STATE: Kahului, HI

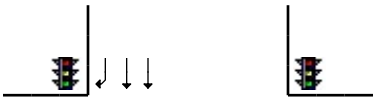
QC JOB #: 11217007
DATE: Wed, Sep 11 2013

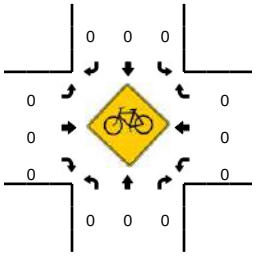
Peak-Hour: 6:55 AM -- 7:55 AM
Peak 15-Min: 7:25 AM -- 7:40 AM

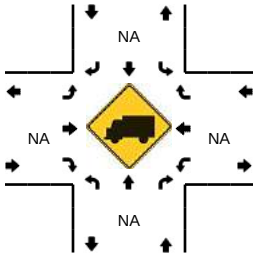


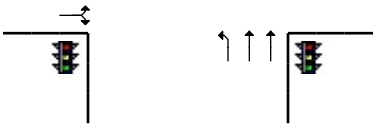


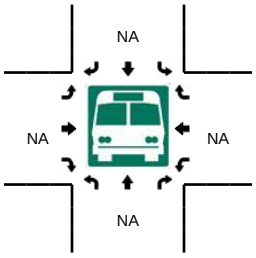












5-Min Count Period Beginning At	Kuihelani Hwy (Hwy 380) (Northbound)				Kuihelani Hwy (Hwy 380) (Southbound)				Mauilani Pkwy (Eastbound)				Mauilani Pkwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:25 AM	2	25	0	0	0	40	10	0	21	0	14	0	0	0	0	0	112	
6:30 AM	1	11	0	0	0	38	21	0	21	0	14	0	0	0	0	0	106	
6:35 AM	3	33	0	0	0	34	25	0	31	0	9	0	0	0	0	0	135	
6:40 AM	1	37	0	0	0	37	29	0	29	0	17	0	0	0	0	0	150	
6:45 AM	9	33	0	0	0	35	24	0	24	0	17	0	0	0	0	0	142	
6:50 AM	3	32	0	0	0	32	23	0	19	0	15	0	0	0	0	0	124	
6:55 AM	3	31	0	0	0	68	22	0	23	0	15	0	0	0	0	0	162	1367
7:00 AM	4	25	0	0	0	60	16	0	23	0	20	0	0	0	0	0	148	1436
7:05 AM	9	37	0	0	0	30	16	0	36	0	22	0	0	0	0	0	150	1507
7:10 AM	5	37	0	0	0	49	20	0	20	0	13	0	0	0	0	0	144	1563
7:15 AM	9	29	0	0	0	45	26	0	27	0	17	0	0	0	0	0	153	1622
7:20 AM	4	35	0	0	0	47	26	0	21	0	10	0	0	0	0	0	143	1669
7:25 AM	14	66	0	0	0	43	31	0	26	0	6	0	0	0	0	0	186	1743
7:30 AM	9	37	0	0	0	53	15	0	20	0	12	0	0	0	0	0	146	1783
7:35 AM	11	40	0	0	0	42	23	0	27	0	9	0	0	0	0	0	152	1800
7:40 AM	5	59	0	0	0	39	20	0	28	0	10	0	0	0	0	0	161	1811
7:45 AM	3	48	0	0	0	52	18	0	39	0	11	0	0	0	0	0	171	1840
7:50 AM	5	39	0	0	0	33	17	0	32	0	14	0	0	0	0	0	140	1856
7:55 AM	1	43	0	0	0	35	15	0	39	0	3	0	0	0	0	0	136	1830
8:00 AM	4	51	0	0	0	34	19	0	25	0	9	0	0	0	0	0	142	1824
8:05 AM	1	36	0	0	0	41	16	0	17	0	7	0	0	0	0	0	118	1792
8:10 AM	3	40	0	0	0	26	17	0	18	0	4	0	0	0	0	0	108	1756
8:15 AM	4	39	0	0	0	52	22	0	18	0	9	0	0	0	0	0	144	1747
8:20 AM	1	31	0	0	0	39	28	0	15	0	7	0	0	0	0	0	121	1725

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	136	572	0	0	0	552	276	0	292	0	108	0	0	0	0	0	1936
Heavy Trucks	12	60	0		0	64	12		16	0	4		0	0	0		168
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

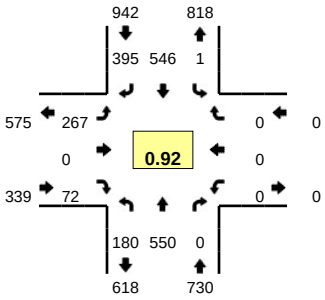
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

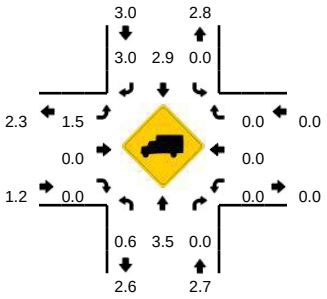
Method for determining peak hour: Total Entering Volume

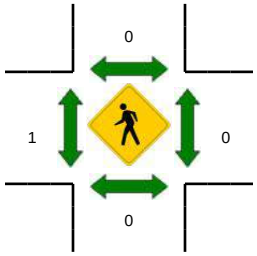
LOCATION: Kuihelani Hwy (Hwy 380) -- Mauilani Pkwy
CITY/STATE: Kahului, HI

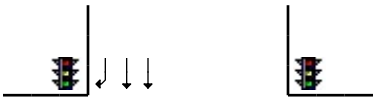
QC JOB #: 11217008
DATE: Wed, Sep 11 2013

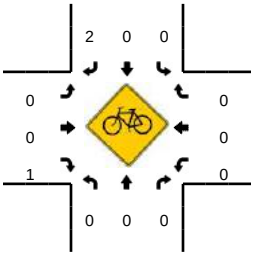


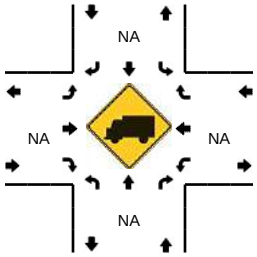
Peak-Hour: 4:25 PM -- 5:25 PM
Peak 15-Min: 5:05 PM -- 5:20 PM

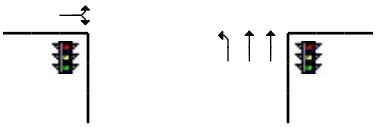


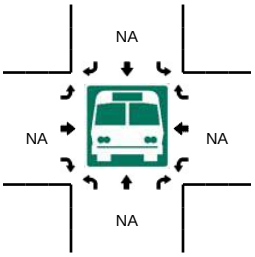












5-Min Count Period Beginning At	Kuihelani Hwy (Hwy 380) (Northbound)				Kuihelani Hwy (Hwy 380) (Southbound)				Mauilani Pkwy (Eastbound)				Mauilani Pkwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:55 PM	8	48	0	0	0	60	34	0	21	0	2	0	0	0	0	0	173	1847
4:00 PM	13	30	0	0	0	22	39	0	21	0	9	0	0	0	0	0	134	1847
4:05 PM	11	56	0	0	0	34	28	0	20	0	8	0	0	0	0	0	157	1847
4:10 PM	14	63	0	0	0	44	27	0	28	0	6	0	0	0	0	0	182	1893
4:15 PM	15	52	0	0	0	52	26	1	14	0	7	0	0	0	0	0	167	1936
4:20 PM	7	33	0	0	0	39	29	1	20	0	3	0	0	0	0	0	132	1904
4:25 PM	15	42	0	0	0	57	40	0	12	0	8	0	0	0	0	0	174	1930
4:30 PM	11	45	0	0	0	40	28	0	25	0	4	0	0	0	0	0	153	1939
4:35 PM	16	36	0	0	0	49	39	0	17	0	6	0	0	0	0	0	163	1931
4:40 PM	19	53	0	0	0	34	36	1	30	0	7	0	0	0	0	0	180	1951
4:45 PM	16	58	0	0	0	48	32	0	20	0	8	0	0	0	0	0	182	1979
4:50 PM	11	34	0	0	0	42	33	0	23	0	5	0	0	0	0	0	148	1945
4:55 PM	18	52	0	0	0	38	23	0	19	0	1	0	0	0	0	0	151	1923
5:00 PM	11	42	0	0	0	48	34	0	21	0	8	0	0	0	0	0	164	1953
5:05 PM	9	55	0	0	0	62	37	0	21	0	5	0	0	0	0	0	189	1985
5:10 PM	26	57	0	0	0	31	32	0	23	0	13	0	0	0	0	0	182	1985
5:15 PM	13	44	0	0	0	52	33	0	32	0	4	0	0	0	0	0	178	1996
5:20 PM	15	32	0	0	0	45	28	0	24	0	3	0	0	0	0	0	147	2011
5:25 PM	12	52	0	0	0	44	26	0	16	0	3	0	0	0	0	0	153	1990
5:30 PM	17	42	0	0	0	50	34	0	15	0	4	0	0	0	0	0	162	1999
5:35 PM	7	41	0	0	1	20	29	0	30	0	4	0	0	0	0	0	132	1968
5:40 PM	8	30	0	0	0	44	35	0	10	0	5	0	0	0	0	0	132	1920
5:45 PM	14	39	0	0	0	46	33	0	14	0	3	0	0	0	0	0	149	1887
5:50 PM	5	35	0	0	0	30	26	0	26	0	5	0	0	0	0	0	127	1866

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	192	624	0	0	0	580	408	0	304	0	88	0	0	0	0	0	2196
Heavy Trucks	0	28	0		0	16	8		0	0	0		0	0	0		52
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	1		0	0	0		0	0	0		1
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

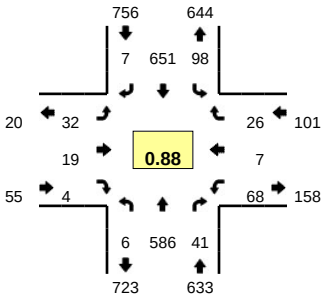
Type of peak hour being reported: Intersection Peak

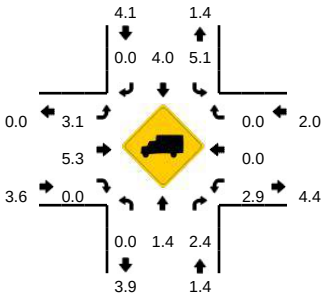
Method for determining peak hour: Total Entering Volume

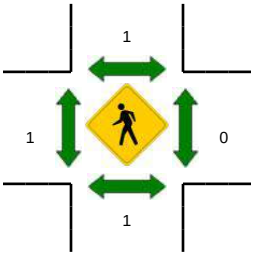
LOCATION: Honoapiilani Hwy (Hwy-30) -- Waiko Rd
CITY/STATE: Wailuku, HI

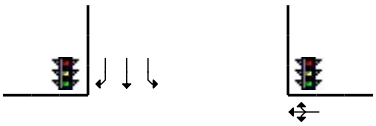
QC JOB #: 11217009
DATE: Wed, Sep 11 2013

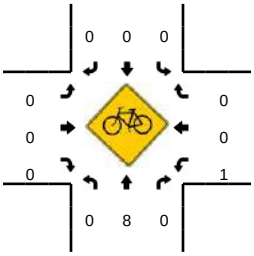
Peak-Hour: 6:55 AM -- 7:55 AM
Peak 15-Min: 7:15 AM -- 7:30 AM

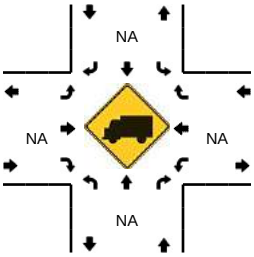


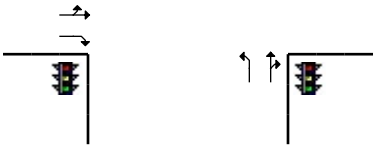


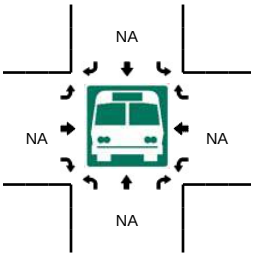












5-Min Count Period Beginning At	Honoapiilani Hwy (Hwy-30) (Northbound)				Honoapiilani Hwy (Hwy-30) (Southbound)				Waiko Rd (Eastbound)				Waiko Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:25 AM	0	20	2	0	6	41	1	0	1	3	1	0	5	1	2	0	83	
6:30 AM	0	24	2	0	4	52	0	0	1	0	1	0	7	0	1	0	92	
6:35 AM	0	33	3	0	5	44	0	0	2	2	0	0	2	0	1	0	92	
6:40 AM	0	31	2	0	5	39	0	0	5	2	0	0	2	0	1	0	87	
6:45 AM	0	37	5	0	4	43	0	0	0	1	0	0	9	0	0	0	99	
6:50 AM	0	33	1	0	5	37	0	0	1	2	1	0	7	0	2	0	89	
6:55 AM	2	32	1	0	3	63	2	0	4	1	1	0	4	0	0	0	113	954
7:00 AM	0	29	4	0	5	48	0	0	2	3	1	0	7	1	2	0	102	1013
7:05 AM	1	42	2	0	5	50	0	0	1	2	0	0	3	1	2	0	109	1076
7:10 AM	0	60	4	0	4	43	0	0	4	0	0	0	7	1	2	0	125	1130
7:15 AM	0	47	2	0	12	61	0	0	3	1	1	0	5	0	2	0	134	1190
7:20 AM	0	48	3	0	18	59	0	0	5	2	0	0	6	0	2	0	143	1268
7:25 AM	0	76	3	0	17	59	0	0	1	1	0	0	2	1	2	0	162	1347
7:30 AM	0	47	7	0	9	55	1	0	2	2	1	0	4	0	5	0	133	1388
7:35 AM	1	47	1	0	9	41	2	0	3	1	0	0	9	1	1	0	116	1412
7:40 AM	1	59	6	0	4	58	0	0	2	3	0	0	6	1	5	0	145	1470
7:45 AM	0	50	4	0	6	62	1	0	2	0	0	0	6	1	1	0	133	1504
7:50 AM	1	49	4	0	6	52	1	0	3	3	0	0	9	0	2	0	130	1545
7:55 AM	0	33	1	0	8	35	2	0	0	2	1	0	9	0	1	0	92	1524
8:00 AM	0	54	1	0	1	42	2	0	0	0	0	0	6	1	2	0	109	1531
8:05 AM	0	35	2	0	3	51	1	0	2	1	1	0	6	2	2	0	106	1528
8:10 AM	0	41	1	0	4	32	1	0	1	0	0	0	6	1	0	0	87	1490
8:15 AM	0	37	3	0	2	33	2	0	0	0	0	0	3	0	5	0	85	1441
8:20 AM	0	44	3	0	2	39	2	0	1	2	0	0	4	1	2	0	100	1398

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	684	32	0	188	716	0	0	36	16	4	0	52	4	24	0	1756
Heavy Trucks	0	12	4		12	36	0		0	0	0		0	0	0		64
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

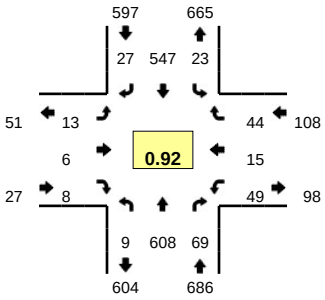
Type of peak hour being reported: Intersection Peak

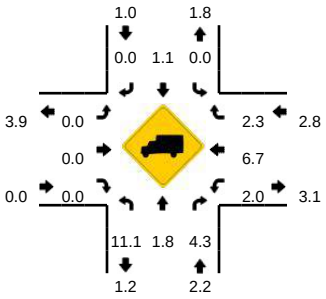
Method for determining peak hour: Total Entering Volume

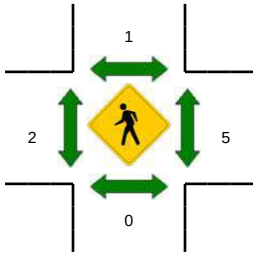
LOCATION: Honoapiilani Hwy (Hwy 30) -- Waiko Rd
CITY/STATE: Wailuku, HI

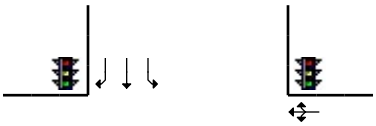
QC JOB #: 11217010
DATE: Wed, Sep 11 2013

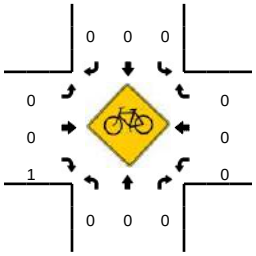
Peak-Hour: 4:30 PM -- 5:30 PM
Peak 15-Min: 4:35 PM -- 4:50 PM

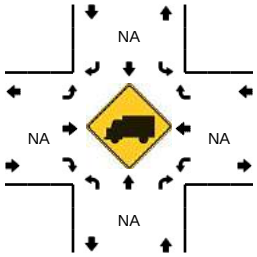


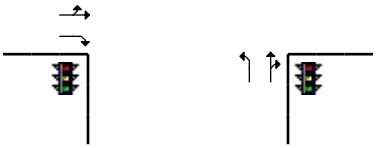


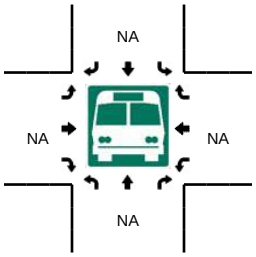












5-Min Count Period Beginning At	Honoapiilani Hwy (Hwy 30) (Northbound)				Honoapiilani Hwy (Hwy 30) (Southbound)				Waiko Rd (Eastbound)				Waiko Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	58	4	0	0	43	4	0	1	0	0	0	4	2	4	0	120	1244
4:05 PM	1	25	6	0	3	38	5	0	3	0	0	0	7	0	5	0	93	1240
4:10 PM	1	65	5	0	0	41	1	0	3	0	1	0	5	0	5	0	127	1260
4:15 PM	1	49	5	0	1	41	2	0	2	0	0	0	3	3	1	0	108	1274
4:20 PM	0	40	4	0	4	38	3	0	2	1	0	0	9	0	2	0	103	1296
4:25 PM	0	55	2	0	0	42	0	0	1	0	0	0	5	1	4	0	110	1324
4:30 PM	0	37	2	0	1	49	1	0	0	2	1	0	3	0	5	0	101	1317
4:35 PM	3	55	6	0	4	50	2	0	0	0	1	0	6	1	9	0	137	1346
4:40 PM	0	39	4	0	2	40	1	0	2	0	0	0	7	3	5	0	103	1318
4:45 PM	1	58	4	0	2	69	2	0	0	2	0	0	8	0	0	0	146	1346
4:50 PM	1	44	7	0	4	50	3	0	5	0	1	0	1	1	2	0	119	1365
4:55 PM	0	54	6	0	2	34	4	0	2	0	0	0	1	1	2	0	106	1373
5:00 PM	1	41	8	0	4	32	0	0	0	0	0	0	3	1	3	0	93	1346
5:05 PM	0	65	5	0	1	45	4	0	0	0	2	0	3	0	4	0	129	1382
5:10 PM	2	50	6	0	1	55	4	0	3	0	0	0	6	0	9	0	136	1391
5:15 PM	0	52	4	0	2	36	1	0	0	1	0	0	3	1	3	0	103	1386
5:20 PM	0	46	10	0	0	47	3	0	1	0	0	0	6	4	0	0	117	1400
5:25 PM	1	67	7	0	0	40	2	0	0	1	3	0	2	3	2	0	128	1418
5:30 PM	0	54	5	0	2	22	1	0	2	1	0	0	4	0	1	0	92	1409
5:35 PM	1	52	2	0	0	34	0	0	2	0	1	0	4	2	3	0	101	1373
5:40 PM	1	45	7	0	2	37	1	0	1	0	0	0	2	0	6	0	102	1372
5:45 PM	0	41	3	0	3	29	4	0	2	0	0	0	3	1	1	0	87	1313
5:50 PM	1	33	3	0	1	32	1	0	0	0	1	0	2	1	2	0	77	1271
5:55 PM	0	34	4	0	2	33	2	0	1	0	2	0	1	0	0	0	79	1244

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	16	608	56	0	32	636	20	0	8	8	4	0	84	16	56	0	1544
Heavy Trucks	0	8	0		0	12	0		0	0	0		0	0	0		20
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	1		0	0	0		1
Railroad Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Waiale Rd -- Waiko Rd

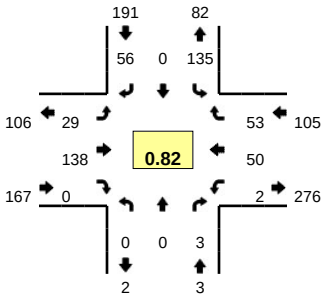
CITY/STATE: Wailuku, HI

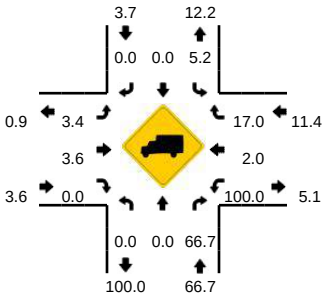
QC JOB #: 11217011

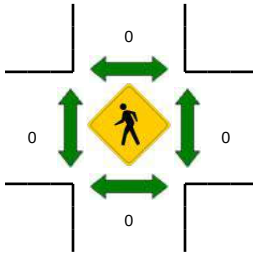
DATE: Wed, Sep 11 2013

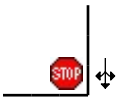
Peak-Hour: 7:00 AM -- 8:00 AM

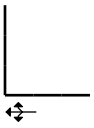
Peak 15-Min: 7:10 AM -- 7:25 AM

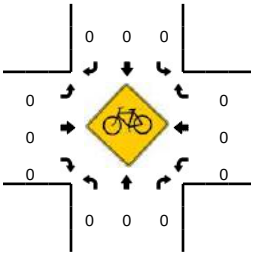


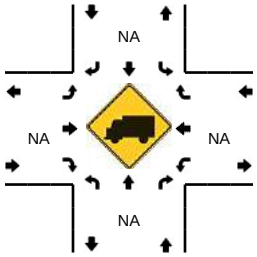


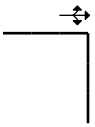


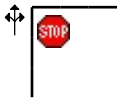


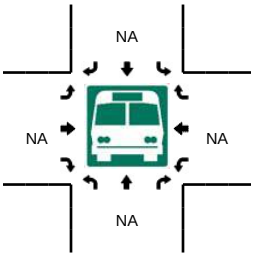












5-Min Count Period Beginning At	Waiale Rd (Northbound)				Waiale Rd (Southbound)				Waiko Rd (Eastbound)				Waiko Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:30 AM	0	0	0	0	8	0	5	0	1	7	0	0	0	1	2	0	24	
6:35 AM	0	0	1	0	9	0	2	0	1	9	0	0	0	2	1	0	25	
6:40 AM	0	0	0	0	9	0	4	0	2	7	0	0	0	1	2	0	25	
6:45 AM	0	0	0	0	9	0	8	0	0	12	0	0	1	5	3	0	38	
6:50 AM	0	0	0	0	13	0	1	0	0	8	0	0	0	3	4	0	29	
6:55 AM	0	0	1	0	11	0	2	0	0	5	0	0	0	0	5	0	24	268
7:00 AM	0	0	0	0	12	0	5	0	2	11	0	0	0	4	3	0	37	295
7:05 AM	0	0	0	0	10	0	3	0	1	6	0	0	1	5	4	0	30	312
7:10 AM	0	0	0	0	17	0	7	0	4	9	0	0	0	2	8	0	47	341
7:15 AM	0	0	1	0	11	0	5	0	2	13	0	0	0	4	5	0	41	361
7:20 AM	0	0	0	0	18	0	4	0	1	23	0	0	0	1	7	0	54	401
7:25 AM	0	0	0	0	4	0	4	0	4	11	0	0	1	1	4	0	29	403
7:30 AM	0	0	0	0	10	0	3	0	6	16	0	0	0	2	5	0	42	421
7:35 AM	0	0	0	0	15	0	5	0	1	9	0	0	0	8	9	0	47	443
7:40 AM	0	0	1	0	7	0	4	0	2	13	0	0	0	5	1	0	33	451
7:45 AM	0	0	1	0	12	0	9	0	2	7	0	0	0	7	5	0	43	456
7:50 AM	0	0	0	0	7	0	2	0	1	12	0	0	0	6	2	0	30	457
7:55 AM	0	0	0	0	12	0	5	0	3	8	0	0	0	5	0	0	33	466
8:00 AM	0	0	0	0	6	0	2	0	1	1	0	0	0	0	3	0	13	442
8:05 AM	0	0	0	0	5	0	8	0	1	2	0	0	0	6	4	0	26	438
8:10 AM	0	0	0	0	5	0	3	0	1	4	0	0	0	2	4	0	19	410
8:15 AM	0	0	0	0	5	0	2	0	2	2	0	0	0	3	6	0	20	389
8:20 AM	0	0	0	0	2	0	2	0	1	4	0	0	0	5	4	0	18	353
8:25 AM	0	0	0	0	10	0	2	0	2	3	0	0	0	1	3	0	21	345

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	4	0	184	0	64	0	28	180	0	0	0	28	80	0	568
Heavy Trucks	0	0	4		20	0	0		4	16	0		0	0	12		56
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

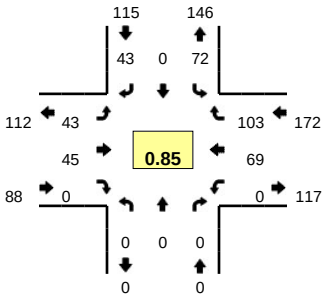
Method for determining peak hour: Total Entering Volume

LOCATION: Waiale Rd -- Waiko Rd

QC JOB #: 11217012

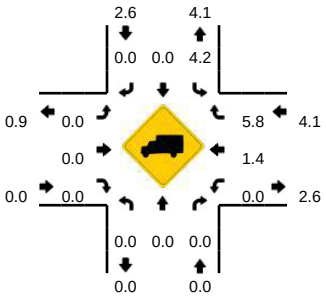
CITY/STATE: Wailuku, HI

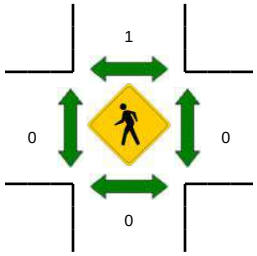
DATE: Wed, Sep 11 2013

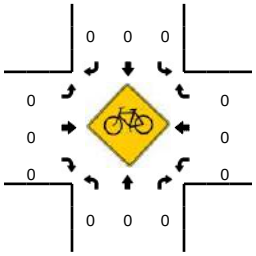


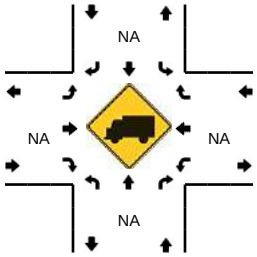
Peak-Hour: 4:15 PM -- 5:15 PM

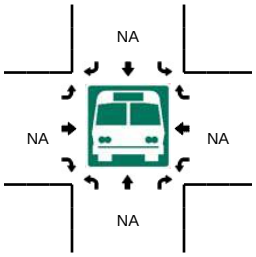
Peak 15-Min: 4:30 PM -- 4:45 PM











5-Min Count Period Beginning At	Waiale Rd (Northbound)				Waiale Rd (Southbound)				Waiko Rd (Eastbound)				Waiko Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:45 PM	0	0	0	0	5	0	0	0	5	8	0	0	0	5	8	0	31	
3:50 PM	0	0	0	0	5	0	1	0	5	4	0	0	0	4	4	0	23	
3:55 PM	0	0	0	0	4	0	4	0	6	4	0	0	0	4	6	0	28	287
4:00 PM	0	0	0	0	6	0	4	0	2	2	0	0	0	4	8	0	26	292
4:05 PM	0	0	0	0	3	0	3	0	4	5	0	0	0	11	5	0	31	301
4:10 PM	0	0	0	0	5	0	4	0	4	2	0	0	0	6	3	0	24	309
4:15 PM	0	0	0	0	5	0	3	0	2	4	0	0	0	6	9	0	29	316
4:20 PM	0	0	0	0	5	0	5	0	3	7	0	0	0	4	5	0	29	332
4:25 PM	0	0	0	0	6	0	3	0	2	1	0	0	0	5	5	0	22	334
4:30 PM	0	0	0	0	1	0	3	0	0	5	0	0	0	10	12	0	31	344
4:35 PM	0	0	0	0	3	0	2	0	6	4	0	0	0	13	12	0	40	349
4:40 PM	0	0	0	0	12	0	8	0	2	5	0	0	0	6	6	0	39	353
4:45 PM	0	0	0	0	6	0	2	0	3	3	0	0	0	2	11	0	27	349
4:50 PM	0	0	0	0	8	0	5	0	7	3	0	0	0	1	9	0	33	359
4:55 PM	0	0	0	0	6	0	1	0	4	3	0	0	0	3	10	0	27	358
5:00 PM	0	0	0	0	6	0	3	0	6	3	0	0	0	3	4	0	25	357
5:05 PM	0	0	0	0	6	0	8	0	5	2	0	0	0	6	14	0	41	367
5:10 PM	0	0	0	0	8	0	0	0	3	5	0	0	0	10	6	0	32	375
5:15 PM	0	0	0	0	5	0	2	0	2	5	0	0	0	6	5	0	25	371
5:20 PM	0	0	0	0	3	0	3	0	5	5	0	0	0	5	7	0	28	370
5:25 PM	0	0	0	0	3	0	0	0	4	3	0	0	0	4	7	0	21	369
5:30 PM	0	0	0	0	2	0	4	0	5	2	0	0	0	2	7	0	22	360
5:35 PM	0	0	0	0	2	0	3	0	1	1	0	0	0	4	3	0	14	334
5:40 PM	0	0	0	0	4	0	4	0	4	4	0	0	0	6	7	0	29	324

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	64	0	52	0	32	56	0	0	0	116	120	0	440
Heavy Trucks	0	0	0		4	0	0		0	0	0		0	0	8		12
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

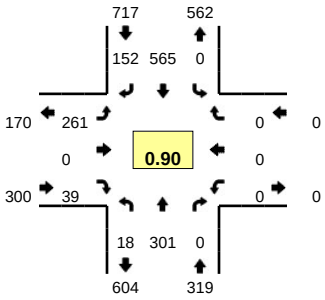
Method for determining peak hour: Total Entering Volume

LOCATION: Kuihelani Hwy (Hwy-380) -- Waiko Rd

QC JOB #: 11217013

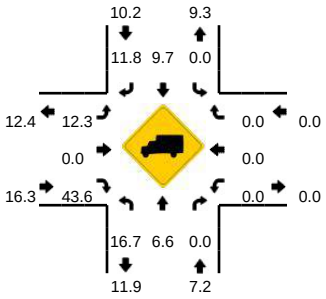
CITY/STATE: Wailuku, HI

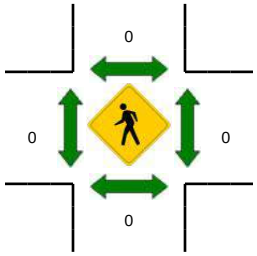
DATE: Wed, Sep 11 2013

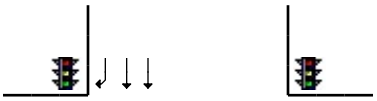


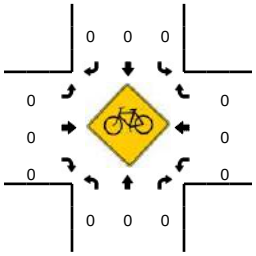
Peak-Hour: 6:55 AM -- 7:55 AM

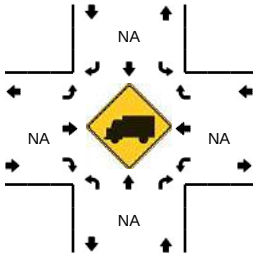
Peak 15-Min: 7:25 AM -- 7:40 AM

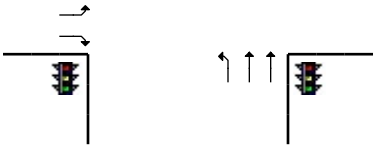


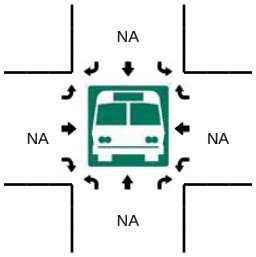












5-Min Count Period Beginning At	Kuihelani Hwy (Hwy-380) (Northbound)				Kuihelani Hwy (Hwy-380) (Southbound)				Waiko Rd (Eastbound)				Waiko Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:25 AM	2	17	0	0	0	39	7	0	11	0	2	0	0	0	0	0	78	
6:30 AM	2	7	0	0	0	39	6	0	8	0	2	0	0	0	0	0	64	
6:35 AM	0	26	0	0	0	49	9	0	13	0	1	0	0	0	0	0	98	
6:40 AM	2	28	0	0	0	35	8	0	15	0	0	0	0	0	0	0	88	
6:45 AM	3	24	0	0	0	43	14	0	10	0	1	0	0	0	0	0	95	
6:50 AM	2	21	0	0	0	43	11	0	19	0	1	0	0	0	0	0	97	
6:55 AM	1	20	0	0	0	59	14	0	16	0	7	0	0	0	0	0	117	964
7:00 AM	2	11	0	0	0	68	12	0	19	0	4	0	0	0	0	0	116	1013
7:05 AM	2	32	0	0	0	54	7	0	10	0	2	0	0	0	0	0	107	1071
7:10 AM	1	19	0	0	0	47	7	0	19	0	3	0	0	0	0	0	96	1102
7:15 AM	3	15	0	0	0	37	17	0	30	0	2	0	0	0	0	0	104	1132
7:20 AM	1	15	0	0	0	51	14	0	30	0	1	0	0	0	0	0	112	1172
7:25 AM	2	39	0	0	0	43	15	0	28	0	8	0	0	0	0	0	135	1229
7:30 AM	2	19	0	0	0	43	12	0	26	0	2	0	0	0	0	0	104	1269
7:35 AM	2	45	0	0	0	43	17	0	20	0	6	0	0	0	0	0	133	1304
7:40 AM	2	26	0	0	0	32	9	0	28	0	1	0	0	0	0	0	98	1314
7:45 AM	0	32	0	0	0	49	21	0	12	0	2	0	0	0	0	0	116	1335
7:50 AM	0	28	0	0	0	39	7	0	23	0	1	0	0	0	0	0	98	1336
7:55 AM	2	43	0	0	0	39	7	0	9	0	2	0	0	0	0	0	102	1321
8:00 AM	1	34	0	0	0	38	5	0	12	0	3	0	0	0	0	0	93	1298
8:05 AM	1	23	0	0	0	40	7	0	11	0	1	0	0	0	0	0	83	1274
8:10 AM	1	39	0	0	0	34	9	0	13	0	1	0	0	0	0	0	97	1275
8:15 AM	2	30	0	0	0	44	8	0	2	0	2	0	0	0	0	0	88	1259
8:20 AM	0	32	0	0	0	34	6	0	6	0	2	0	0	0	0	0	80	1227

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	24	412	0	0	0	516	176	0	296	0	64	0	0	0	0	0	1488
Heavy Trucks	4	28	0		0	56	24		40	0	28		0	0	0		180
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

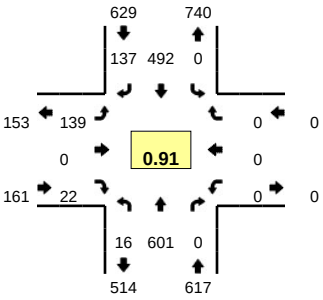
Method for determining peak hour: Total Entering Volume

LOCATION: Kuihelani Hwy (Hwy-380) -- Waiko Rd

CITY/STATE: Wailuku, HI

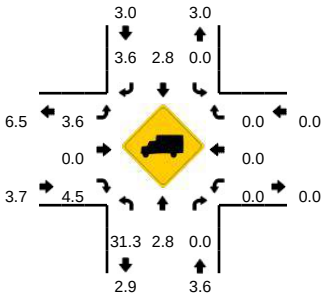
QC JOB #: 11217014

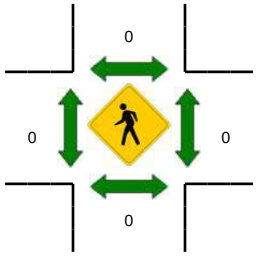
DATE: Wed, Sep 11 2013

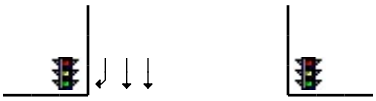


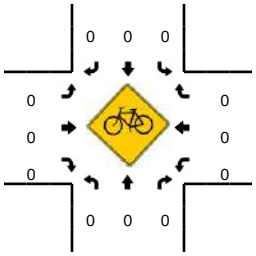
Peak-Hour: 4:15 PM -- 5:15 PM

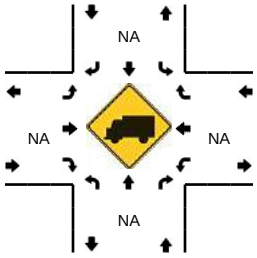
Peak 15-Min: 5:00 PM -- 5:15 PM

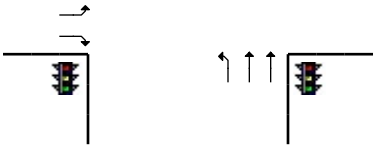


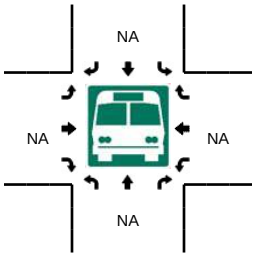












5-Min Count Period Beginning At	Kuihelani Hwy (Hwy-380) (Northbound)				Kuihelani Hwy (Hwy-380) (Southbound)				Waiko Rd (Eastbound)				Waiko Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:45 PM	3	26	0	0	0	71	7	0	11	0	2	0	0	0	0	0	120	
3:50 PM	6	41	0	0	0	45	10	0	11	0	0	0	0	0	0	0	113	
3:55 PM	2	57	0	0	0	41	6	0	9	0	1	1	0	0	0	0	117	1251
4:00 PM	3	35	0	0	0	38	8	0	8	0	2	0	0	0	0	0	94	1249
4:05 PM	0	53	0	0	0	23	12	0	15	0	1	0	0	0	0	0	104	1236
4:10 PM	4	52	0	0	0	36	8	0	11	0	2	0	0	0	0	0	113	1270
4:15 PM	2	50	0	0	0	44	14	0	12	0	2	0	0	0	0	0	124	1312
4:20 PM	2	43	0	0	0	44	9	0	6	0	3	0	0	0	0	0	107	1316
4:25 PM	2	45	0	0	0	50	13	0	10	0	2	0	0	0	0	0	122	1315
4:30 PM	0	45	0	0	0	27	14	0	15	0	2	0	0	0	0	0	103	1333
4:35 PM	2	43	0	0	0	42	18	0	15	0	1	0	0	0	0	0	121	1334
4:40 PM	2	42	0	0	0	24	10	0	13	0	1	0	0	0	0	0	92	1330
4:45 PM	0	54	0	0	0	46	8	0	19	0	1	0	0	0	0	0	128	1338
4:50 PM	2	33	0	0	0	48	8	0	10	0	1	0	0	0	0	0	102	1327
4:55 PM	3	64	0	0	0	31	13	0	10	0	1	0	0	0	0	0	122	1332
5:00 PM	1	60	0	0	0	53	8	0	11	0	1	0	0	0	0	0	134	1372
5:05 PM	0	54	0	0	0	32	15	0	9	0	3	0	0	0	0	0	113	1381
5:10 PM	0	68	0	0	0	51	7	0	9	0	4	0	0	0	0	0	139	1407
5:15 PM	0	45	0	0	0	37	7	0	9	0	5	0	0	0	0	0	103	1386
5:20 PM	1	46	0	0	0	39	10	0	11	0	1	0	0	0	0	0	108	1387
5:25 PM	1	58	0	0	0	48	10	0	7	0	1	0	0	0	0	0	125	1390
5:30 PM	1	43	0	0	0	39	2	0	7	0	1	0	0	0	0	0	93	1380
5:35 PM	0	37	0	0	0	29	10	0	2	0	0	0	0	0	0	0	78	1337
5:40 PM	1	44	0	0	0	37	4	0	7	0	0	0	0	0	0	0	93	1338

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	4	728	0	0	0	544	120	0	116	0	32	0	0	0	0	0	1544
Heavy Trucks	0	24	0		0	20	0		4	0	0		0	0	0		48
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Honoapiilani Hwy (Hwy 30) -- Kuihelani Hwy (Hwy 380)

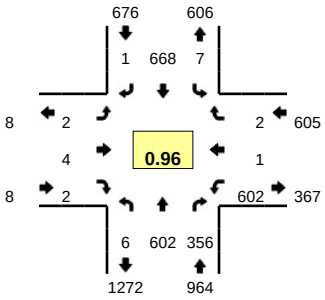
QC JOB #: 11217015

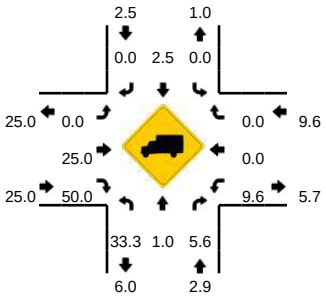
CITY/STATE: Wailuku, HI

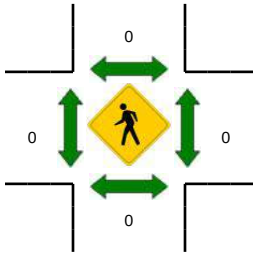
DATE: Wed, Sep 11 2013

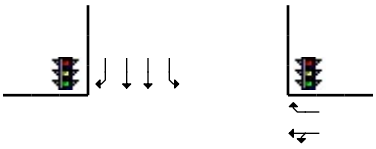
Peak-Hour: 7:00 AM -- 8:00 AM

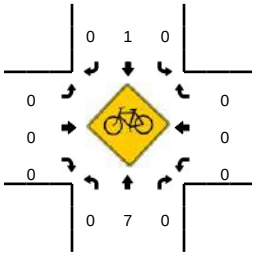
Peak 15-Min: 7:20 AM -- 7:35 AM

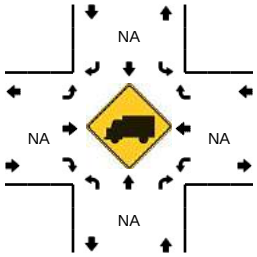


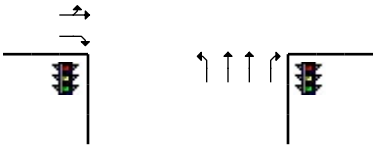


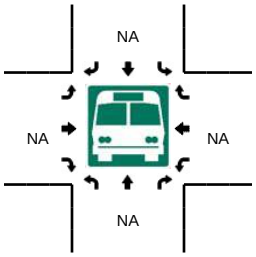












5-Min Count Period Beginning At	Honoapiilani Hwy (Hwy 30) (Northbound)				Honoapiilani Hwy (Hwy 30) (Southbound)				Kuihelani Hwy (Hwy 380) (Eastbound)				Kuihelani Hwy (Hwy 380) (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:30 AM	0	27	29	0	0	46	0	0	0	0	0	0	49	1	0	0	152	
6:35 AM	0	27	23	2	0	43	0	0	0	0	0	0	41	0	0	0	136	
6:40 AM	0	40	33	0	0	49	0	0	0	0	0	0	38	0	0	0	160	
6:45 AM	0	30	24	0	0	46	0	0	0	0	0	0	45	0	0	0	145	
6:50 AM	0	35	15	0	0	47	0	0	0	0	0	0	36	0	0	0	133	
6:55 AM	0	32	19	0	0	51	0	0	0	0	0	0	39	0	0	0	141	1503
7:00 AM	0	32	29	0	0	48	0	0	0	0	0	0	80	0	0	0	189	1620
7:05 AM	0	58	21	0	0	68	0	0	0	0	0	0	70	0	0	0	217	1741
7:10 AM	0	47	18	0	0	45	0	0	0	0	0	0	54	0	0	0	164	1801
7:15 AM	0	43	19	0	0	55	0	0	0	0	0	0	47	0	0	0	164	1843
7:20 AM	0	78	38	0	0	59	0	0	0	0	0	0	47	0	0	0	222	1937
7:25 AM	0	58	23	0	1	64	0	0	0	0	0	0	43	0	0	0	189	2012
7:30 AM	1	45	36	0	0	46	1	0	1	0	0	0	48	0	0	0	178	2038
7:35 AM	1	62	38	0	1	72	0	0	0	1	1	0	43	1	1	0	221	2123
7:40 AM	2	45	35	0	2	53	0	0	1	0	0	0	48	0	0	0	186	2149
7:45 AM	0	44	26	0	1	40	0	0	0	0	0	0	44	0	0	0	155	2159
7:50 AM	2	42	27	0	2	70	0	0	0	3	1	0	37	0	0	0	184	2210
7:55 AM	0	48	46	0	0	48	0	0	0	0	0	0	41	0	1	0	184	2253
8:00 AM	0	42	27	0	1	37	0	0	0	0	0	0	37	0	0	0	144	2208
8:05 AM	0	40	30	0	0	48	0	0	0	0	0	0	39	0	1	0	158	2149
8:10 AM	0	32	43	0	0	34	0	0	1	0	0	0	43	0	0	0	153	2138
8:15 AM	0	40	26	0	1	44	0	0	0	0	0	0	27	0	0	0	138	2112
8:20 AM	0	46	29	0	0	27	0	0	0	0	0	0	54	0	0	0	156	2046
8:25 AM	0	39	38	0	2	42	0	0	0	0	0	0	38	0	0	0	159	2016

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	4	724	388	0	4	676	4	0	4	0	0	0	552	0	0	0	2356
Heavy Trucks	0	8	20		0	24	0		0	0	0		76	0	0		128
Pedestrians		0				0				0				0			0
Bicycles	0	7	0		0	0	0		0	0	0		0	0	0		7
Railroad Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

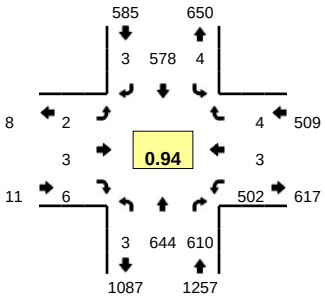
Method for determining peak hour: Total Entering Volume

LOCATION: Honoapiilani Hwy (Hwy 30) -- Kuihelani Hwy (Hwy 380)

QC JOB #: 11217016

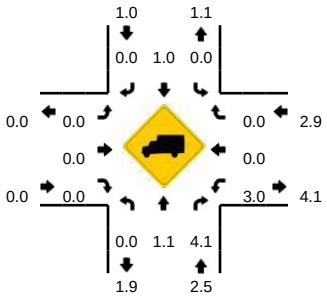
CITY/STATE: Wailuku, HI

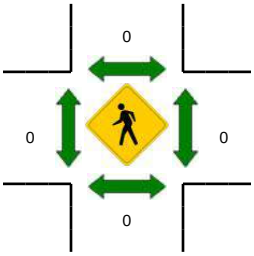
DATE: Wed, Sep 11 2013

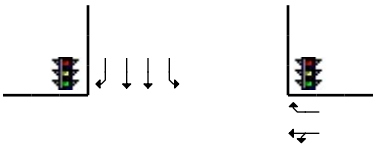


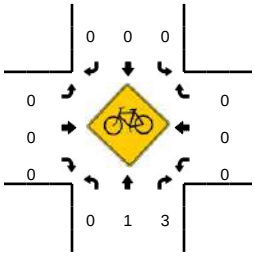
Peak-Hour: 4:30 PM -- 5:30 PM

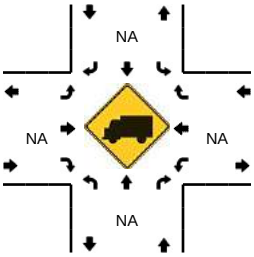
Peak 15-Min: 5:00 PM -- 5:15 PM

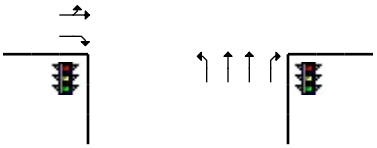


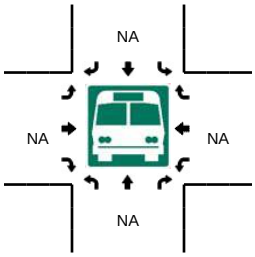












5-Min Count Period Beginning At	Honoapiilani Hwy (Hwy 30) (Northbound)				Honoapiilani Hwy (Hwy 30) (Southbound)				Kuihelani Hwy (Hwy 380) (Eastbound)				Kuihelani Hwy (Hwy 380) (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	39	51	0	0	48	0	0	0	0	0	0	45	0	0	0	183	2044
4:05 PM	1	56	69	0	0	36	2	0	0	0	0	0	27	0	0	0	191	2094
4:10 PM	0	44	48	0	1	40	0	0	0	0	3	0	29	0	0	0	165	2084
4:15 PM	0	34	38	0	0	40	0	0	0	0	0	0	49	0	0	0	161	2099
4:20 PM	0	58	52	0	2	51	0	0	0	0	0	0	39	0	1	0	203	2150
4:25 PM	0	32	40	0	3	36	0	0	0	0	0	0	36	0	0	0	147	2108
4:30 PM	0	54	29	0	1	46	0	0	0	0	0	0	57	0	0	0	187	2118
4:35 PM	0	43	58	0	0	50	1	0	0	0	0	0	32	0	0	0	184	2149
4:40 PM	0	53	62	0	0	48	1	0	0	0	0	0	35	0	0	0	199	2166
4:45 PM	0	54	34	0	0	58	1	0	0	0	2	0	49	0	1	0	199	2171
4:50 PM	0	48	59	0	2	67	0	0	0	0	1	0	39	1	0	0	217	2221
4:55 PM	1	56	43	0	0	42	0	0	2	1	0	0	29	0	0	0	174	2210
5:00 PM	0	60	57	1	0	39	0	0	0	0	0	0	37	0	0	0	194	2221
5:05 PM	0	54	72	0	0	42	0	0	0	0	1	0	49	1	2	0	221	2251
5:10 PM	1	61	54	0	0	47	0	0	0	0	0	0	49	0	1	0	213	2299
5:15 PM	0	40	40	0	0	48	0	0	0	2	1	0	48	1	0	0	180	2318
5:20 PM	0	66	51	0	0	44	0	0	0	0	1	0	35	0	0	0	197	2312
5:25 PM	0	55	51	0	1	47	0	0	0	0	0	0	43	0	0	0	197	2362
5:30 PM	0	50	45	0	0	27	0	0	0	0	0	0	46	0	0	0	168	2343
5:35 PM	0	51	31	0	0	35	0	0	0	0	0	0	41	0	0	0	158	2317
5:40 PM	0	44	43	0	0	30	0	0	0	0	0	0	25	0	0	0	142	2260
5:45 PM	0	29	37	0	1	36	1	0	0	0	2	0	38	1	0	0	145	2206
5:50 PM	0	38	35	0	1	30	1	0	0	0	0	0	40	0	0	0	145	2134
5:55 PM	0	33	35	0	0	30	0	0	0	0	0	0	29	0	0	0	127	2087

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	4	700	732	4	0	512	0	0	0	0	4	0	540	4	12	0	2512
Heavy Trucks	0	8	32		0	0	0		0	0	0		20	0	0		60
Pedestrians		0				0				0				0			0
Bicycles	0	1	0		0	0	0		0	0	0		0	0	0		1
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/20/2013 8:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

APPENDIX B: LOS WORKSHEETS

LOS Worksheets – Existing Conditions

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	34	137	58	271	48	157	20	381	345	206	403	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.98		1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1844	1550		1784	1583	1770	1863	1547	1770	1863	1583
Flt Permitted		0.88	1.00		0.59	1.00	0.46	1.00	1.00	0.27	1.00	1.00
Satd. Flow (perm)		1640	1550		1105	1583	862	1863	1547	510	1863	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	38	154	65	304	54	176	22	428	388	231	453	15
RTOR Reduction (vph)	0	0	41	0	0	111	0	0	248	0	0	8
Lane Group Flow (vph)	0	192	24	0	358	65	22	428	140	231	453	7
Confl. Peds. (#/hr)			1	1					1			
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		34.6	34.6		34.6	34.6	36.0	34.0	34.0	49.4	43.4	43.4
Effective Green, g (s)		34.6	34.6		34.6	34.6	36.0	34.0	34.0	49.4	43.4	43.4
Actuated g/C Ratio		0.37	0.37		0.37	0.37	0.38	0.36	0.36	0.53	0.46	0.46
Clearance Time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		603	570		406	582	349	673	559	420	860	730
v/s Ratio Prot							0.00	c0.23		c0.07	0.24	
v/s Ratio Perm		0.12	0.02		c0.32	0.04	0.02		0.09	0.22		0.00
v/c Ratio		0.32	0.04		0.88	0.11	0.06	0.64	0.25	0.55	0.53	0.01
Uniform Delay, d1		21.3	19.1		27.8	19.6	18.2	24.9	21.1	14.4	18.0	13.7
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.2	0.0		19.5	0.1	0.0	2.7	0.5	0.9	1.1	0.0
Delay (s)		21.5	19.1		47.3	19.6	18.2	27.6	21.6	15.3	19.1	13.7
Level of Service		C	B		D	B	B	C	C	B	B	B
Approach Delay (s)		20.9			38.1			24.6			17.7	
Approach LOS		C			D			C			B	

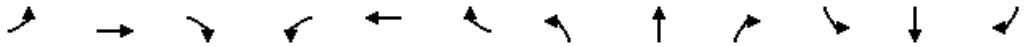
Intersection Summary			
HCM 2000 Control Delay	25.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	94.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	73.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	427	215	39	26	159	261	76	170	76	159	95	232
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.97	1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.95		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1767	1813		1768	1863	1543	1770	1762		1768	1664	
Flt Permitted	0.44	1.00		0.60	1.00	1.00	0.36	1.00		0.30	1.00	
Satd. Flow (perm)	818	1813		1109	1863	1543	668	1762		567	1664	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	445	224	41	27	166	272	79	177	79	166	99	242
RTOR Reduction (vph)	0	4	0	0	0	219	0	13	0	0	69	0
Lane Group Flow (vph)	445	261	0	27	166	53	79	243	0	166	272	0
Confl. Peds. (#/hr)	3		1	1		3			4	4		
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	47.5	40.5		19.8	17.8	17.8	24.1	18.6		32.7	22.9	
Effective Green, g (s)	47.5	40.5		19.8	17.8	17.8	24.1	18.6		32.7	22.9	
Actuated g/C Ratio	0.52	0.45		0.22	0.20	0.20	0.27	0.20		0.36	0.25	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	685	807		256	364	302	243	360		333	419	
v/s Ratio Prot	c0.18	0.14		0.00	0.09		0.02	0.14		c0.05	c0.16	
v/s Ratio Perm	c0.16			0.02		0.03	0.07			0.13		
v/c Ratio	0.65	0.32		0.11	0.46	0.18	0.33	0.68		0.50	0.65	
Uniform Delay, d1	14.3	16.3		28.2	32.3	30.4	26.0	33.4		21.4	30.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	0.2		0.1	0.9	0.3	0.3	5.0		0.4	3.5	
Delay (s)	15.9	16.6		28.3	33.2	30.7	26.2	38.3		21.8	33.9	
Level of Service	B	B		C	C	C	C	D		C	C	
Approach Delay (s)		16.2			31.5			35.5			29.9	
Approach LOS		B			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	90.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	170	130	90	67	160	108	139	211	80	191	175	179
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	179	137	95	71	168	114	146	222	84	201	184	188

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	411	353	146	306	201	373
Volume Left (vph)	179	71	146	0	201	0
Volume Right (vph)	95	114	0	84	0	188
Hadj (s)	-0.02	-0.12	0.53	-0.16	0.53	-0.32
Departure Headway (s)	8.8	8.8	9.8	9.1	9.6	8.8
Degree Utilization, x	1.01	0.86	0.40	0.78	0.54	0.91
Capacity (veh/h)	411	403	351	386	361	400
Control Delay (s)	77.1	47.1	18.0	36.3	22.1	53.4
Approach Delay (s)	77.1	47.1	30.4		42.4	
Approach LOS	F	E	D		E	

Intersection Summary				
Delay	48.3			
Level of Service	E			
Intersection Capacity Utilization	81.1%	ICU Level of Service	D	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	322	0	159	0	0	0	81	483	0	0	561	250
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0					5.0	7.0			7.0	7.0
Lane Util. Factor		1.00					1.00	0.95			0.95	1.00
Frt		0.96					1.00	1.00			1.00	0.85
Flt Protected		0.97					0.95	1.00			1.00	1.00
Satd. Flow (prot)		1722					1770	3539			3539	1583
Flt Permitted		0.97					0.95	1.00			1.00	1.00
Satd. Flow (perm)		1722					1770	3539			3539	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	335	0	166	0	0	0	84	503	0	0	584	260
RTOR Reduction (vph)	0	43	0	0	0	0	0	0	0	0	0	179
Lane Group Flow (vph)	0	458	0	0	0	0	84	503	0	0	584	81
Turn Type	Perm	NA					Prot	NA		Prot	NA	Perm
Protected Phases		4					5	2		1	6	
Permitted Phases	4											6
Actuated Green, G (s)		30.5					7.0	36.9			24.9	24.9
Effective Green, g (s)		30.5					7.0	36.9			24.9	24.9
Actuated g/C Ratio		0.38					0.09	0.46			0.31	0.31
Clearance Time (s)		6.0					5.0	7.0			7.0	7.0
Vehicle Extension (s)		2.0					2.0	5.0			5.0	5.0
Lane Grp Cap (vph)		653					154	1624			1096	490
v/s Ratio Prot							c0.05	0.14			c0.17	
v/s Ratio Perm		0.27										0.05
v/c Ratio		0.70					0.55	0.31			0.53	0.16
Uniform Delay, d1		21.1					35.2	13.7			22.9	20.2
Progression Factor		1.00					1.00	1.00			1.00	1.00
Incremental Delay, d2		2.8					2.1	0.2			0.9	0.3
Delay (s)		23.9					37.3	13.9			23.9	20.5
Level of Service		C					D	B			C	C
Approach Delay (s)		23.9			0.0			17.3			22.8	
Approach LOS		C			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	21.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	80.4	Sum of lost time (s)	18.0
Intersection Capacity Utilization	63.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	19	4	68	7	26	6	586	41	98	651	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.98		0.99		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.96		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.97	1.00		0.97		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1805	1546		1718		1769	1844		1770	1863	1549
Flt Permitted		0.79	1.00		0.76		0.30	1.00		0.24	1.00	1.00
Satd. Flow (perm)		1467	1546		1355		563	1844		439	1863	1549
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	36	22	5	77	8	30	7	666	47	111	740	8
RTOR Reduction (vph)	0	0	4	0	11	0	0	2	0	0	0	3
Lane Group Flow (vph)	0	58	1	0	104	0	7	711	0	111	740	5
Confl. Peds. (#/hr)	1		1	1		1	1					1
Confl. Bikes (#/hr)						8						
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		11.1	11.1		11.6		44.9	44.2		53.2	48.5	48.5
Effective Green, g (s)		11.1	11.1		11.6		44.9	44.2		53.2	48.5	48.5
Actuated g/C Ratio		0.14	0.14		0.15		0.58	0.58		0.69	0.63	0.63
Clearance Time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0		2.0		2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		212	223		204		340	1061		390	1176	978
v/s Ratio Prot							0.00	c0.39		c0.02	c0.40	
v/s Ratio Perm		0.04	0.00		c0.08		0.01			0.18		0.00
v/c Ratio		0.27	0.00		0.51		0.02	0.67		0.28	0.63	0.01
Uniform Delay, d1		29.3	28.1		30.0		7.2	11.3		6.8	8.7	5.2
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.3	0.0		0.7		0.0	2.2		0.1	1.5	0.0
Delay (s)		29.5	28.1		30.7		7.2	13.5		6.9	10.2	5.2
Level of Service		C	C		C		A	B		A	B	A
Approach Delay (s)		29.4			30.7			13.4			9.7	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	76.8	Sum of lost time (s)	16.5
Intersection Capacity Utilization	64.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	29	138	50	53	135	56
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	35	168	61	65	165	68
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	126				332	93
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	126				332	93
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				75	93
cM capacity (veh/h)	1461				647	964

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	204	126	233
Volume Left	35	0	165
Volume Right	0	65	68
cSH	1461	1700	716
Volume to Capacity	0.02	0.07	0.33
Queue Length 95th (ft)	2	0	35
Control Delay (s)	1.5	0.0	12.4
Lane LOS	A		B
Approach Delay (s)	1.5	0.0	12.4
Approach LOS			B

Intersection Summary			
Average Delay	5.7		
Intersection Capacity Utilization	33.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	261	39	18	301	565	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8		5.0	6.3	6.3	6.3
Lane Util. Factor	1.00		1.00	0.95	0.95	1.00
Frt	0.98		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1754		1770	3539	3539	1583
Flt Permitted	0.96		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1754		1770	3539	3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	290	43	20	334	628	169
RTOR Reduction (vph)	4	0	0	0	0	105
Lane Group Flow (vph)	329	0	20	334	628	64
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases						6
Actuated Green, G (s)	17.0		2.0	29.5	22.5	22.5
Effective Green, g (s)	17.0		2.0	29.5	22.5	22.5
Actuated g/C Ratio	0.29		0.03	0.49	0.38	0.38
Clearance Time (s)	6.8		5.0	6.3	6.3	6.3
Vehicle Extension (s)	2.0		2.0	3.0	3.0	3.0
Lane Grp Cap (vph)	500		59	1751	1336	597
v/s Ratio Prot	c0.19		0.01	c0.09	c0.18	
v/s Ratio Perm						0.04
v/c Ratio	0.66		0.34	0.19	0.47	0.11
Uniform Delay, d1	18.7		28.2	8.4	14.0	12.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	2.4		1.2	0.1	0.3	0.1
Delay (s)	21.1		29.4	8.4	14.3	12.1
Level of Service	C		C	A	B	B
Approach Delay (s)	21.1			9.6	13.8	
Approach LOS	C			A	B	

Intersection Summary			
HCM 2000 Control Delay	14.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	59.6	Sum of lost time (s)	18.1
Intersection Capacity Utilization	44.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	4	2	602	1	2	6	602	356	7	668	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1832	1583	1681	1686	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1832	1583	1681	1686	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	2	4	2	627	1	2	6	627	371	7	696	1
RTOR Reduction (vph)	0	0	2	0	0	0	0	0	0	0	0	1
Lane Group Flow (vph)	0	6	0	313	315	2	6	627	371	7	696	0
Turn Type	Split	NA	Perm	Split	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			Free			Free			6
Actuated Green, G (s)		0.8	0.8	20.8	20.8	65.8	0.7	24.5	65.8	0.7	24.5	24.5
Effective Green, g (s)		0.8	0.8	20.8	20.8	65.8	0.7	24.5	65.8	0.7	24.5	24.5
Actuated g/C Ratio		0.01	0.01	0.32	0.32	1.00	0.01	0.37	1.00	0.01	0.37	0.37
Clearance Time (s)		5.0	5.0	5.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0		2.0	4.0		2.0	4.0	4.0
Lane Grp Cap (vph)		22	19	531	532	1583	18	1317	1583	18	1317	589
v/s Ratio Prot		0.00		0.19	c0.19		0.00	0.18		0.00	c0.20	
v/s Ratio Perm			0.00			0.00			c0.23			0.00
v/c Ratio		0.27	0.00	0.59	0.59	0.00	0.33	0.48	0.23	0.39	0.53	0.00
Uniform Delay, d1		32.2	32.1	18.9	18.9	0.0	32.3	15.8	0.0	32.3	16.1	13.0
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		6.6	0.0	1.7	1.8	0.0	3.9	0.4	0.3	5.0	0.5	0.0
Delay (s)		38.8	32.1	20.6	20.7	0.0	36.3	16.1	0.3	37.3	16.6	13.0
Level of Service		D	C	C	C	A	D	B	A	D	B	B
Approach Delay (s)		37.2			20.6			10.4			16.8	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	65.8	Sum of lost time (s)	19.0
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	19	76	24	271	124	165	41	394	259	143	377	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1843	1583		1801	1532	1770	1863	1583	1770	1863	1583
Flt Permitted		0.90	1.00		0.73	1.00	0.47	1.00	1.00	0.29	1.00	1.00
Satd. Flow (perm)		1666	1583		1364	1532	870	1863	1583	540	1863	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	20	82	26	291	133	177	44	424	278	154	405	38
RTOR Reduction (vph)	0	0	17	0	0	97	0	0	175	0	0	21
Lane Group Flow (vph)	0	102	9	0	424	80	44	424	103	154	405	17
Confl. Peds. (#/hr)	6					6						
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		31.1	31.1		31.1	31.1	35.1	31.8	31.8	44.7	37.4	37.4
Effective Green, g (s)		31.1	31.1		31.1	31.1	35.1	31.8	31.8	44.7	37.4	37.4
Actuated g/C Ratio		0.36	0.36		0.36	0.36	0.41	0.37	0.37	0.52	0.44	0.44
Clearance Time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		603	573		494	555	390	690	586	408	812	690
v/s Ratio Prot							0.00	c0.23		c0.04	0.22	
v/s Ratio Perm		0.06	0.01		c0.31	0.05	0.04		0.07	0.16		0.01
v/c Ratio		0.17	0.02		0.86	0.14	0.11	0.61	0.18	0.38	0.50	0.02
Uniform Delay, d1		18.6	17.5		25.3	18.4	15.4	22.0	18.2	12.5	17.4	13.8
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.1	0.0		13.6	0.1	0.0	2.3	0.3	0.2	1.0	0.0
Delay (s)		18.7	17.5		38.9	18.5	15.5	24.4	18.5	12.7	18.5	13.8
Level of Service		B	B		D	B	B	C	B	B	B	B
Approach Delay (s)		18.4			32.9			21.6			16.7	
Approach LOS		B			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	85.8	Sum of lost time (s)	14.0
Intersection Capacity Utilization	68.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	231	169	36	55	239	273	25	109	45	252	161	254
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	0.99		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.96		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1806		1765	1863	1583	1767	1770		1769	1664	
Flt Permitted	0.35	1.00		0.63	1.00	1.00	0.43	1.00		0.49	1.00	
Satd. Flow (perm)	649	1806		1163	1863	1583	806	1770		907	1664	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	238	174	37	57	246	281	26	112	46	260	166	262
RTOR Reduction (vph)	0	5	0	0	0	216	0	12	0	0	39	0
Lane Group Flow (vph)	238	206	0	57	246	65	26	146	0	260	389	0
Confl. Peds. (#/hr)			3	3			3		1	1		3
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	40.8	30.9		25.1	20.2	20.2	22.2	20.2		37.1	30.1	
Effective Green, g (s)	40.8	30.9		25.1	20.2	20.2	22.2	20.2		37.1	30.1	
Actuated g/C Ratio	0.46	0.35		0.29	0.23	0.23	0.25	0.23		0.42	0.34	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	500	634		365	428	363	225	406		499	569	
v/s Ratio Prot	c0.08	0.11		0.01	c0.13		0.00	0.08		c0.07	c0.23	
v/s Ratio Perm	0.14			0.04		0.04	0.03			0.15		
v/c Ratio	0.48	0.32		0.16	0.57	0.18	0.12	0.36		0.52	0.68	
Uniform Delay, d1	15.4	20.9		23.2	30.0	27.2	25.0	28.4		17.5	24.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.3		0.1	1.9	0.2	0.1	0.5		0.5	3.4	
Delay (s)	15.7	21.2		23.3	31.9	27.4	25.1	29.0		18.0	28.2	
Level of Service	B	C		C	C	C	C	C		B	C	
Approach Delay (s)		18.3			28.9			28.4			24.3	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	24.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	87.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	234	195	52	29	240	211	43	78	40	122	76	273
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	239	199	53	30	245	215	44	80	41	124	78	279

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	491	490	44	120	124	356
Volume Left (vph)	239	30	44	0	124	0
Volume Right (vph)	53	215	0	41	0	279
Hadj (s)	0.07	-0.22	0.53	-0.20	0.53	-0.51
Departure Headway (s)	7.7	7.3	9.8	9.1	8.9	7.8
Degree Utilization, x	1.05	0.99	0.12	0.30	0.31	0.78
Capacity (veh/h)	463	490	356	385	397	451
Control Delay (s)	83.0	65.8	13.0	14.8	14.6	31.8
Approach Delay (s)	83.0	65.8	14.3		27.3	
Approach LOS	F	F	B		D	

Intersection Summary				
Delay	54.4			
Level of Service	F			
Intersection Capacity Utilization	91.2%	ICU Level of Service	F	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	267	0	72	0	0	0	180	550	0	1	546	395
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0					5.0	7.0		5.0	7.0	7.0
Lane Util. Factor		1.00					1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes		1.00					1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00					1.00	1.00		1.00	1.00	1.00
Frt		0.97					1.00	1.00		1.00	1.00	0.85
Flt Protected		0.96					0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1741					1770	3539		1770	3539	1550
Flt Permitted		0.96					0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1741					1770	3539		1770	3539	1550
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	290	0	78	0	0	0	196	598	0	1	593	429
RTOR Reduction (vph)	0	53	0	0	0	0	0	0	0	0	0	264
Lane Group Flow (vph)	0	315	0	0	0	0	196	598	0	1	593	165
Confl. Peds. (#/hr)												1
Turn Type	Perm	NA					Prot	NA		Prot	NA	Perm
Protected Phases		4					5	2		1	6	
Permitted Phases	4											6
Actuated Green, G (s)		21.2					14.3	47.0		0.7	33.4	33.4
Effective Green, g (s)		21.2					14.3	47.0		0.7	33.4	33.4
Actuated g/C Ratio		0.24					0.16	0.54		0.01	0.38	0.38
Clearance Time (s)		6.0					5.0	7.0		5.0	7.0	7.0
Vehicle Extension (s)		2.0					2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		424					291	1914		14	1360	595
v/s Ratio Prot							c0.11	0.17		0.00	c0.17	
v/s Ratio Perm		0.18										0.11
v/c Ratio		0.74					0.67	0.31		0.07	0.44	0.28
Uniform Delay, d1		30.3					34.1	11.0		42.8	19.8	18.4
Progression Factor		1.00					1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		6.1					4.8	0.2		0.8	0.5	0.5
Delay (s)		36.4					38.9	11.2		43.6	20.3	19.0
Level of Service		D					D	B		D	C	B
Approach Delay (s)		36.4			0.0			18.0			19.7	
Approach LOS		D			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	21.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	86.9	Sum of lost time (s)	18.0
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	13	6	8	49	15	44	9	608	69	23	547	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00		0.98		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.94		1.00	0.98		1.00	1.00	0.85
Flt Protected		0.97	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1801	1583		1692		1769	1829		1769	1863	1546
Flt Permitted		0.81	1.00		0.84		0.37	1.00		0.25	1.00	1.00
Satd. Flow (perm)		1508	1583		1461		686	1829		471	1863	1546
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	14	7	9	53	16	48	10	661	75	25	595	29
RTOR Reduction (vph)	0	0	8	0	21	0	0	3	0	0	0	11
Lane Group Flow (vph)	0	21	1	0	96	0	10	733	0	25	595	18
Confl. Peds. (#/hr)	1					1	2		5	5		2
Confl. Bikes (#/hr)						8						
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		10.5	10.5		11.0		42.5	41.8		44.3	42.7	42.7
Effective Green, g (s)		10.5	10.5		11.0		42.5	41.8		44.3	42.7	42.7
Actuated g/C Ratio		0.15	0.15		0.16		0.60	0.59		0.63	0.61	0.61
Clearance Time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0		2.0		2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		224	236		228		424	1085		325	1129	937
v/s Ratio Prot							0.00	c0.40		c0.00	0.32	
v/s Ratio Perm		0.01	0.00		c0.07		0.01			0.05		0.01
v/c Ratio		0.09	0.01		0.42		0.02	0.68		0.08	0.53	0.02
Uniform Delay, d1		25.8	25.5		26.8		5.9	9.7		6.5	8.0	5.5
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.1	0.0		0.5		0.0	2.2		0.0	0.8	0.0
Delay (s)		25.9	25.5		27.3		5.9	11.9		6.5	8.9	5.5
Level of Service		C	C		C		A	B		A	A	A
Approach Delay (s)		25.8			27.3			11.8			8.6	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	11.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.4	Sum of lost time (s)	16.5
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	43	45	69	103	72	43
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	51	53	81	121	85	51
Pedestrians					1	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	203				297	143
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	203				297	143
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				87	94
cM capacity (veh/h)	1367				668	904

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	104	202	135
Volume Left	51	0	85
Volume Right	0	121	51
cSH	1367	1700	740
Volume to Capacity	0.04	0.12	0.18
Queue Length 95th (ft)	3	0	17
Control Delay (s)	3.9	0.0	10.9
Lane LOS	A		B
Approach Delay (s)	3.9	0.0	10.9
Approach LOS			B

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	31.5%	ICU Level of Service	A
Analysis Period (min)	15		

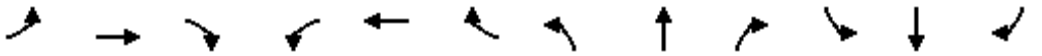
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	139	22	16	601	492	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8		5.0	6.3	6.3	6.3
Lane Util. Factor	1.00		1.00	0.95	0.95	1.00
Frt	0.98		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1753		1770	3539	3539	1583
Flt Permitted	0.96		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1753		1770	3539	3539	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	153	24	18	660	541	151
RTOR Reduction (vph)	4	0	0	0	0	90
Lane Group Flow (vph)	173	0	18	660	541	61
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases						6
Actuated Green, G (s)	13.7		0.9	27.8	21.9	21.9
Effective Green, g (s)	13.7		0.9	27.8	21.9	21.9
Actuated g/C Ratio	0.25		0.02	0.51	0.40	0.40
Clearance Time (s)	6.8		5.0	6.3	6.3	6.3
Vehicle Extension (s)	2.0		2.0	3.0	3.0	3.0
Lane Grp Cap (vph)	439		29	1801	1419	634
v/s Ratio Prot	c0.10		0.01	c0.19	0.15	
v/s Ratio Perm						0.04
v/c Ratio	0.39		0.62	0.37	0.38	0.10
Uniform Delay, d1	17.0		26.7	8.1	11.6	10.2
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2		26.1	0.1	0.2	0.1
Delay (s)	17.2		52.8	8.2	11.7	10.2
Level of Service	B		D	A	B	B
Approach Delay (s)	17.2			9.4	11.4	
Approach LOS	B			A	B	

Intersection Summary			
HCM 2000 Control Delay	11.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	54.6	Sum of lost time (s)	18.1
Intersection Capacity Utilization	36.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	3	6	502	3	4	3	644	610	4	578	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1826	1583	1681	1686	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1826	1583	1681	1686	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	2	3	6	534	3	4	3	685	649	4	615	3
RTOR Reduction (vph)	0	0	6	0	0	0	0	0	0	0	0	2
Lane Group Flow (vph)	0	5	0	267	270	4	3	685	649	4	615	1
Turn Type	Split	NA	Perm	Split	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			Free			Free			6
Actuated Green, G (s)		0.8	0.8	17.7	17.7	60.9	0.6	22.8	60.9	0.6	22.8	22.8
Effective Green, g (s)		0.8	0.8	17.7	17.7	60.9	0.6	22.8	60.9	0.6	22.8	22.8
Actuated g/C Ratio		0.01	0.01	0.29	0.29	1.00	0.01	0.37	1.00	0.01	0.37	0.37
Clearance Time (s)		5.0	5.0	5.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0		2.0	4.0		2.0	4.0	4.0
Lane Grp Cap (vph)		23	20	488	490	1583	17	1324	1583	17	1324	592
v/s Ratio Prot		0.00		0.16	c0.16		0.00	c0.19		0.00	0.17	
v/s Ratio Perm			0.00			0.00			c0.41			0.00
v/c Ratio		0.22	0.00	0.55	0.55	0.00	0.18	0.52	0.41	0.24	0.46	0.00
Uniform Delay, d1		29.7	29.7	18.2	18.2	0.0	29.9	14.8	0.0	29.9	14.4	11.9
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		4.7	0.1	1.3	1.3	0.0	1.8	0.5	0.8	2.6	0.4	0.0
Delay (s)		34.5	29.7	19.5	19.6	0.0	31.7	15.2	0.8	32.5	14.8	11.9
Level of Service		C	C	B	B	A	C	B	A	C	B	B
Approach Delay (s)		31.9			19.4			8.3			14.9	
Approach LOS		C			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	12.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	60.9	Sum of lost time (s)	19.0
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

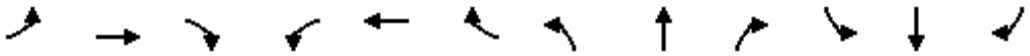
LOS Worksheets – Year 2022 without Project Conditions



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	170	70	290	80	280	30	480	380	440	490	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.98		1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1849	1550		1790	1583	1770	1863	1547	1770	1863	1583
Flt Permitted		0.82	1.00		0.56	1.00	0.35	1.00	1.00	0.15	1.00	1.00
Satd. Flow (perm)		1532	1550		1039	1583	657	1863	1547	286	1863	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	34	191	79	326	90	315	34	539	427	494	551	11
RTOR Reduction (vph)	0	0	50	0	0	174	0	0	265	0	0	6
Lane Group Flow (vph)	0	225	29	0	416	141	34	539	162	494	551	5
Confl. Peds. (#/hr)			1	1					1			
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		40.1	40.1		40.1	40.1	42.2	38.7	38.7	57.7	50.2	50.2
Effective Green, g (s)		40.1	40.1		40.1	40.1	42.2	38.7	38.7	57.7	50.2	50.2
Actuated g/C Ratio		0.37	0.37		0.37	0.37	0.39	0.36	0.36	0.54	0.47	0.47
Clearance Time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		569	576		386	588	293	668	555	359	867	737
v/s Ratio Prot							0.00	0.29		c0.19	0.30	
v/s Ratio Perm		0.15	0.02		c0.40	0.09	0.04		0.10	c0.54		0.00
v/c Ratio		0.40	0.05		1.08	0.24	0.12	0.81	0.29	1.38	0.64	0.01
Uniform Delay, d1		24.9	21.7		33.8	23.3	20.7	31.2	24.7	26.0	21.9	15.4
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.3	0.0		68.2	0.2	0.1	8.0	0.6	185.9	2.1	0.0
Delay (s)		25.3	21.7		102.0	23.5	20.8	39.2	25.3	211.9	24.0	15.4
Level of Service		C	C		F	C	C	D	C	F	C	B
Approach Delay (s)		24.3			68.2			32.7			111.8	
Approach LOS		C			E			C			F	

Intersection Summary			
HCM 2000 Control Delay	67.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.29		
Actuated Cycle Length (s)	107.8	Sum of lost time (s)	14.0
Intersection Capacity Utilization	96.3%	ICU Level of Service	F
Analysis Period (min)	15		

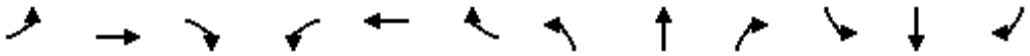
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	340	570	70	80	410	420	70	470	140	240	170	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.97	1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.97		1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1828		1770	1863	1539	1770	1786		1770	1727	
Flt Permitted	0.14	1.00		0.11	1.00	1.00	0.44	1.00		0.09	1.00	
Satd. Flow (perm)	256	1828		203	1863	1539	827	1786		161	1727	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	354	594	73	83	427	438	73	490	146	250	177	167
RTOR Reduction (vph)	0	2	0	0	0	166	0	8	0	0	22	0
Lane Group Flow (vph)	354	665	0	83	427	272	73	628	0	250	322	0
Confl. Peds. (#/hr)	3		1	1		3			4	4		
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	65.5	52.5		44.7	36.7	36.7	47.2	41.3		59.4	48.5	
Effective Green, g (s)	65.5	52.5		44.7	36.7	36.7	47.2	41.3		59.4	48.5	
Actuated g/C Ratio	0.49	0.39		0.33	0.27	0.27	0.35	0.31		0.44	0.36	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	391	711		160	506	418	330	546		227	620	
v/s Ratio Prot	c0.16	c0.36		0.03	0.23		0.01	0.35		c0.11	0.19	
v/s Ratio Perm	0.28			0.14		0.18	0.07			c0.38		
v/c Ratio	0.91	0.93		0.52	0.84	0.65	0.22	1.15		1.10	0.52	
Uniform Delay, d1	35.1	39.6		34.8	46.4	43.4	30.0	46.8		40.4	34.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	23.3	19.4		1.2	12.2	3.6	0.1	87.4		89.5	0.7	
Delay (s)	58.4	58.9		36.0	58.6	47.0	30.1	134.2		129.9	34.7	
Level of Service	E	E		D	E	D	C	F		F	C	
Approach Delay (s)		58.7			51.3			123.5			74.8	
Approach LOS		E			D			F			E	

Intersection Summary			
HCM 2000 Control Delay	73.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	134.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	103.7%	ICU Level of Service	G
Analysis Period (min)	15		

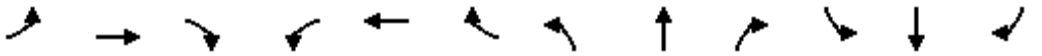
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	130	340	170	70	420	210	220	560	80	100	470	170
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	137	358	179	74	442	221	232	589	84	105	495	179

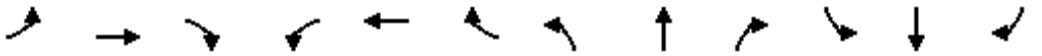
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	674	737	232	674	105	674
Volume Left (vph)	137	74	232	0	105	0
Volume Right (vph)	179	221	0	84	0	179
Hadj (s)	-0.08	-0.13	0.53	-0.05	0.53	-0.15
Departure Headway (s)	9.4	9.3	10.2	9.6	10.2	9.5
Degree Utilization, x	1.75	1.91	0.65	1.79	0.30	1.77
Capacity (veh/h)	389	391	347	381	351	384
Control Delay (s)	372.3	440.7	29.2	388.2	16.2	379.9
Approach Delay (s)	372.3	440.7	296.4		330.7	
Approach LOS	F	F	F		F	

Intersection Summary				
Delay	355.9			
Level of Service	F			
Intersection Capacity Utilization	119.3%	ICU Level of Service	H	
Analysis Period (min)	15			



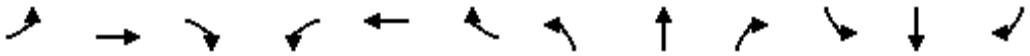
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	760	0	50	0	0	0	60	1090	0	0	880	550
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0					5.0	7.0			7.0	7.0
Lane Util. Factor		1.00					1.00	0.95			0.95	1.00
Frt		0.99					1.00	1.00			1.00	0.85
Flt Protected		0.96					0.95	1.00			1.00	1.00
Satd. Flow (prot)		1764					1770	3539			3539	1583
Flt Permitted		0.96					0.95	1.00			1.00	1.00
Satd. Flow (perm)		1764					1770	3539			3539	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	792	0	52	0	0	0	62	1135	0	0	917	573
RTOR Reduction (vph)	0	49	0	0	0	0	0	0	0	0	0	311
Lane Group Flow (vph)	0	795	0	0	0	0	62	1135	0	0	917	262
Turn Type	Perm	NA					Prot	NA		Prot	NA	Perm
Protected Phases		4					5	2		1	6	
Permitted Phases	4											6
Actuated Green, G (s)		31.3					6.9	59.2			47.3	47.3
Effective Green, g (s)		31.3					6.9	59.2			47.3	47.3
Actuated g/C Ratio		0.30					0.07	0.57			0.46	0.46
Clearance Time (s)		6.0					5.0	7.0			7.0	7.0
Vehicle Extension (s)		2.0					2.0	5.0			5.0	5.0
Lane Grp Cap (vph)		533					118	2024			1617	723
v/s Ratio Prot							0.04	c0.32			0.26	
v/s Ratio Perm		0.45										0.17
v/c Ratio		1.49					0.53	0.56			0.57	0.36
Uniform Delay, d1		36.1					46.7	14.0			20.6	18.3
Progression Factor		1.00					1.00	1.00			1.00	1.00
Incremental Delay, d2		231.2					1.9	0.6			0.8	0.6
Delay (s)		267.3					48.7	14.5			21.4	18.9
Level of Service		F					D	B			C	B
Approach Delay (s)		267.3			0.0			16.3			20.4	
Approach LOS		F			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	78.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	103.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	93.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	100	10	30	40	130	10	670	20	190	700	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.98		0.97		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	1.00		1.00	1.00	0.85
Flt Protected		1.00	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1854	1547		1642		1769	1855		1770	1863	1548
Flt Permitted		0.93	1.00		0.93		0.29	1.00		0.18	1.00	1.00
Satd. Flow (perm)		1727	1547		1531		531	1855		328	1863	1548
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	11	114	11	34	45	148	11	761	23	216	795	11
RTOR Reduction (vph)	0	0	9	0	56	0	0	1	0	0	0	4
Lane Group Flow (vph)	0	125	2	0	171	0	11	783	0	216	795	7
Confl. Peds. (#/hr)	1		1	1		1	1					1
Confl. Bikes (#/hr)						8						
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		14.3	14.3		14.8		51.0	50.3		62.9	58.2	58.2
Effective Green, g (s)		14.3	14.3		14.8		51.0	50.3		62.9	58.2	58.2
Actuated g/C Ratio		0.16	0.16		0.16		0.57	0.56		0.70	0.65	0.65
Clearance Time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0		2.0		2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		275	246		252		311	1040		368	1208	1004
v/s Ratio Prot							0.00	c0.42		c0.06	0.43	
v/s Ratio Perm		0.07	0.00		c0.11		0.02			0.36		0.00
v/c Ratio		0.45	0.01		0.68		0.04	0.75		0.59	0.66	0.01
Uniform Delay, d1		34.2	31.7		35.2		9.1	15.0		11.1	9.7	5.6
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.4	0.0		5.6		0.0	3.7		1.5	1.8	0.0
Delay (s)		34.6	31.7		40.8		9.1	18.7		12.7	11.4	5.6
Level of Service		C	C		D		A	B		B	B	A
Approach Delay (s)		34.4			40.8			18.6			11.6	
Approach LOS		C			D			B			B	

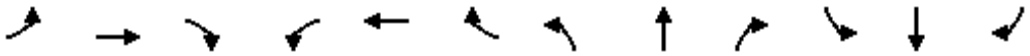
Intersection Summary			
HCM 2000 Control Delay	18.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	89.7	Sum of lost time (s)	16.5
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	290	20	110	190	290	10	190	80	260	70	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1767	1842		1768	1863	1549	1767	1863	1549	1767	1822	
Flt Permitted	0.63	1.00		0.52	1.00	1.00	0.70	1.00	1.00	0.63	1.00	
Satd. Flow (perm)	1169	1842		966	1863	1549	1303	1863	1549	1169	1822	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	315	22	120	207	315	11	207	87	283	76	11
RTOR Reduction (vph)	0	6	0	0	0	201	0	0	53	0	7	0
Lane Group Flow (vph)	11	331	0	120	207	114	11	207	34	283	80	0
Confl. Peds. (#/hr)	2		2	2		2	2		2	2		2
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	11.8	11.8		11.8	11.8	11.8	12.9	12.9	12.9	12.9	12.9	
Effective Green, g (s)	11.8	11.8		11.8	11.8	11.8	12.9	12.9	12.9	12.9	12.9	
Actuated g/C Ratio	0.36	0.36		0.36	0.36	0.36	0.39	0.39	0.39	0.39	0.39	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	421	664		348	672	558	514	734	611	461	718	
v/s Ratio Prot		c0.18			0.11			0.11			0.04	
v/s Ratio Perm	0.01			0.12		0.07	0.01		0.02	c0.24		
v/c Ratio	0.03	0.50		0.34	0.31	0.20	0.02	0.28	0.06	0.61	0.11	
Uniform Delay, d1	6.7	8.1		7.6	7.5	7.2	6.0	6.7	6.1	7.9	6.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.6		0.6	0.3	0.2	0.0	0.2	0.0	2.4	0.1	
Delay (s)	6.8	8.7		8.2	7.8	7.4	6.1	7.0	6.2	10.3	6.3	
Level of Service	A	A		A	A	A	A	A	A	B	A	
Approach Delay (s)		8.7			7.7			6.7			9.4	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	32.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.6%	ICU Level of Service	B
Analysis Period (min)	15		

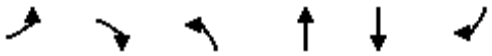
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	170	130	130	10	100	50	240	160	10	100	90	160
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	185	141	141	11	109	54	261	174	11	109	98	174
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	163			283			935	766	212	766	810	136
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	163			283			935	766	212	766	810	136
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	87			99			0	39	99	26	64	81
cM capacity (veh/h)	1416			1280			129	287	828	148	271	913

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	185	283	11	163	261	185	109	272
Volume Left	185	0	11	0	261	0	109	0
Volume Right	0	141	0	54	0	11	0	174
cSH	1416	1700	1280	1700	129	298	148	492
Volume to Capacity	0.13	0.17	0.01	0.10	2.02	0.62	0.74	0.55
Queue Length 95th (ft)	11	0	1	0	528	96	110	83
Control Delay (s)	7.9	0.0	7.8	0.0	543.5	34.9	77.7	20.9
Lane LOS	A		A		F	D	F	C
Approach Delay (s)	3.1		0.5		332.6		37.2	
Approach LOS					F		E	

Intersection Summary				
Average Delay	111.7			
Intersection Capacity Utilization	59.3%	ICU Level of Service	B	
Analysis Period (min)	15			

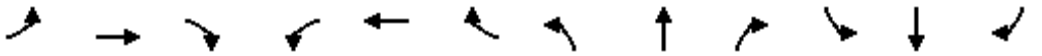


Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	460	200	90	490	560	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8		5.0	6.3	6.3	6.3
Lane Util. Factor	1.00		1.00	0.95	0.95	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	0.97		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1726		1770	3539	3539	1583
Flt Permitted	0.97		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1726		1770	3539	3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	511	222	100	544	622	244
RTOR Reduction (vph)	10	0	0	0	0	175
Lane Group Flow (vph)	723	0	100	544	622	69
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases						6
Actuated Green, G (s)	32.4		7.7	35.5	22.8	22.8
Effective Green, g (s)	32.4		7.7	35.5	22.8	22.8
Actuated g/C Ratio	0.40		0.10	0.44	0.28	0.28
Clearance Time (s)	6.8		5.0	6.3	6.3	6.3
Vehicle Extension (s)	2.0		2.0	3.0	3.0	3.0
Lane Grp Cap (vph)	690		168	1551	996	445
v/s Ratio Prot	c0.42		c0.06	0.15	c0.18	
v/s Ratio Perm						0.04
v/c Ratio	1.05		0.60	0.35	0.62	0.15
Uniform Delay, d1	24.3		35.2	15.1	25.4	21.9
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	47.6		3.7	0.1	1.2	0.2
Delay (s)	71.9		38.9	15.2	26.6	22.0
Level of Service	E		D	B	C	C
Approach Delay (s)	71.9			18.9	25.3	
Approach LOS	E			B	C	

Intersection Summary			
HCM 2000 Control Delay	38.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	81.0	Sum of lost time (s)	18.1
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

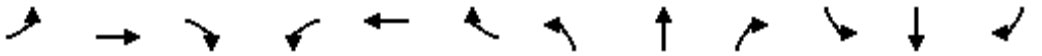
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	120	0	740	280	0	850
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0		4.0
Lane Util. Factor	1.00		1.00	1.00		1.00
Frt	1.00		1.00	0.85		1.00
Flt Protected	0.95		1.00	1.00		1.00
Satd. Flow (prot)	1770		1863	1583		1863
Flt Permitted	0.95		1.00	1.00		1.00
Satd. Flow (perm)	1770		1863	1583		1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	130	0	804	304	0	924
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	130	0	804	304	0	924
Turn Type	NA	custom	NA	Free	Perm	NA
Protected Phases			2			6
Permitted Phases	8	8		Free	6	
Actuated Green, G (s)	7.7		38.0	53.7		38.0
Effective Green, g (s)	7.7		38.0	53.7		38.0
Actuated g/C Ratio	0.14		0.71	1.00		0.71
Clearance Time (s)	4.0		4.0			4.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	253		1318	1583		1318
v/s Ratio Prot			0.43			c0.50
v/s Ratio Perm	c0.07			0.19		
v/c Ratio	0.51		0.61	0.19		0.70
Uniform Delay, d1	21.3		4.0	0.0		4.6
Progression Factor	1.00		1.00	1.00		1.00
Incremental Delay, d2	1.8		0.8	0.3		1.7
Delay (s)	23.0		4.9	0.3		6.3
Level of Service	C		A	A		A
Approach Delay (s)	23.0		3.6			6.3
Approach LOS	C		A			A

Intersection Summary			
HCM 2000 Control Delay	5.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	53.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	10	10	760	10	10	10	940	610	10	770	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1817	1583	1681	1687	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1817	1583	1681	1687	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	10	10	10	792	10	10	10	979	635	10	802	10
RTOR Reduction (vph)	0	0	10	0	0	0	0	0	0	0	0	6
Lane Group Flow (vph)	0	20	0	404	398	10	10	979	635	10	802	4
Turn Type	Split	NA	Perm	Split	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			Free			Free			6
Actuated Green, G (s)		3.9	3.9	36.0	36.0	101.3	0.9	41.5	101.3	0.9	41.5	41.5
Effective Green, g (s)		3.9	3.9	36.0	36.0	101.3	0.9	41.5	101.3	0.9	41.5	41.5
Actuated g/C Ratio		0.04	0.04	0.36	0.36	1.00	0.01	0.41	1.00	0.01	0.41	0.41
Clearance Time (s)		5.0	5.0	5.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0		2.0	4.0		2.0	4.0	4.0
Lane Grp Cap (vph)		69	60	597	599	1583	15	1449	1583	15	1449	648
v/s Ratio Prot		0.01		c0.24	0.24		0.01	c0.28		0.01	0.23	
v/s Ratio Perm			0.00			0.01			c0.40			0.00
v/c Ratio		0.29	0.01	0.68	0.66	0.01	0.67	0.68	0.40	0.67	0.55	0.01
Uniform Delay, d1		47.4	46.8	27.7	27.6	0.0	50.1	24.4	0.0	50.1	22.8	17.7
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.3	0.0	3.0	2.8	0.0	62.4	1.4	0.8	62.4	0.6	0.0
Delay (s)		49.7	46.9	30.8	30.3	0.0	112.4	25.8	0.8	112.4	23.4	17.7
Level of Service		D	D	C	C	A	F	C	A	F	C	B
Approach Delay (s)		48.7			30.2			16.5			24.4	
Approach LOS		D			C			B			C	

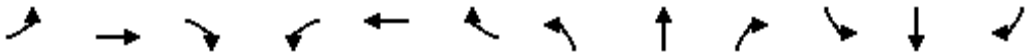
Intersection Summary			
HCM 2000 Control Delay	22.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	101.3	Sum of lost time (s)	19.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	80	30	290	140	390	40	480	280	370	480	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1842	1583		1802	1528	1770	1863	1583	1770	1863	1583
Flt Permitted		0.81	1.00		0.73	1.00	0.40	1.00	1.00	0.17	1.00	1.00
Satd. Flow (perm)		1508	1583		1364	1528	749	1863	1583	325	1863	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	22	86	32	312	151	419	43	516	301	398	516	32
RTOR Reduction (vph)	0	0	20	0	0	211	0	0	194	0	0	17
Lane Group Flow (vph)	0	108	12	0	463	208	43	516	107	398	516	15
Confl. Peds. (#/hr)	6					6						
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		37.5	37.5		37.5	37.5	40.5	36.9	36.9	56.1	48.5	48.5
Effective Green, g (s)		37.5	37.5		37.5	37.5	40.5	36.9	36.9	56.1	48.5	48.5
Actuated g/C Ratio		0.36	0.36		0.36	0.36	0.39	0.36	0.36	0.54	0.47	0.47
Clearance Time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		545	572		493	553	328	663	563	387	872	741
v/s Ratio Prot							0.00	0.28		c0.15	0.28	
v/s Ratio Perm		0.07	0.01		c0.34	0.14	0.05		0.07	c0.40		0.01
v/c Ratio		0.20	0.02		0.94	0.38	0.13	0.78	0.19	1.03	0.59	0.02
Uniform Delay, d1		22.7	21.2		31.9	24.4	19.9	29.7	23.0	23.4	20.3	14.8
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.1	0.0		25.8	0.3	0.1	6.7	0.3	53.2	1.6	0.0
Delay (s)		22.8	21.3		57.7	24.7	19.9	36.4	23.4	76.6	21.9	14.8
Level of Service		C	C		E	C	B	D	C	E	C	B
Approach Delay (s)		22.5			42.0			31.0			44.7	
Approach LOS		C			D			C			D	

Intersection Summary			
HCM 2000 Control Delay	38.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	103.6	Sum of lost time (s)	14.0
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		

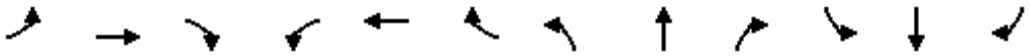
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	210	430	50	100	580	400	30	200	60	340	400	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.97		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1828		1768	1863	1583	1770	1789		1769	1764	
Flt Permitted	0.09	1.00		0.29	1.00	1.00	0.13	1.00		0.34	1.00	
Satd. Flow (perm)	164	1828		549	1863	1583	240	1789		631	1764	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	216	443	52	103	598	412	31	206	62	351	412	175
RTOR Reduction (vph)	0	2	0	0	0	260	0	8	0	0	11	0
Lane Group Flow (vph)	216	493	0	103	598	152	31	260	0	351	576	0
Confl. Peds. (#/hr)			3	3			3		1	1		3
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	60.4	47.1		48.6	40.3	40.3	34.8	31.0		49.1	40.3	
Effective Green, g (s)	60.4	47.1		48.6	40.3	40.3	34.8	31.0		49.1	40.3	
Actuated g/C Ratio	0.51	0.39		0.41	0.34	0.34	0.29	0.26		0.41	0.34	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	285	720		307	628	533	118	464		384	594	
v/s Ratio Prot	c0.10	0.27		0.02	c0.32		0.01	0.15		c0.10	c0.33	
v/s Ratio Perm	0.29			0.11		0.10	0.07			0.28		
v/c Ratio	0.76	0.68		0.34	0.95	0.28	0.26	0.56		0.91	0.97	
Uniform Delay, d1	30.5	30.0		23.5	38.7	29.0	33.0	38.3		30.9	39.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.8	2.7		0.2	24.5	0.3	0.4	1.5		25.3	29.4	
Delay (s)	40.3	32.7		23.7	63.2	29.3	33.5	39.9		56.2	68.5	
Level of Service	D	C		C	E	C	C	D		E	E	
Approach Delay (s)		35.0			47.0			39.2			63.9	
Approach LOS		D			D			D			E	

Intersection Summary			
HCM 2000 Control Delay	48.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	119.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	93.7%	ICU Level of Service	F
Analysis Period (min)	15		

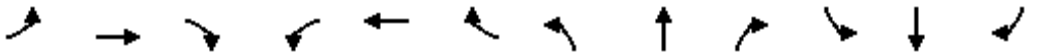
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	250	420	140	30	390	70	150	360	40	100	400	300
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	255	429	143	31	398	71	153	367	41	102	408	306

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	827	500	153	408	102	714
Volume Left (vph)	255	31	153	0	102	0
Volume Right (vph)	143	71	0	41	0	306
Hadj (s)	-0.01	-0.04	0.53	-0.04	0.53	-0.27
Departure Headway (s)	9.4	9.4	10.2	9.6	10.2	9.4
Degree Utilization, x	2.17	1.31	0.43	1.09	0.29	1.86
Capacity (veh/h)	388	390	342	384	350	390
Control Delay (s)	555.8	183.5	19.5	102.4	16.0	416.6
Approach Delay (s)	555.8	183.5	79.8		366.5	
Approach LOS	F	F	F		F	

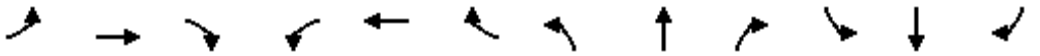
Intersection Summary				
Delay	331.0			
Level of Service	F			
Intersection Capacity Utilization	132.0%	ICU Level of Service	H	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	590	0	10	0	0	0	60	880	0	10	1210	790
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0					5.0	7.0		5.0	7.0	7.0
Lane Util. Factor		1.00					1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes		1.00					1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00					1.00	1.00		1.00	1.00	1.00
Frt		1.00					1.00	1.00		1.00	1.00	0.85
Flt Protected		0.95					0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1771					1770	3539		1770	3539	1550
Flt Permitted		0.95					0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1771					1770	3539		1770	3539	1550
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	641	0	11	0	0	0	65	957	0	11	1315	859
RTOR Reduction (vph)	0	53	0	0	0	0	0	0	0	0	0	380
Lane Group Flow (vph)	0	599	0	0	0	0	65	957	0	11	1315	479
Confl. Peds. (#/hr)												1
Turn Type	Perm	NA					Prot	NA		Prot	NA	Perm
Protected Phases		4					5	2		1	6	
Permitted Phases	4											6
Actuated Green, G (s)		30.3					7.7	76.9		1.3	70.5	70.5
Effective Green, g (s)		30.3					7.7	76.9		1.3	70.5	70.5
Actuated g/C Ratio		0.24					0.06	0.61		0.01	0.56	0.56
Clearance Time (s)		6.0					5.0	7.0		5.0	7.0	7.0
Vehicle Extension (s)		2.0					2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		424					107	2151		18	1972	863
v/s Ratio Prot							c0.04	0.27		0.01	c0.37	
v/s Ratio Perm		0.34										0.31
v/c Ratio		1.41					0.61	0.44		0.61	0.67	0.55
Uniform Delay, d1		48.1					57.9	13.3		62.3	19.7	17.9
Progression Factor		1.00					1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		199.0					6.5	0.3		36.2	1.1	1.3
Delay (s)		247.1					64.5	13.6		98.5	20.9	19.3
Level of Service		F					E	B		F	C	B
Approach Delay (s)		247.1			0.0			16.9			20.6	
Approach LOS		F			A			B			C	

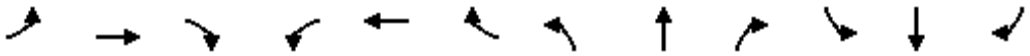
Intersection Summary			
HCM 2000 Control Delay	57.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	126.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	85.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	30	10	30	70	120	10	650	30	120	590	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00		0.98		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.93		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.99	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1839	1583		1678		1769	1848		1769	1863	1545
Flt Permitted		0.85	1.00		0.95		0.37	1.00		0.20	1.00	1.00
Satd. Flow (perm)		1574	1583		1601		692	1848		368	1863	1545
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	33	11	33	76	130	11	707	33	130	641	11
RTOR Reduction (vph)	0	0	9	0	35	0	0	1	0	0	0	4
Lane Group Flow (vph)	0	44	2	0	204	0	11	739	0	130	641	7
Confl. Peds. (#/hr)	1					1	2		5	5		2
Confl. Bikes (#/hr)						8						
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		14.7	14.7		15.2		47.6	46.8		57.8	53.0	53.0
Effective Green, g (s)		14.7	14.7		15.2		47.6	46.8		57.8	53.0	53.0
Actuated g/C Ratio		0.17	0.17		0.18		0.56	0.55		0.68	0.62	0.62
Clearance Time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0		2.0		2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		272	273		286		397	1017		365	1161	963
v/s Ratio Prot							0.00	c0.40		c0.03	c0.34	
v/s Ratio Perm		0.03	0.00		c0.13		0.02			0.21		0.00
v/c Ratio		0.16	0.01		0.71		0.03	0.73		0.36	0.55	0.01
Uniform Delay, d1		29.9	29.1		32.8		8.5	14.3		9.1	9.2	6.1
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.1	0.0		6.8		0.0	3.2		0.2	1.0	0.0
Delay (s)		30.0	29.1		39.6		8.5	17.5		9.3	10.2	6.1
Level of Service		C	C		D		A	B		A	B	A
Approach Delay (s)		29.8			39.6			17.4			10.0	
Approach LOS		C			D			B			A	

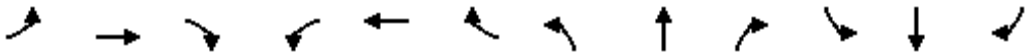
Intersection Summary			
HCM 2000 Control Delay	17.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	75.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	170	10	70	180	210	20	60	100	210	190	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1767	1845		1767	1863	1549	1767	1863	1549	1767	1832	
Flt Permitted	0.63	1.00		0.63	1.00	1.00	0.62	1.00	1.00	0.71	1.00	
Satd. Flow (perm)	1180	1845		1180	1863	1549	1145	1863	1549	1329	1832	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	185	11	76	196	228	22	65	109	228	207	22
RTOR Reduction (vph)	0	6	0	0	0	166	0	0	57	0	8	0
Lane Group Flow (vph)	11	190	0	76	196	62	22	65	52	228	221	0
Confl. Peds. (#/hr)	2		2	2		2	2		2	2		2
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	8.5	8.5		8.5	8.5	8.5	14.8	14.8	14.8	14.8	14.8	
Effective Green, g (s)	8.5	8.5		8.5	8.5	8.5	14.8	14.8	14.8	14.8	14.8	
Actuated g/C Ratio	0.27	0.27		0.27	0.27	0.27	0.47	0.47	0.47	0.47	0.47	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	320	501		320	505	420	541	880	732	628	866	
v/s Ratio Prot		0.10			c0.11			0.03			0.12	
v/s Ratio Perm	0.01			0.06		0.04	0.02		0.03	c0.17		
v/c Ratio	0.03	0.38		0.24	0.39	0.15	0.04	0.07	0.07	0.36	0.26	
Uniform Delay, d1	8.4	9.3		8.9	9.3	8.7	4.4	4.5	4.5	5.3	4.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.5		0.4	0.5	0.2	0.0	0.0	0.0	0.4	0.2	
Delay (s)	8.4	9.7		9.3	9.8	8.8	4.5	4.5	4.5	5.6	5.1	
Level of Service	A	A		A	A	A	A	A	A	A	A	
Approach Delay (s)		9.7			9.3			4.5			5.4	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	31.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

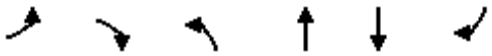
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	130	100	170	20	130	130	110	80	10	100	130	140
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	141	109	185	22	141	141	120	87	11	109	141	152
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	283			293			891	810	201	701	832	212
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	283			293			891	810	201	701	832	212
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	89			98			0	68	99	55	47	82
cM capacity (veh/h)	1280			1268			114	275	840	239	267	828

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	141	293	22	283	120	98	109	293
Volume Left	141	0	22	0	120	0	109	0
Volume Right	0	185	0	141	0	11	0	152
cSH	1280	1700	1268	1700	114	297	239	411
Volume to Capacity	0.11	0.17	0.02	0.17	1.05	0.33	0.45	0.71
Queue Length 95th (ft)	9	0	1	0	176	35	55	136
Control Delay (s)	8.2	0.0	7.9	0.0	169.9	23.0	32.0	32.8
Lane LOS	A		A		F	C	D	D
Approach Delay (s)	2.7		0.6		103.8		32.6	
Approach LOS					F		D	

Intersection Summary				
Average Delay	27.2			
Intersection Capacity Utilization	56.8%	ICU Level of Service	B	
Analysis Period (min)	15			

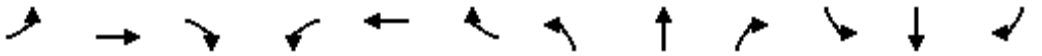


Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	190	90	130	610	650	340
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8		5.0	6.3	6.3	6.3
Lane Util. Factor	1.00		1.00	0.95	0.95	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	0.97		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1723		1770	3539	3539	1583
Flt Permitted	0.97		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1723		1770	3539	3539	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	209	99	143	670	714	374
RTOR Reduction (vph)	13	0	0	0	0	242
Lane Group Flow (vph)	295	0	143	670	714	132
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases						6
Actuated Green, G (s)	18.5		11.4	42.7	26.3	26.3
Effective Green, g (s)	18.5		11.4	42.7	26.3	26.3
Actuated g/C Ratio	0.25		0.15	0.57	0.35	0.35
Clearance Time (s)	6.8		5.0	6.3	6.3	6.3
Vehicle Extension (s)	2.0		2.0	3.0	3.0	3.0
Lane Grp Cap (vph)	429		271	2033	1252	560
v/s Ratio Prot	c0.17		c0.08	0.19	c0.20	
v/s Ratio Perm						0.08
v/c Ratio	0.69		0.53	0.33	0.57	0.24
Uniform Delay, d1	25.3		29.0	8.3	19.4	16.9
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	3.6		0.9	0.1	0.6	0.2
Delay (s)	28.9		29.8	8.4	20.1	17.1
Level of Service	C		C	A	C	B
Approach Delay (s)	28.9			12.2	19.1	
Approach LOS	C			B	B	

Intersection Summary			
HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	74.3	Sum of lost time (s)	18.1
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	270	0	900	100	0	680
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0		4.0
Lane Util. Factor	1.00		1.00	1.00		1.00
Frt	1.00		1.00	0.85		1.00
Flt Protected	0.95		1.00	1.00		1.00
Satd. Flow (prot)	1770		1863	1583		1863
Flt Permitted	0.95		1.00	1.00		1.00
Satd. Flow (perm)	1770		1863	1583		1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	293	0	978	109	0	739
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	293	0	978	109	0	739
Turn Type	NA	custom	NA	Free	Perm	NA
Protected Phases			2			6
Permitted Phases	8	8		Free	6	
Actuated Green, G (s)	13.4		34.8	56.2		34.8
Effective Green, g (s)	13.4		34.8	56.2		34.8
Actuated g/C Ratio	0.24		0.62	1.00		0.62
Clearance Time (s)	4.0		4.0			4.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	422		1153	1583		1153
v/s Ratio Prot			c0.53			0.40
v/s Ratio Perm	c0.17			0.07		
v/c Ratio	0.69		0.85	0.07		0.64
Uniform Delay, d1	19.5		8.6	0.0		6.8
Progression Factor	1.00		1.00	1.00		1.00
Incremental Delay, d2	4.9		6.0	0.1		1.2
Delay (s)	24.4		14.6	0.1		8.0
Level of Service	C		B	A		A
Approach Delay (s)	24.4		13.1			8.0
Approach LOS	C		B			A

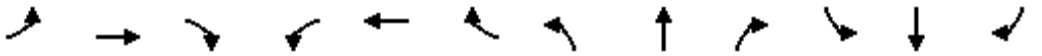
Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	56.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	10	10	720	10	10	10	740	730	10	860	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1817	1583	1681	1688	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1817	1583	1681	1688	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	11	11	11	766	11	11	11	787	777	11	915	11
RTOR Reduction (vph)	0	0	11	0	0	0	0	0	0	0	0	7
Lane Group Flow (vph)	0	22	0	391	386	11	11	787	777	11	915	4
Turn Type	Split	NA	Perm	Split	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			Free			Free			6
Actuated Green, G (s)		3.9	3.9	33.7	33.7	96.6	1.8	38.2	96.6	1.8	38.2	38.2
Effective Green, g (s)		3.9	3.9	33.7	33.7	96.6	1.8	38.2	96.6	1.8	38.2	38.2
Actuated g/C Ratio		0.04	0.04	0.35	0.35	1.00	0.02	0.40	1.00	0.02	0.40	0.40
Clearance Time (s)		5.0	5.0	5.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0		2.0	4.0		2.0	4.0	4.0
Lane Grp Cap (vph)		73	63	586	588	1583	32	1399	1583	32	1399	625
v/s Ratio Prot		0.01		c0.23	0.23		0.01	0.22		0.01	c0.26	
v/s Ratio Perm			0.00			0.01			c0.49			0.00
v/c Ratio		0.30	0.01	0.67	0.66	0.01	0.34	0.56	0.49	0.34	0.65	0.01
Uniform Delay, d1		45.0	44.5	26.7	26.6	0.0	46.8	22.7	0.0	46.8	23.8	17.7
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.3	0.0	2.9	2.6	0.0	2.3	0.6	1.1	2.3	1.2	0.0
Delay (s)		47.3	44.5	29.6	29.2	0.0	49.2	23.3	1.1	49.2	25.0	17.7
Level of Service		D	D	C	C	A	D	C	A	D	C	B
Approach Delay (s)		46.4			29.0			12.5			25.2	
Approach LOS		D			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	96.6	Sum of lost time (s)	19.0
Intersection Capacity Utilization	60.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

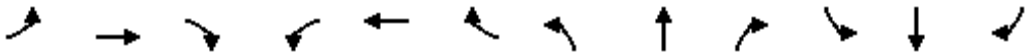
LOS Worksheets – Year 2022 with Partial Development Conditions



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	170	71	330	80	280	31	561	454	440	556	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.98		1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1849	1550		1788	1583	1770	1863	1547	1770	1863	1583
Flt Permitted		0.73	1.00		0.55	1.00	0.28	1.00	1.00	0.09	1.00	1.00
Satd. Flow (perm)		1358	1550		1018	1583	521	1863	1547	165	1863	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	34	191	80	371	90	315	35	630	510	494	625	11
RTOR Reduction (vph)	0	0	51	0	0	159	0	0	257	0	0	6
Lane Group Flow (vph)	0	225	29	0	461	156	35	630	253	494	625	5
Confl. Peds. (#/hr)			1	1					1			
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		40.0	40.0		40.0	40.0	44.8	41.2	41.2	60.2	52.6	52.6
Effective Green, g (s)		40.0	40.0		40.0	40.0	44.8	41.2	41.2	60.2	52.6	52.6
Actuated g/C Ratio		0.36	0.36		0.36	0.36	0.41	0.37	0.37	0.55	0.48	0.48
Clearance Time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		492	562		369	574	252	696	578	308	889	755
v/s Ratio Prot							0.00	0.34		c0.22	0.34	
v/s Ratio Perm		0.17	0.02		c0.45	0.10	0.05		0.16	c0.66		0.00
v/c Ratio		0.46	0.05		1.25	0.27	0.14	0.91	0.44	1.60	0.70	0.01
Uniform Delay, d1		26.8	22.8		35.1	24.8	20.8	32.7	25.8	34.0	22.7	15.1
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.5	0.0		132.8	0.2	0.1	16.1	1.1	286.5	3.2	0.0
Delay (s)		27.3	22.8		167.9	25.0	20.9	48.8	26.9	320.4	25.8	15.1
Level of Service		C	C		F	C	C	D	C	F	C	B
Approach Delay (s)		26.1			109.9			38.5			154.5	
Approach LOS		C			F			D			F	

Intersection Summary			
HCM 2000 Control Delay	92.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.50		
Actuated Cycle Length (s)	110.2	Sum of lost time (s)	14.0
Intersection Capacity Utilization	102.8%	ICU Level of Service	G
Analysis Period (min)	15		

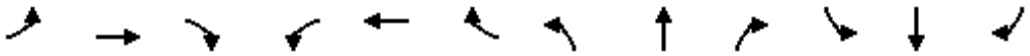
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	364	620	70	148	438	420	70	514	206	240	205	172
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.97	1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1830		1770	1863	1538	1770	1767		1770	1735	
Flt Permitted	0.10	1.00		0.11	1.00	1.00	0.36	1.00		0.09	1.00	
Satd. Flow (perm)	183	1830		199	1863	1538	676	1767		161	1735	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	379	646	73	154	456	438	73	535	215	250	214	179
RTOR Reduction (vph)	0	3	0	0	0	149	0	10	0	0	20	0
Lane Group Flow (vph)	379	716	0	154	456	289	73	740	0	250	373	0
Confl. Peds. (#/hr)	3		1	1		3			4	4		
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	68.5	50.9		50.0	37.4	37.4	47.3	41.3		59.3	48.3	
Effective Green, g (s)	68.5	50.9		50.0	37.4	37.4	47.3	41.3		59.3	48.3	
Actuated g/C Ratio	0.50	0.37		0.36	0.27	0.27	0.34	0.30		0.43	0.35	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	391	675		215	505	417	279	529		221	608	
v/s Ratio Prot	c0.18	c0.39		0.07	0.24		0.01	c0.42		c0.11	0.21	
v/s Ratio Perm	0.30			0.19		0.19	0.08			0.38		
v/c Ratio	0.97	1.06		0.72	0.90	0.69	0.26	1.40		1.13	0.61	
Uniform Delay, d1	42.6	43.5		35.0	48.4	45.1	31.7	48.3		41.1	37.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	36.8	52.1		9.1	19.3	5.0	0.2	190.9		100.4	1.8	
Delay (s)	79.4	95.5		44.1	67.8	50.0	31.8	239.1		141.5	38.9	
Level of Service	E	F		D	E	D	C	F		F	D	
Approach Delay (s)		90.0			56.9			220.7			78.8	
Approach LOS		F			E			F			E	

Intersection Summary			
HCM 2000 Control Delay	108.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	137.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	114.8%	ICU Level of Service	H
Analysis Period (min)	15		

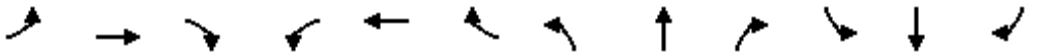
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	169	417	170	70	483	210	220	571	80	100	475	203
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	178	439	179	74	508	221	232	601	84	105	500	214

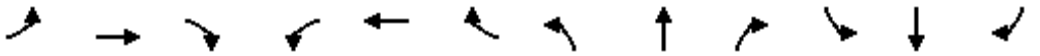
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	796	803	232	685	105	714
Volume Left (vph)	178	74	232	0	105	0
Volume Right (vph)	179	221	0	84	0	214
Hadj (s)	-0.06	-0.11	0.53	-0.05	0.53	-0.18
Departure Headway (s)	9.4	9.3	10.2	9.6	10.2	9.5
Degree Utilization, x	2.08	2.09	0.65	1.82	0.30	1.87
Capacity (veh/h)	389	392	347	381	351	386
Control Delay (s)	515.2	518.0	29.2	401.8	16.2	424.0
Approach Delay (s)	515.2	518.0	307.7		371.5	
Approach LOS	F	F	F		F	

Intersection Summary				
Delay	423.6			
Level of Service	F			
Intersection Capacity Utilization	139.0%	ICU Level of Service	H	
Analysis Period (min)	15			



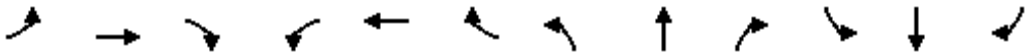
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	837	0	50	0	0	0	60	1114	0	0	891	613
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0					5.0	7.0			7.0	7.0
Lane Util. Factor		1.00					1.00	0.95			0.95	1.00
Frt		0.99					1.00	1.00			1.00	0.85
Flt Protected		0.95					0.95	1.00			1.00	1.00
Satd. Flow (prot)		1765					1770	3539			3539	1583
Flt Permitted		0.95					0.95	1.00			1.00	1.00
Satd. Flow (perm)		1765					1770	3539			3539	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	872	0	52	0	0	0	62	1160	0	0	928	639
RTOR Reduction (vph)	0	49	0	0	0	0	0	0	0	0	0	339
Lane Group Flow (vph)	0	875	0	0	0	0	62	1160	0	0	928	300
Turn Type	Perm	NA					Prot	NA		Prot	NA	Perm
Protected Phases		4					5	2		1	6	
Permitted Phases	4											6
Actuated Green, G (s)		31.2					7.0	61.7			49.7	49.7
Effective Green, g (s)		31.2					7.0	61.7			49.7	49.7
Actuated g/C Ratio		0.29					0.07	0.58			0.47	0.47
Clearance Time (s)		6.0					5.0	7.0			7.0	7.0
Vehicle Extension (s)		2.0					2.0	5.0			5.0	5.0
Lane Grp Cap (vph)		520					116	2061			1660	742
v/s Ratio Prot							0.04	c0.33			0.26	
v/s Ratio Perm		0.50										0.19
v/c Ratio		1.68					0.53	0.56			0.56	0.40
Uniform Delay, d1		37.4					47.9	13.7			20.2	18.4
Progression Factor		1.00					1.00	1.00			1.00	1.00
Incremental Delay, d2		315.2					2.4	0.6			0.7	0.8
Delay (s)		352.5					50.2	14.3			20.9	19.2
Level of Service		F					D	B			C	B
Approach Delay (s)		352.5			0.0			16.1			20.2	
Approach LOS		F			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	101.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	105.9	Sum of lost time (s)	18.0
Intersection Capacity Utilization	98.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	100	11	52	40	130	11	826	64	190	806	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.98		0.98		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.92		1.00	0.99		1.00	1.00	0.85
Flt Protected		1.00	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1854	1547		1654		1770	1843		1770	1863	1547
Flt Permitted		0.92	1.00		0.84		0.22	1.00		0.06	1.00	1.00
Satd. Flow (perm)		1711	1547		1400		416	1843		110	1863	1547
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	11	114	12	59	45	148	12	939	73	216	916	11
RTOR Reduction (vph)	0	0	10	0	42	0	0	2	0	0	0	3
Lane Group Flow (vph)	0	125	2	0	210	0	12	1010	0	216	916	8
Confl. Peds. (#/hr)	1		1	1		1	1					1
Confl. Bikes (#/hr)						8						
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		19.7	19.7		20.2		73.8	71.9		88.6	82.7	82.7
Effective Green, g (s)		19.7	19.7		20.2		73.8	71.9		88.6	82.7	82.7
Actuated g/C Ratio		0.16	0.16		0.17		0.61	0.60		0.73	0.68	0.68
Clearance Time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0		2.0		2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		279	252		234		275	1096		255	1275	1059
v/s Ratio Prot							0.00	c0.55		c0.09	0.49	
v/s Ratio Perm		0.07	0.00		c0.15		0.03			0.53		0.00
v/c Ratio		0.45	0.01		0.90		0.04	0.92		0.85	0.72	0.01
Uniform Delay, d1		45.6	42.4		49.3		11.4	21.9		38.4	11.8	6.0
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.4	0.0		31.6		0.0	13.0		21.3	2.4	0.0
Delay (s)		46.1	42.4		80.9		11.4	34.9		59.6	14.3	6.0
Level of Service		D	D		F		B	C		E	B	A
Approach Delay (s)		45.7			80.9			34.6			22.8	
Approach LOS		D			F			C			C	

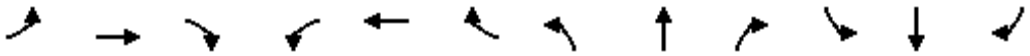
Intersection Summary			
HCM 2000 Control Delay	34.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.8	Sum of lost time (s)	16.5
Intersection Capacity Utilization	90.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	29	315	20	133	203	290	10	284	122	260	166	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1767	1843		1768	1863	1549	1767	1863	1549	1767	1827	
Flt Permitted	0.62	1.00		0.47	1.00	1.00	0.63	1.00	1.00	0.56	1.00	
Satd. Flow (perm)	1154	1843		874	1863	1549	1173	1863	1549	1042	1827	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.82
Adj. Flow (vph)	32	342	22	145	221	315	11	309	133	283	180	23
RTOR Reduction (vph)	0	6	0	0	0	201	0	0	78	0	11	0
Lane Group Flow (vph)	32	358	0	145	221	114	11	309	55	283	192	0
Confl. Peds. (#/hr)	2		2	2		2	2		2	2		2
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	12.8	12.8		12.8	12.8	12.8	14.7	14.7	14.7	14.7	14.7	
Effective Green, g (s)	12.8	12.8		12.8	12.8	12.8	14.7	14.7	14.7	14.7	14.7	
Actuated g/C Ratio	0.36	0.36		0.36	0.36	0.36	0.41	0.41	0.41	0.41	0.41	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	416	664		315	671	558	485	771	641	431	756	
v/s Ratio Prot		c0.19			0.12			0.17			0.11	
v/s Ratio Perm	0.03			0.17		0.07	0.01		0.04	c0.27		
v/c Ratio	0.08	0.54		0.46	0.33	0.20	0.02	0.40	0.09	0.66	0.25	
Uniform Delay, d1	7.5	9.0		8.7	8.2	7.8	6.2	7.3	6.3	8.4	6.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.8		1.1	0.3	0.2	0.0	0.3	0.1	3.6	0.2	
Delay (s)	7.5	9.9		9.8	8.5	8.0	6.2	7.6	6.4	12.0	7.0	
Level of Service	A	A		A	A	A	A	A	A	B	A	
Approach Delay (s)		9.7			8.6			7.2			9.9	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	35.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		

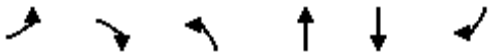
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	196	157	141	10	112	50	246	160	10	100	90	175
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	213	171	153	11	122	54	267	174	11	109	98	190
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	176			324			1056	871	247	865	921	149
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	176			324			1056	871	247	865	921	149
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	85			99			0	28	99	0	57	79
cM capacity (veh/h)	1400			1236			94	243	791	101	227	898

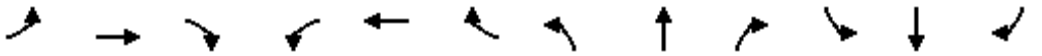
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	213	324	11	176	267	185	109	288
Volume Left	213	0	11	0	267	0	109	0
Volume Right	0	153	0	54	0	11	0	190
cSH	1400	1700	1236	1700	94	253	101	449
Volume to Capacity	0.15	0.19	0.01	0.10	2.84	0.73	1.07	0.64
Queue Length 95th (ft)	13	0	1	0	639	127	172	110
Control Delay (s)	8.0	0.0	7.9	0.0	924.4	49.8	189.1	26.3
Lane LOS	A		A		F	E	F	D
Approach Delay (s)	3.2		0.5		567.0		70.9	
Approach LOS					F		F	

Intersection Summary				
Average Delay	182.0			
Intersection Capacity Utilization	62.7%	ICU Level of Service		B
Analysis Period (min)	15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	484	200	90	490	560	231
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8		5.0	6.3	6.3	6.3
Lane Util. Factor	1.00		1.00	0.95	0.95	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	0.97		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1728		1770	3539	3539	1583
Flt Permitted	0.97		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1728		1770	3539	3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	538	222	100	544	622	257
RTOR Reduction (vph)	9	0	0	0	0	185
Lane Group Flow (vph)	751	0	100	544	622	72
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases						6
Actuated Green, G (s)	32.4		7.7	35.5	22.8	22.8
Effective Green, g (s)	32.4		7.7	35.5	22.8	22.8
Actuated g/C Ratio	0.40		0.10	0.44	0.28	0.28
Clearance Time (s)	6.8		5.0	6.3	6.3	6.3
Vehicle Extension (s)	2.0		2.0	3.0	3.0	3.0
Lane Grp Cap (vph)	691		168	1551	996	445
v/s Ratio Prot	c0.43		c0.06	0.15	c0.18	
v/s Ratio Perm						0.05
v/c Ratio	1.09		0.60	0.35	0.62	0.16
Uniform Delay, d1	24.3		35.2	15.1	25.4	21.9
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	60.2		3.7	0.1	1.2	0.2
Delay (s)	84.5		38.9	15.2	26.6	22.1
Level of Service	F		D	B	C	C
Approach Delay (s)	84.5			18.9	25.3	
Approach LOS	F			B	C	

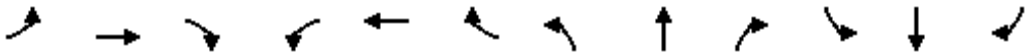
Intersection Summary			
HCM 2000 Control Delay	43.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	81.0	Sum of lost time (s)	18.1
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	116	25	40	28	15	86	24	738	14	66	848	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.98		1.00	0.98		1.00	1.00	0.97	1.00	1.00	0.97
Flpb, ped/bikes	0.99	1.00		0.99	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.91		1.00	0.87		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1760	1665		1760	1588		1767	1863	1540	1767	1863	1540
Flt Permitted	0.69	1.00		0.71	1.00		0.19	1.00	1.00	0.26	1.00	1.00
Satd. Flow (perm)	1272	1665		1318	1588		348	1863	1540	474	1863	1540
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	126	27	43	30	16	93	26	802	15	72	922	72
RTOR Reduction (vph)	0	35	0	0	76	0	0	0	5	0	0	24
Lane Group Flow (vph)	126	35	0	30	33	0	26	802	10	72	922	48
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	9.8	9.8		9.8	9.8		34.7	34.7	34.7	34.7	34.7	34.7
Effective Green, g (s)	9.8	9.8		9.8	9.8		34.7	34.7	34.7	34.7	34.7	34.7
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.66	0.66	0.66	0.66	0.66	0.66
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	237	310		246	296		230	1231	1017	313	1231	1017
v/s Ratio Prot		0.02			0.02			0.43			c0.49	
v/s Ratio Perm	c0.10			0.02			0.07		0.01	0.15		0.03
v/c Ratio	0.53	0.11		0.12	0.11		0.11	0.65	0.01	0.23	0.75	0.05
Uniform Delay, d1	19.3	17.7		17.8	17.7		3.3	5.3	3.0	3.6	6.0	3.1
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.3	0.2		0.2	0.2		0.2	1.2	0.0	0.4	2.5	0.0
Delay (s)	21.6	17.9		18.0	17.9		3.5	6.5	3.0	3.9	8.5	3.1
Level of Service	C	B		B	B		A	A	A	A	A	A
Approach Delay (s)		20.3			17.9			6.4			7.8	
Approach LOS		C			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	52.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized												
Volume (veh/h)	68	0	25	10	0	10	25	266	10	90	108	49
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	74	0	27	11	0	11	27	289	11	98	117	53
Approach Volume (veh/h)		101			22			327			268	
Crossing Volume (veh/h)		226			390			172			38	
High Capacity (veh/h)		1160			1019			1211			1344	
High v/c (veh/h)		0.09			0.02			0.27			0.20	
Low Capacity (veh/h)		957			830			1003			1124	
Low v/c (veh/h)		0.11			0.03			0.33			0.24	

Intersection Summary				
Maximum v/c High	0.27			
Maximum v/c Low	0.33			
Intersection Capacity Utilization	47.5%	ICU Level of Service	A	

Intersection	
Intersection Delay, s/veh	6.6
Intersection LOS	A

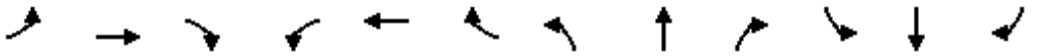
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	101	22	327	268
Demand Flow Rate, veh/h	103	22	334	273
Vehicles Circulating, veh/h	230	398	175	39
Vehicles Exiting, veh/h	82	111	158	381
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	5.2	5.0	7.7	5.8
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	103	22	334	273
Cap Entry Lane, veh/h	898	759	949	1087
Entry HV Adj Factor	0.981	1.000	0.980	0.980
Flow Entry, veh/h	101	22	327	268
Cap Entry, veh/h	880	759	929	1065
V/C Ratio	0.115	0.029	0.352	0.251
Control Delay, s/veh	5.2	5.0	7.7	5.8
LOS	A	A	A	A
95th %tile Queue, veh	0	0	2	1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	144	0	777	301	0	917
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0		4.0
Lane Util. Factor	1.00		1.00	1.00		1.00
Frpb, ped/bikes	1.00		1.00	0.98		1.00
Flpb, ped/bikes	1.00		1.00	1.00		1.00
Frt	1.00		1.00	0.85		1.00
Flt Protected	0.95		1.00	1.00		1.00
Satd. Flow (prot)	1770		1863	1550		1863
Flt Permitted	0.95		1.00	1.00		1.00
Satd. Flow (perm)	1770		1863	1550		1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	157	0	845	327	0	997
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	157	0	845	327	0	997
Confl. Peds. (#/hr)		2		2		
Turn Type	NA	custom	NA	Free	Perm	NA
Protected Phases			2			6
Permitted Phases	8	8		Free	6	
Actuated Green, G (s)	9.6		41.6	59.2		41.6
Effective Green, g (s)	9.6		41.6	59.2		41.6
Actuated g/C Ratio	0.16		0.70	1.00		0.70
Clearance Time (s)	4.0		4.0			4.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	287		1309	1550		1309
v/s Ratio Prot			0.45			c0.54
v/s Ratio Perm	c0.09			0.21		
v/c Ratio	0.55		0.65	0.21		0.76
Uniform Delay, d1	22.8		4.8	0.0		5.6
Progression Factor	1.00		1.00	1.00		1.00
Incremental Delay, d2	2.1		1.1	0.3		2.7
Delay (s)	24.9		5.9	0.3		8.3
Level of Service	C		A	A		A
Approach Delay (s)	24.9		4.3			8.3
Approach LOS	C		A			A

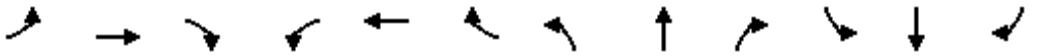
Intersection Summary			
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	59.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	10	10	760	10	10	10	998	610	10	860	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1817	1583	1681	1687	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1817	1583	1681	1687	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	10	10	10	792	10	10	10	1040	635	10	896	10
RTOR Reduction (vph)	0	0	10	0	0	0	0	0	0	0	0	6
Lane Group Flow (vph)	0	20	0	404	398	10	10	1040	635	10	896	4
Turn Type	Split	NA	Perm	Split	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			Free			Free			6
Actuated Green, G (s)		3.9	3.9	37.1	37.1	105.3	0.9	44.4	105.3	0.9	44.4	44.4
Effective Green, g (s)		3.9	3.9	37.1	37.1	105.3	0.9	44.4	105.3	0.9	44.4	44.4
Actuated g/C Ratio		0.04	0.04	0.35	0.35	1.00	0.01	0.42	1.00	0.01	0.42	0.42
Clearance Time (s)		5.0	5.0	5.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0		2.0	4.0		2.0	4.0	4.0
Lane Grp Cap (vph)		67	58	592	594	1583	15	1492	1583	15	1492	667
v/s Ratio Prot		0.01		c0.24	0.24		0.01	c0.29		0.01	0.25	
v/s Ratio Perm			0.00			0.01			c0.40			0.00
v/c Ratio		0.30	0.01	0.68	0.67	0.01	0.67	0.70	0.40	0.67	0.60	0.01
Uniform Delay, d1		49.4	48.8	29.1	28.9	0.0	52.1	24.9	0.0	52.1	23.6	17.7
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.5	0.0	3.2	3.0	0.0	62.4	1.6	0.8	62.4	0.8	0.0
Delay (s)		51.9	48.9	32.3	31.9	0.0	114.4	26.5	0.8	114.4	24.4	17.7
Level of Service		D	D	C	C	A	F	C	A	F	C	B
Approach Delay (s)		50.9			31.7			17.3			25.3	
Approach LOS		D			C			B			C	

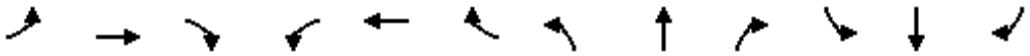
Intersection Summary			
HCM 2000 Control Delay	23.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	105.3	Sum of lost time (s)	19.0
Intersection Capacity Utilization	63.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	80	32	384	140	390	43	568	351	370	582	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1844	1583		1797	1526	1770	1863	1583	1770	1863	1583
Flt Permitted		0.65	1.00		0.72	1.00	0.25	1.00	1.00	0.09	1.00	1.00
Satd. Flow (perm)		1214	1583		1333	1526	470	1863	1583	172	1863	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	22	86	34	413	151	419	46	611	377	398	626	32
RTOR Reduction (vph)	0	0	22	0	0	171	0	0	239	0	0	17
Lane Group Flow (vph)	0	108	13	0	564	248	46	611	138	398	626	15
Confl. Peds. (#/hr)	6					6						
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		40.0	40.0		40.0	40.0	44.7	39.8	39.8	58.8	49.9	49.9
Effective Green, g (s)		40.0	40.0		40.0	40.0	44.7	39.8	39.8	58.8	49.9	49.9
Actuated g/C Ratio		0.37	0.37		0.37	0.37	0.41	0.37	0.37	0.54	0.46	0.46
Clearance Time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		446	581		490	561	251	681	579	313	854	726
v/s Ratio Prot							0.01	0.33		c0.18	0.34	
v/s Ratio Perm		0.09	0.01		c0.42	0.16	0.07		0.09	c0.51		0.01
v/c Ratio		0.24	0.02		1.15	0.44	0.18	0.90	0.24	1.27	0.73	0.02
Uniform Delay, d1		23.9	21.9		34.4	26.0	20.7	32.6	24.0	33.1	24.0	16.1
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.2	0.0		89.3	0.4	0.1	15.4	0.4	144.9	4.0	0.0
Delay (s)		24.1	21.9		123.7	26.4	20.8	47.9	24.4	178.0	28.0	16.1
Level of Service		C	C		F	C	C	D	C	F	C	B
Approach Delay (s)		23.6			82.2			38.2			84.2	
Approach LOS		C			F			D			F	

Intersection Summary			
HCM 2000 Control Delay	66.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	108.8	Sum of lost time (s)	14.0
Intersection Capacity Utilization	97.4%	ICU Level of Service	F
Analysis Period (min)	15		

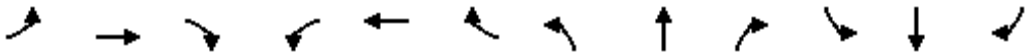
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	231	480	50	171	645	400	30	238	127	340	446	199
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.95		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1831		1770	1863	1583	1770	1752		1769	1760	
Flt Permitted	0.09	1.00		0.17	1.00	1.00	0.12	1.00		0.20	1.00	
Satd. Flow (perm)	168	1831		316	1863	1583	226	1752		373	1760	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	238	495	52	176	665	412	31	245	131	351	460	205
RTOR Reduction (vph)	0	3	0	0	0	237	0	14	0	0	11	0
Lane Group Flow (vph)	238	544	0	176	665	175	31	362	0	351	654	0
Confl. Peds. (#/hr)			3	3			3		1	1		3
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	60.8	44.3		53.2	40.5	40.5	36.6	32.9		51.0	42.3	
Effective Green, g (s)	60.8	44.3		53.2	40.5	40.5	36.6	32.9		51.0	42.3	
Actuated g/C Ratio	0.49	0.36		0.43	0.33	0.33	0.30	0.27		0.41	0.34	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	297	659		286	613	521	113	468		303	605	
v/s Ratio Prot	c0.11	0.30		0.06	c0.36		0.01	0.21		c0.12	0.37	
v/s Ratio Perm	0.29			0.20		0.11	0.07			c0.36		
v/c Ratio	0.80	0.83		0.62	1.08	0.34	0.27	0.77		1.16	1.08	
Uniform Delay, d1	33.3	35.8		25.3	41.2	31.1	34.3	41.6		31.2	40.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	13.6	8.4		2.8	61.5	0.4	0.5	7.8		101.7	60.3	
Delay (s)	46.9	44.2		28.1	102.7	31.5	34.8	49.4		132.9	100.7	
Level of Service	D	D		C	F	C	C	D		F	F	
Approach Delay (s)		45.0			68.8			48.3			111.8	
Approach LOS		D			E			D			F	

Intersection Summary			
HCM 2000 Control Delay	73.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	123.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	102.6%	ICU Level of Service	G
Analysis Period (min)	15		

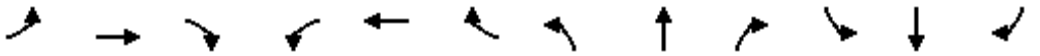
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	286	501	140	30	484	70	150	368	40	100	412	341
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	292	511	143	31	494	71	153	376	41	102	420	348

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	946	596	153	416	102	768
Volume Left (vph)	292	31	153	0	102	0
Volume Right (vph)	143	71	0	41	0	348
Hadj (s)	0.01	-0.03	0.53	-0.03	0.53	-0.28
Departure Headway (s)	9.5	9.4	10.2	9.6	10.2	9.3
Degree Utilization, x	2.49	1.56	0.43	1.11	0.29	2.00
Capacity (veh/h)	389	385	342	386	350	391
Control Delay (s)	696.8	288.9	19.5	109.5	16.0	476.9
Approach Delay (s)	696.8	288.9	85.3		422.9	
Approach LOS	F	F	F		F	

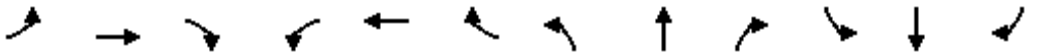
Intersection Summary				
Delay	418.5			
Level of Service	F			
Intersection Capacity Utilization	146.4%	ICU Level of Service	H	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	671	0	10	0	0	0	60	899	0	10	1237	884
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0					5.0	7.0		5.0	7.0	7.0
Lane Util. Factor		1.00					1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes		1.00					1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00					1.00	1.00		1.00	1.00	1.00
Frt		1.00					1.00	1.00		1.00	1.00	0.85
Flt Protected		0.95					0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1772					1770	3539		1770	3539	1550
Flt Permitted		0.95					0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1772					1770	3539		1770	3539	1550
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	729	0	11	0	0	0	65	977	0	11	1345	961
RTOR Reduction (vph)	0	54	0	0	0	0	0	0	0	0	0	405
Lane Group Flow (vph)	0	686	0	0	0	0	65	977	0	11	1345	556
Confl. Peds. (#/hr)												1
Turn Type	Perm	NA					Prot	NA		Prot	NA	Perm
Protected Phases		4					5	2		1	6	
Permitted Phases	4											6
Actuated Green, G (s)		30.1					7.8	78.8		1.3	72.3	72.3
Effective Green, g (s)		30.1					7.8	78.8		1.3	72.3	72.3
Actuated g/C Ratio		0.23					0.06	0.61		0.01	0.56	0.56
Clearance Time (s)		6.0					5.0	7.0		5.0	7.0	7.0
Vehicle Extension (s)		2.0					2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		416					107	2175		17	1995	874
v/s Ratio Prot							c0.04	0.28		0.01	c0.38	
v/s Ratio Perm		0.39										0.36
v/c Ratio		1.65					0.61	0.45		0.65	0.67	0.64
Uniform Delay, d1		49.0					58.7	13.1		63.2	19.7	19.0
Progression Factor		1.00					1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		303.1					6.5	0.3		49.2	1.2	2.1
Delay (s)		352.2					65.2	13.5		112.4	20.9	21.1
Level of Service		F					E	B		F	C	C
Approach Delay (s)		352.2			0.0			16.7			21.4	
Approach LOS		F			A			B			C	

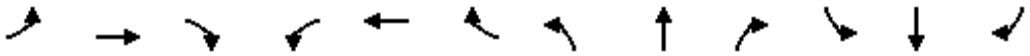
Intersection Summary			
HCM 2000 Control Delay	79.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	128.2	Sum of lost time (s)	18.0
Intersection Capacity Utilization	90.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	30	12	82	70	120	13	811	67	120	788	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00		0.98		1.00	1.00		1.00	1.00	0.97
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.94		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.99	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1839	1583		1697		1770	1837		1770	1863	1543
Flt Permitted		0.85	1.00		0.88		0.22	1.00		0.09	1.00	1.00
Satd. Flow (perm)		1589	1583		1521		410	1837		159	1863	1543
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	33	13	89	76	130	14	882	73	130	857	11
RTOR Reduction (vph)	0	0	10	0	22	0	0	2	0	0	0	4
Lane Group Flow (vph)	0	44	3	0	273	0	14	953	0	130	857	7
Confl. Peds. (#/hr)	1					1	2		5	5		2
Confl. Bikes (#/hr)						8						
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		22.6	22.6		23.1		69.4	67.5		80.3	74.4	74.4
Effective Green, g (s)		22.6	22.6		23.1		69.4	67.5		80.3	74.4	74.4
Actuated g/C Ratio		0.20	0.20		0.20		0.60	0.58		0.70	0.64	0.64
Clearance Time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0		2.0		2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		311	310		304		268	1074		233	1201	994
v/s Ratio Prot							0.00	c0.52		c0.04	c0.46	
v/s Ratio Perm		0.03	0.00		c0.18		0.03			0.35		0.00
v/c Ratio		0.14	0.01		0.90		0.05	0.89		0.56	0.71	0.01
Uniform Delay, d1		38.4	37.4		45.0		11.9	20.7		20.9	13.5	7.3
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.1	0.0		26.3		0.0	9.7		1.6	2.5	0.0
Delay (s)		38.5	37.4		71.3		11.9	30.4		22.5	16.0	7.3
Level of Service		D	D		E		B	C		C	B	A
Approach Delay (s)		38.2			71.3			30.1			16.8	
Approach LOS		D			E			C			B	

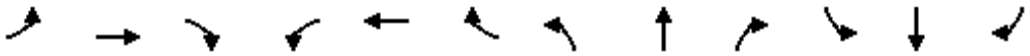
Intersection Summary			
HCM 2000 Control Delay	29.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	115.4	Sum of lost time (s)	16.5
Intersection Capacity Utilization	89.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	24	193	10	126	210	210	20	155	143	210	291	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1767	1847		1767	1863	1549	1768	1863	1549	1767	1823	
Flt Permitted	0.62	1.00		0.62	1.00	1.00	0.52	1.00	1.00	0.65	1.00	
Satd. Flow (perm)	1146	1847		1154	1863	1549	964	1863	1549	1211	1823	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	210	11	137	228	228	22	168	155	228	316	45
RTOR Reduction (vph)	0	5	0	0	0	152	0	0	90	0	12	0
Lane Group Flow (vph)	26	216	0	137	228	76	22	168	65	228	349	0
Confl. Peds. (#/hr)	2		2	2		2	2		2	2		2
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	10.7	10.7		10.7	10.7	10.7	13.6	13.6	13.6	13.6	13.6	
Effective Green, g (s)	10.7	10.7		10.7	10.7	10.7	13.6	13.6	13.6	13.6	13.6	
Actuated g/C Ratio	0.33	0.33		0.33	0.33	0.33	0.42	0.42	0.42	0.42	0.42	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	379	611		382	617	513	405	784	652	509	767	
v/s Ratio Prot		0.12			c0.12			0.09			c0.19	
v/s Ratio Perm	0.02			0.12		0.05	0.02		0.04	0.19		
v/c Ratio	0.07	0.35		0.36	0.37	0.15	0.05	0.21	0.10	0.45	0.46	
Uniform Delay, d1	7.4	8.2		8.2	8.2	7.6	5.5	5.9	5.7	6.7	6.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.4		0.6	0.4	0.1	0.1	0.1	0.1	0.6	0.4	
Delay (s)	7.5	8.5		8.8	8.6	7.7	5.6	6.1	5.7	7.3	7.1	
Level of Service	A	A		A	A	A	A	A	A	A	A	
Approach Delay (s)		8.4			8.3			5.9			7.2	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	32.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	52.5%	ICU Level of Service	A
Analysis Period (min)	15		

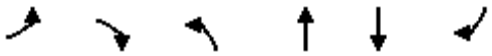
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	158	120	183	20	160	130	126	80	10	100	130	175
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	172	130	199	22	174	141	137	87	11	109	141	190
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	315			329			1052	932	230	816	961	245
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	315			329			1052	932	230	816	961	245
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	86			98			0	61	99	40	35	76
cM capacity (veh/h)	1245			1230			67	226	809	182	217	794

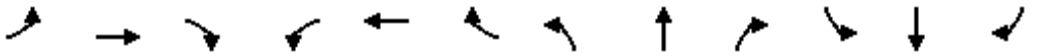
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	172	329	22	315	137	98	109	332
Volume Left	172	0	22	0	137	0	109	0
Volume Right	0	199	0	141	0	11	0	190
cSH	1245	1700	1230	1700	67	245	182	372
Volume to Capacity	0.14	0.19	0.02	0.19	2.05	0.40	0.60	0.89
Queue Length 95th (ft)	12	0	1	0	320	45	82	222
Control Delay (s)	8.4	0.0	8.0	0.0	621.7	29.1	50.6	57.0
Lane LOS	A		A		F	D	F	F
Approach Delay (s)	2.9		0.5		374.8		55.4	
Approach LOS					F		F	

Intersection Summary				
Average Delay	75.3			
Intersection Capacity Utilization	63.0%	ICU Level of Service		B
Analysis Period (min)	15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	209	90	130	610	650	367
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8		5.0	6.3	6.3	6.3
Lane Util. Factor	1.00		1.00	0.95	0.95	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	0.97		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1727		1770	3539	3539	1583
Flt Permitted	0.97		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1727		1770	3539	3539	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	230	99	143	670	714	403
RTOR Reduction (vph)	12	0	0	0	0	261
Lane Group Flow (vph)	317	0	143	670	714	142
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases						6
Actuated Green, G (s)	19.7		11.5	43.2	26.7	26.7
Effective Green, g (s)	19.7		11.5	43.2	26.7	26.7
Actuated g/C Ratio	0.26		0.15	0.57	0.35	0.35
Clearance Time (s)	6.8		5.0	6.3	6.3	6.3
Vehicle Extension (s)	2.0		2.0	3.0	3.0	3.0
Lane Grp Cap (vph)	447		267	2011	1243	556
v/s Ratio Prot	c0.18		c0.08	0.19	c0.20	
v/s Ratio Perm						0.09
v/c Ratio	0.71		0.54	0.33	0.57	0.25
Uniform Delay, d1	25.6		29.8	8.7	20.0	17.6
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	4.2		1.0	0.1	0.6	0.2
Delay (s)	29.7		30.8	8.8	20.7	17.8
Level of Service	C		C	A	C	B
Approach Delay (s)	29.7			12.7	19.6	
Approach LOS	C			B	B	

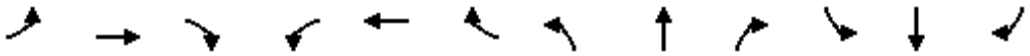
Intersection Summary			
HCM 2000 Control Delay	18.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	76.0	Sum of lost time (s)	18.1
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	36	51	32	41	91	62	886	40	108	667	158
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.98		1.00	0.98		1.00	1.00	0.97	1.00	1.00	0.97
Flpb, ped/bikes	0.99	1.00		0.99	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.91		1.00	0.90		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1757	1672		1758	1638		1765	1863	1536	1770	1863	1536
Flt Permitted	0.62	1.00		0.70	1.00		0.31	1.00	1.00	0.18	1.00	1.00
Satd. Flow (perm)	1140	1672		1288	1638		568	1863	1536	334	1863	1536
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	136	39	55	35	45	99	67	963	43	117	725	172
RTOR Reduction (vph)	0	44	0	0	80	0	0	0	13	0	0	53
Lane Group Flow (vph)	136	50	0	35	64	0	67	963	30	117	725	119
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	13.8	13.8		13.8	13.8		49.6	49.6	49.6	49.6	49.6	49.6
Effective Green, g (s)	13.8	13.8		13.8	13.8		49.6	49.6	49.6	49.6	49.6	49.6
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.69	0.69	0.69	0.69	0.69	0.69
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	220	323		248	316		394	1294	1067	232	1294	1067
v/s Ratio Prot		0.03			0.04			c0.52			0.39	
v/s Ratio Perm	c0.12			0.03			0.12		0.02	0.35		0.08
v/c Ratio	0.62	0.15		0.14	0.20		0.17	0.74	0.03	0.50	0.56	0.11
Uniform Delay, d1	26.4	23.9		23.9	24.2		3.8	6.9	3.4	5.1	5.4	3.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.1	0.2		0.3	0.3		0.2	2.4	0.0	1.7	0.6	0.0
Delay (s)	31.5	24.2		24.1	24.5		4.0	9.3	3.4	6.8	6.0	3.7
Level of Service	C	C		C	C		A	A	A	A	A	A
Approach Delay (s)		28.5			24.4			8.7			5.7	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	71.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized												
Volume (veh/h)	130	0	64	10	0	90	65	80	10	10	236	142
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	141	0	70	11	0	98	71	87	11	11	257	154
Approach Volume (veh/h)		211			109			168			422	
Crossing Volume (veh/h)		278			299			152			82	
High Capacity (veh/h)		1113			1095			1229			1299	
High v/c (veh/h)		0.19			0.10			0.14			0.32	
Low Capacity (veh/h)		915			899			1020			1084	
Low v/c (veh/h)		0.23			0.12			0.17			0.39	

Intersection Summary				
Maximum v/c High	0.32			
Maximum v/c Low	0.39			
Intersection Capacity Utilization	57.8%	ICU Level of Service	B	

Intersection	
Intersection Delay, s/veh	7.1
Intersection LOS	A

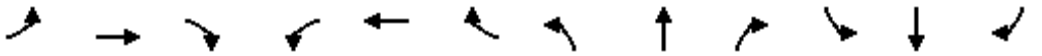
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	211	109	169	422
Demand Flow Rate, veh/h	215	111	172	430
Vehicles Circulating, veh/h	284	305	155	83
Vehicles Exiting, veh/h	229	22	344	333
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	7.0	5.7	5.5	8.1
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	215	111	172	430
Cap Entry Lane, veh/h	851	833	968	1040
Entry HV Adj Factor	0.981	0.982	0.984	0.981
Flow Entry, veh/h	211	109	169	422
Cap Entry, veh/h	835	818	952	1020
V/C Ratio	0.253	0.133	0.178	0.413
Control Delay, s/veh	7.0	5.7	5.5	8.1
LOS	A	A	A	A
95th %tile Queue, veh	1	0	1	2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	323	0	988	155	0	748
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0		4.0
Lane Util. Factor	1.00		1.00	1.00		1.00
Frpb, ped/bikes	1.00		1.00	0.98		1.00
Flpb, ped/bikes	1.00		1.00	1.00		1.00
Frt	1.00		1.00	0.85		1.00
Flt Protected	0.95		1.00	1.00		1.00
Satd. Flow (prot)	1770		1863	1550		1863
Flt Permitted	0.95		1.00	1.00		1.00
Satd. Flow (perm)	1770		1863	1550		1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	351	0	1074	168	0	813
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	351	0	1074	168	0	813
Confl. Peds. (#/hr)		2		2		
Turn Type	NA	custom	NA	Free	Perm	NA
Protected Phases			2			6
Permitted Phases	8	8		Free	6	
Actuated Green, G (s)	17.6		44.3	69.9		44.3
Effective Green, g (s)	17.6		44.3	69.9		44.3
Actuated g/C Ratio	0.25		0.63	1.00		0.63
Clearance Time (s)	4.0		4.0			4.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	445		1180	1550		1180
v/s Ratio Prot			c0.58			0.44
v/s Ratio Perm	c0.20			0.11		
v/c Ratio	0.79		0.91	0.11		0.69
Uniform Delay, d1	24.4		11.1	0.0		8.3
Progression Factor	1.00		1.00	1.00		1.00
Incremental Delay, d2	9.0		10.5	0.1		1.7
Delay (s)	33.4		21.6	0.1		10.0
Level of Service	C		C	A		B
Approach Delay (s)	33.4		18.7			10.0
Approach LOS	C		B			B

Intersection Summary			
HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	69.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.6%	ICU Level of Service	D
Analysis Period (min)	15		

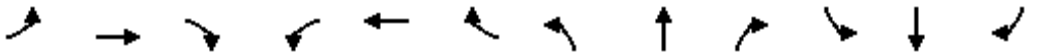
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	10	10	720	10	10	10	883	730	10	981	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1817	1583	1681	1688	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1817	1583	1681	1688	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	11	11	11	766	11	11	11	939	777	11	1044	11
RTOR Reduction (vph)	0	0	11	0	0	0	0	0	0	0	0	6
Lane Group Flow (vph)	0	22	0	391	386	11	11	939	777	11	1044	5
Turn Type	Split	NA	Perm	Split	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			Free			Free			6
Actuated Green, G (s)		3.9	3.9	36.0	36.0	106.0	1.9	45.2	106.0	1.9	45.2	45.2
Effective Green, g (s)		3.9	3.9	36.0	36.0	106.0	1.9	45.2	106.0	1.9	45.2	45.2
Actuated g/C Ratio		0.04	0.04	0.34	0.34	1.00	0.02	0.43	1.00	0.02	0.43	0.43
Clearance Time (s)		5.0	5.0	5.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0		2.0	4.0		2.0	4.0	4.0
Lane Grp Cap (vph)		66	58	570	573	1583	31	1509	1583	31	1509	675
v/s Ratio Prot		0.01		c0.23	0.23		0.01	0.27		0.01	c0.29	
v/s Ratio Perm			0.00			0.01			c0.49			0.00
v/c Ratio		0.33	0.01	0.69	0.67	0.01	0.35	0.62	0.49	0.35	0.69	0.01
Uniform Delay, d1		49.8	49.2	30.1	30.0	0.0	51.4	23.7	0.0	51.4	24.7	17.5
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		3.0	0.0	3.4	3.1	0.0	2.5	0.9	1.1	2.5	1.5	0.0
Delay (s)		52.8	49.2	33.6	33.1	0.0	54.0	24.6	1.1	54.0	26.2	17.5
Level of Service		D	D	C	C	A	D	C	A	D	C	B
Approach Delay (s)		51.6			32.9			14.2			26.4	
Approach LOS		D			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	22.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	106.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	64.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

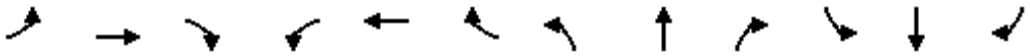
LOS Worksheets – Year 2026 without Project Conditions



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	210	80	270	150	320	60	440	370	460	510	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.98		1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1848	1550		1803	1583	1770	1863	1547	1770	1863	1583
Flt Permitted		0.69	1.00		0.53	1.00	0.29	1.00	1.00	0.18	1.00	1.00
Satd. Flow (perm)		1290	1550		994	1583	536	1863	1547	333	1863	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	45	236	90	303	169	360	67	494	416	517	573	11
RTOR Reduction (vph)	0	0	56	0	0	173	0	0	234	0	0	6
Lane Group Flow (vph)	0	281	34	0	472	187	67	494	182	517	573	5
Confl. Peds. (#/hr)			1	1					1			
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		40.1	40.1		40.1	40.1	41.3	36.0	36.0	55.1	45.8	45.8
Effective Green, g (s)		40.1	40.1		40.1	40.1	41.3	36.0	36.0	55.1	45.8	45.8
Actuated g/C Ratio		0.38	0.38		0.38	0.38	0.39	0.34	0.34	0.52	0.44	0.44
Clearance Time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		491	590		378	603	272	637	529	380	811	689
v/s Ratio Prot							0.01	0.27		c0.19	0.31	
v/s Ratio Perm		0.22	0.02		c0.47	0.12	0.08		0.12	c0.52		0.00
v/c Ratio		0.57	0.06		1.25	0.31	0.25	0.78	0.34	1.36	0.71	0.01
Uniform Delay, d1		25.8	20.6		32.5	22.8	21.0	31.0	25.8	23.3	24.2	16.8
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		1.3	0.0		132.2	0.2	0.2	6.9	0.8	178.5	3.5	0.0
Delay (s)		27.1	20.6		164.7	23.1	21.2	37.8	26.6	201.8	27.8	16.8
Level of Service		C	C		F	C	C	D	C	F	C	B
Approach Delay (s)		25.5			103.4			31.9			109.4	
Approach LOS		C			F			C			F	

Intersection Summary			
HCM 2000 Control Delay	75.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	105.2	Sum of lost time (s)	14.0
Intersection Capacity Utilization	100.6%	ICU Level of Service	G
Analysis Period (min)	15		

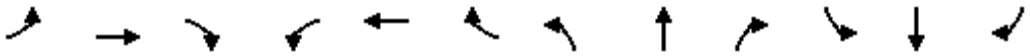
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	350	620	70	90	430	400	140	490	160	250	190	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.97	1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1830		1770	1863	1539	1770	1781		1770	1735	
Flt Permitted	0.11	1.00		0.11	1.00	1.00	0.37	1.00		0.09	1.00	
Satd. Flow (perm)	213	1830		201	1863	1539	697	1781		165	1735	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	365	646	73	94	448	417	146	510	167	260	198	167
RTOR Reduction (vph)	0	2	0	0	0	157	0	8	0	0	21	0
Lane Group Flow (vph)	365	717	0	94	448	260	146	669	0	260	344	0
Confl. Peds. (#/hr)	3		1	1		3			4	4		
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	67.0	53.4		45.7	37.1	37.1	48.0	40.2		58.3	45.5	
Effective Green, g (s)	67.0	53.4		45.7	37.1	37.1	48.0	40.2		58.3	45.5	
Actuated g/C Ratio	0.50	0.39		0.34	0.27	0.27	0.35	0.30		0.43	0.34	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	392	722		167	510	422	309	529		226	583	
v/s Ratio Prot	c0.17	c0.39		0.04	0.24		0.03	c0.38		c0.11	0.20	
v/s Ratio Perm	0.29			0.15		0.17	0.14			0.38		
v/c Ratio	0.93	0.99		0.56	0.88	0.62	0.47	1.26		1.15	0.59	
Uniform Delay, d1	38.8	40.8		35.6	46.9	42.9	31.4	47.6		40.2	37.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	28.3	31.5		2.6	15.7	2.7	0.4	133.2		106.4	1.5	
Delay (s)	67.2	72.2		38.2	62.6	45.6	31.9	180.8		146.7	38.7	
Level of Service	E	E		D	E	D	C	F		F	D	
Approach Delay (s)		70.5			52.8			154.4			83.6	
Approach LOS		E			D			F			F	

Intersection Summary			
HCM 2000 Control Delay	87.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	135.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	108.2%	ICU Level of Service	G
Analysis Period (min)	15		

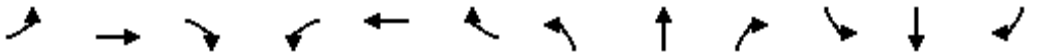
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	140	390	160	70	420	230	250	620	80	120	490	160
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	147	411	168	74	442	242	263	653	84	126	516	168

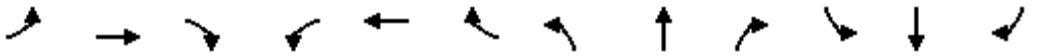
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	726	758	263	737	126	684
Volume Left (vph)	147	74	263	0	126	0
Volume Right (vph)	168	242	0	84	0	168
Hadj (s)	-0.06	-0.14	0.53	-0.05	0.53	-0.14
Departure Headway (s)	9.4	9.3	10.2	9.6	10.2	9.5
Degree Utilization, x	1.90	1.96	0.74	1.96	0.36	1.80
Capacity (veh/h)	389	392	349	381	351	384
Control Delay (s)	434.3	463.7	36.2	462.7	17.5	393.2
Approach Delay (s)	434.3	463.7	350.5		334.6	
Approach LOS	F	F	F		F	

Intersection Summary				
Delay	391.1			
Level of Service	F			
Intersection Capacity Utilization	126.6%	ICU Level of Service	H	
Analysis Period (min)	15			



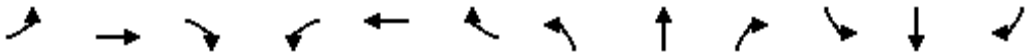
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	810	0	50	0	0	0	110	1260	0	0	910	600
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0					5.0	7.0			7.0	7.0
Lane Util. Factor		1.00					1.00	0.95			0.95	1.00
Frt		0.99					1.00	1.00			1.00	0.85
Flt Protected		0.96					0.95	1.00			1.00	1.00
Satd. Flow (prot)		1765					1770	3539			3539	1583
Flt Permitted		0.96					0.95	1.00			1.00	1.00
Satd. Flow (perm)		1765					1770	3539			3539	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	844	0	52	0	0	0	115	1312	0	0	948	625
RTOR Reduction (vph)	0	51	0	0	0	0	0	0	0	0	0	336
Lane Group Flow (vph)	0	845	0	0	0	0	115	1312	0	0	948	289
Turn Type	Perm	NA					Prot	NA		Prot	NA	Perm
Protected Phases		4					5	2		1	6	
Permitted Phases	4											6
Actuated Green, G (s)		30.7					11.9	68.9			52.0	52.0
Effective Green, g (s)		30.7					11.9	68.9			52.0	52.0
Actuated g/C Ratio		0.27					0.11	0.61			0.46	0.46
Clearance Time (s)		6.0					5.0	7.0			7.0	7.0
Vehicle Extension (s)		2.0					2.0	5.0			5.0	5.0
Lane Grp Cap (vph)		481					187	2165			1634	731
v/s Ratio Prot							0.06	c0.37			0.27	
v/s Ratio Perm		0.48										0.18
v/c Ratio		1.76					0.61	0.61			0.58	0.39
Uniform Delay, d1		40.9					48.2	13.5			22.3	19.9
Progression Factor		1.00					1.00	1.00			1.00	1.00
Incremental Delay, d2		349.1					4.2	0.7			0.8	0.7
Delay (s)		390.0					52.3	14.2			23.1	20.7
Level of Service		F					D	B			C	C
Approach Delay (s)		390.0			0.0			17.3			22.1	
Approach LOS		F			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	105.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	112.6	Sum of lost time (s)	18.0
Intersection Capacity Utilization	101.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	120	10	30	60	60	10	710	20	200	700	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.98		0.98		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.95		1.00	1.00		1.00	1.00	0.85
Flt Protected		1.00	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1856	1546		1715		1769	1855		1770	1863	1548
Flt Permitted		0.96	1.00		0.89		0.30	1.00		0.16	1.00	1.00
Satd. Flow (perm)		1788	1546		1539		553	1855		294	1863	1548
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	11	136	11	34	68	68	11	807	23	227	795	11
RTOR Reduction (vph)	0	0	9	0	20	0	0	1	0	0	0	4
Lane Group Flow (vph)	0	147	2	0	150	0	11	829	0	227	795	7
Confl. Peds. (#/hr)	1		1	1		1	1					1
Confl. Bikes (#/hr)						8						
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		13.5	13.5		14.0		53.5	52.8		65.9	61.2	61.2
Effective Green, g (s)		13.5	13.5		14.0		53.5	52.8		65.9	61.2	61.2
Actuated g/C Ratio		0.15	0.15		0.15		0.58	0.57		0.72	0.67	0.67
Clearance Time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0		2.0		2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		262	227		234		331	1065		356	1240	1030
v/s Ratio Prot							0.00	c0.45		c0.06	0.43	
v/s Ratio Perm		0.08	0.00		c0.10		0.02			0.39		0.00
v/c Ratio		0.56	0.01		0.64		0.03	0.78		0.64	0.64	0.01
Uniform Delay, d1		36.4	33.5		36.6		8.6	15.0		12.4	8.9	5.2
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		1.6	0.0		4.2		0.0	4.3		2.7	1.6	0.0
Delay (s)		38.1	33.5		40.8		8.6	19.3		15.2	10.5	5.2
Level of Service		D	C		D		A	B		B	B	A
Approach Delay (s)		37.8			40.8			19.2			11.5	
Approach LOS		D			D			B			B	

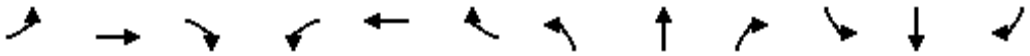
Intersection Summary			
HCM 2000 Control Delay	18.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	91.9	Sum of lost time (s)	16.5
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	330	20	110	140	360	10	230	90	290	80	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1767	1844		1768	1863	1549	1767	1863	1549	1767	1824	
Flt Permitted	0.66	1.00		0.45	1.00	1.00	0.69	1.00	1.00	0.60	1.00	
Satd. Flow (perm)	1228	1844		838	1863	1549	1289	1863	1549	1124	1824	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.82
Adj. Flow (vph)	11	359	22	120	152	391	11	250	98	315	87	12
RTOR Reduction (vph)	0	5	0	0	0	250	0	0	58	0	7	0
Lane Group Flow (vph)	11	376	0	120	152	141	11	250	40	315	92	0
Confl. Peds. (#/hr)	2		2	2		2	2		2	2		2
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	12.6	12.6		12.6	12.6	12.6	14.4	14.4	14.4	14.4	14.4	
Effective Green, g (s)	12.6	12.6		12.6	12.6	12.6	14.4	14.4	14.4	14.4	14.4	
Actuated g/C Ratio	0.36	0.36		0.36	0.36	0.36	0.41	0.41	0.41	0.41	0.41	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	442	663		301	670	557	530	766	637	462	750	
v/s Ratio Prot		c0.20			0.08			0.13			0.05	
v/s Ratio Perm	0.01			0.14		0.09	0.01		0.03	c0.28		
v/c Ratio	0.02	0.57		0.40	0.23	0.25	0.02	0.33	0.06	0.68	0.12	
Uniform Delay, d1	7.2	9.0		8.4	7.8	7.9	6.1	7.0	6.2	8.4	6.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	1.1		0.9	0.2	0.2	0.0	0.3	0.0	4.1	0.1	
Delay (s)	7.3	10.1		9.2	8.0	8.1	6.1	7.3	6.3	12.5	6.5	
Level of Service	A	B		A	A	A	A	A	A	B	A	
Approach Delay (s)		10.0			8.3			6.9			11.1	
Approach LOS		B			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	35.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		

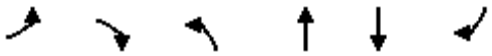
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	220	150	140	10	100	50	250	180	10	100	90	180
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	239	163	152	11	109	54	272	196	11	109	98	196
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	163			315			1092	902	239	908	951	136
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	163			315			1092	902	239	908	951	136
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	83			99			0	14	99	0	54	79
cM capacity (veh/h)	1416			1245			85	229	800	62	214	913

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	239	315	11	163	272	207	109	293
Volume Left	239	0	11	0	272	0	109	0
Volume Right	0	152	0	54	0	11	0	196
cSH	1416	1700	1245	1700	85	237	62	437
Volume to Capacity	0.17	0.19	0.01	0.10	3.21	0.87	1.75	0.67
Queue Length 95th (ft)	15	0	1	0	Err	177	248	121
Control Delay (s)	8.1	0.0	7.9	0.0	Err	73.3	503.8	28.5
Lane LOS	A		A		F	F	F	D
Approach Delay (s)	3.5		0.5		5712.9		157.0	
Approach LOS					F		F	

Intersection Summary				
Average Delay	1738.9			
Intersection Capacity Utilization	63.5%	ICU Level of Service		B
Analysis Period (min)	15			

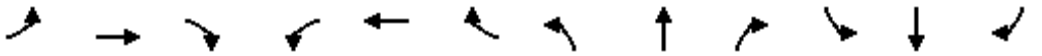


Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	500	180	90	600	570	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8		5.0	6.3	6.3	6.3
Lane Util. Factor	1.00		1.00	0.95	0.95	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1733		1770	3539	3539	1583
Flt Permitted	0.96		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1733		1770	3539	3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	556	200	100	667	633	267
RTOR Reduction (vph)	8	0	0	0	0	191
Lane Group Flow (vph)	748	0	100	667	633	76
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases						6
Actuated Green, G (s)	32.4		7.8	35.8	23.0	23.0
Effective Green, g (s)	32.4		7.8	35.8	23.0	23.0
Actuated g/C Ratio	0.40		0.10	0.44	0.28	0.28
Clearance Time (s)	6.8		5.0	6.3	6.3	6.3
Vehicle Extension (s)	2.0		2.0	3.0	3.0	3.0
Lane Grp Cap (vph)	690		169	1558	1001	447
v/s Ratio Prot	c0.43		c0.06	0.19	c0.18	
v/s Ratio Perm						0.05
v/c Ratio	1.08		0.59	0.43	0.63	0.17
Uniform Delay, d1	24.4		35.2	15.7	25.5	22.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	59.4		3.7	0.2	1.3	0.2
Delay (s)	83.8		38.9	15.9	26.8	22.1
Level of Service	F		D	B	C	C
Approach Delay (s)	83.8			18.9	25.4	
Approach LOS	F			B	C	

Intersection Summary			
HCM 2000 Control Delay	41.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	81.3	Sum of lost time (s)	18.1
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

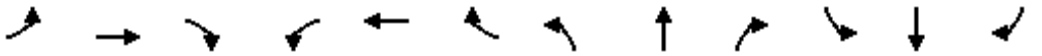
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	120	0	790	340	0	870
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0		4.0
Lane Util. Factor	1.00		1.00	1.00		1.00
Frt	1.00		1.00	0.85		1.00
Flt Protected	0.95		1.00	1.00		1.00
Satd. Flow (prot)	1770		1863	1583		1863
Flt Permitted	0.95		1.00	1.00		1.00
Satd. Flow (perm)	1770		1863	1583		1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	130	0	859	370	0	946
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	130	0	859	370	0	946
Turn Type	NA	custom	NA	Free	Perm	NA
Protected Phases			2			6
Permitted Phases	8	8		Free	6	
Actuated Green, G (s)	7.7		38.8	54.5		38.8
Effective Green, g (s)	7.7		38.8	54.5		38.8
Actuated g/C Ratio	0.14		0.71	1.00		0.71
Clearance Time (s)	4.0		4.0			4.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	250		1326	1583		1326
v/s Ratio Prot			0.46			c0.51
v/s Ratio Perm	c0.07			0.23		
v/c Ratio	0.52		0.65	0.23		0.71
Uniform Delay, d1	21.7		4.2	0.0		4.6
Progression Factor	1.00		1.00	1.00		1.00
Incremental Delay, d2	1.9		1.1	0.3		1.8
Delay (s)	23.6		5.3	0.3		6.4
Level of Service	C		A	A		A
Approach Delay (s)	23.6		3.8			6.4
Approach LOS	C		A			A

Intersection Summary			
HCM 2000 Control Delay	6.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	54.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	10	10	740	10	10	10	1040	700	10	800	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1817	1583	1681	1687	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1817	1583	1681	1687	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	10	10	10	771	10	10	10	1083	729	10	833	10
RTOR Reduction (vph)	0	0	10	0	0	0	0	0	0	0	0	6
Lane Group Flow (vph)	0	20	0	393	388	10	10	1083	729	10	833	4
Turn Type	Split	NA	Perm	Split	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			Free			Free			6
Actuated Green, G (s)		3.9	3.9	36.7	36.7	108.6	1.9	47.1	108.6	1.9	47.1	47.1
Effective Green, g (s)		3.9	3.9	36.7	36.7	108.6	1.9	47.1	108.6	1.9	47.1	47.1
Actuated g/C Ratio		0.04	0.04	0.34	0.34	1.00	0.02	0.43	1.00	0.02	0.43	0.43
Clearance Time (s)		5.0	5.0	5.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0		2.0	4.0		2.0	4.0	4.0
Lane Grp Cap (vph)		65	56	568	570	1583	30	1534	1583	30	1534	686
v/s Ratio Prot		0.01		c0.23	0.23		0.01	c0.31		0.01	0.24	
v/s Ratio Perm			0.00			0.01			c0.46			0.00
v/c Ratio		0.31	0.01	0.69	0.68	0.01	0.33	0.71	0.46	0.33	0.54	0.01
Uniform Delay, d1		51.0	50.5	31.1	30.9	0.0	52.7	25.1	0.0	52.7	22.8	17.5
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.7	0.0	3.6	3.3	0.0	2.4	1.6	1.0	2.4	0.5	0.0
Delay (s)		53.7	50.5	34.7	34.3	0.0	55.1	26.7	1.0	55.1	23.3	17.5
Level of Service		D	D	C	C	A	E	C	A	E	C	B
Approach Delay (s)		52.7			34.0			16.6			23.6	
Approach LOS		D			C			B			C	

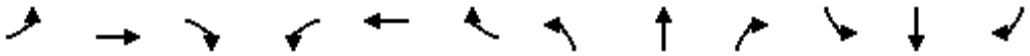
Intersection Summary			
HCM 2000 Control Delay	22.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	108.6	Sum of lost time (s)	19.0
Intersection Capacity Utilization	64.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	100	30	280	170	410	70	480	270	400	490	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1846	1583		1807	1527	1770	1863	1583	1770	1863	1583
Flt Permitted		0.82	1.00		0.73	1.00	0.34	1.00	1.00	0.16	1.00	1.00
Satd. Flow (perm)		1522	1583		1366	1527	640	1863	1583	304	1863	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	22	108	32	301	183	441	75	516	290	430	527	43
RTOR Reduction (vph)	0	0	20	0	0	208	0	0	189	0	0	24
Lane Group Flow (vph)	0	130	12	0	484	233	75	516	101	430	527	19
Confl. Peds. (#/hr)	6					6						
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		39.2	39.2		39.2	39.2	41.9	36.4	36.4	55.5	46.0	46.0
Effective Green, g (s)		39.2	39.2		39.2	39.2	41.9	36.4	36.4	55.5	46.0	46.0
Actuated g/C Ratio		0.37	0.37		0.37	0.37	0.40	0.35	0.35	0.53	0.44	0.44
Clearance Time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		569	592		511	571	315	647	550	372	818	695
v/s Ratio Prot							0.01	0.28		c0.17	0.28	
v/s Ratio Perm		0.09	0.01		c0.35	0.15	0.08		0.06	c0.44		0.01
v/c Ratio		0.23	0.02		0.95	0.41	0.24	0.80	0.18	1.16	0.64	0.03
Uniform Delay, d1		22.4	20.6		31.7	24.2	20.2	30.8	23.8	24.7	23.0	16.7
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.1	0.0		26.8	0.3	0.1	7.8	0.3	96.3	2.4	0.0
Delay (s)		22.6	20.7		58.6	24.5	20.3	38.6	24.1	121.0	25.3	16.7
Level of Service		C	C		E	C	C	D	C	F	C	B
Approach Delay (s)		22.2			42.3			32.3			66.1	
Approach LOS		C			D			C			E	

Intersection Summary			
HCM 2000 Control Delay	46.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	104.7	Sum of lost time (s)	14.0
Intersection Capacity Utilization	90.2%	ICU Level of Service	E
Analysis Period (min)	15		

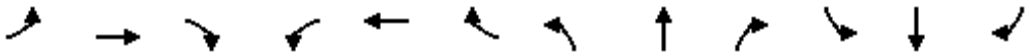
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	460	80	110	660	400	30	220	70	360	430	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.96		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1814		1769	1863	1583	1770	1786		1769	1790	
Flt Permitted	0.09	1.00		0.19	1.00	1.00	0.14	1.00		0.30	1.00	
Satd. Flow (perm)	168	1814		361	1863	1583	258	1786		550	1790	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	186	474	82	113	680	412	31	227	72	371	443	124
RTOR Reduction (vph)	0	4	0	0	0	226	0	8	0	0	7	0
Lane Group Flow (vph)	186	552	0	113	680	186	31	291	0	371	560	0
Confl. Peds. (#/hr)			3	3			3		1	1		3
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	56.9	44.3		49.1	40.4	40.4	33.8	30.1		48.2	39.5	
Effective Green, g (s)	56.9	44.3		49.1	40.4	40.4	33.8	30.1		48.2	39.5	
Actuated g/C Ratio	0.49	0.38		0.42	0.35	0.35	0.29	0.26		0.41	0.34	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	255	691		257	647	550	123	462		365	608	
v/s Ratio Prot	c0.08	c0.30		0.03	c0.37		0.01	0.16		c0.11	0.31	
v/s Ratio Perm	0.28			0.15		0.12	0.07			c0.31		
v/c Ratio	0.73	0.80		0.44	1.05	0.34	0.25	0.63		1.02	0.92	
Uniform Delay, d1	27.1	32.0		23.4	37.9	28.0	31.7	38.1		31.3	36.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.5	6.4		0.4	49.5	0.4	0.4	2.7		51.3	19.5	
Delay (s)	35.6	38.4		23.8	87.4	28.4	32.1	40.8		82.6	56.4	
Level of Service	D	D		C	F	C	C	D		F	E	
Approach Delay (s)		37.7			61.3			40.0			66.8	
Approach LOS		D			E			D			E	

Intersection Summary			
HCM 2000 Control Delay	55.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	116.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	97.4%	ICU Level of Service	F
Analysis Period (min)	15		

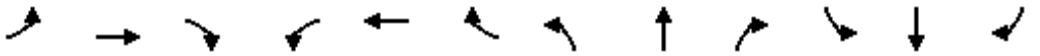
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	230	430	170	30	440	90	130	390	40	100	470	300
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	235	439	173	31	449	92	133	398	41	102	480	306

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	847	571	133	439	102	786
Volume Left (vph)	235	31	133	0	102	0
Volume Right (vph)	173	92	0	41	0	306
Hadj (s)	-0.03	-0.05	0.53	-0.03	0.53	-0.24
Departure Headway (s)	9.4	9.4	10.2	9.6	10.2	9.4
Degree Utilization, x	2.22	1.49	0.37	1.17	0.29	2.05
Capacity (veh/h)	389	394	351	379	350	390
Control Delay (s)	576.9	259.9	17.9	130.3	16.0	501.2
Approach Delay (s)	576.9	259.9	104.2		445.4	
Approach LOS	F	F	F		F	

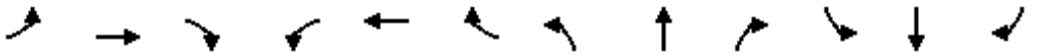
Intersection Summary				
Delay	379.5			
Level of Service	F			
Intersection Capacity Utilization	139.7%	ICU Level of Service		H
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	650	0	10	0	0	0	70	900	0	10	1330	850
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0					5.0	7.0		5.0	7.0	7.0
Lane Util. Factor		1.00					1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes		1.00					1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00					1.00	1.00		1.00	1.00	1.00
Frt		1.00					1.00	1.00		1.00	1.00	0.85
Flt Protected		0.95					0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1772					1770	3539		1770	3539	1550
Flt Permitted		0.95					0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1772					1770	3539		1770	3539	1550
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	707	0	11	0	0	0	76	978	0	11	1446	924
RTOR Reduction (vph)	0	54	0	0	0	0	0	0	0	0	0	396
Lane Group Flow (vph)	0	664	0	0	0	0	76	978	0	11	1446	528
Confl. Peds. (#/hr)												1
Turn Type	Perm	NA					Prot	NA		Prot	NA	Perm
Protected Phases		4					5	2		1	6	
Permitted Phases	4											6
Actuated Green, G (s)		30.1					8.5	80.4		1.3	73.2	73.2
Effective Green, g (s)		30.1					8.5	80.4		1.3	73.2	73.2
Actuated g/C Ratio		0.23					0.07	0.62		0.01	0.56	0.56
Clearance Time (s)		6.0					5.0	7.0		5.0	7.0	7.0
Vehicle Extension (s)		2.0					2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		410					115	2192		17	1995	874
v/s Ratio Prot							c0.04	0.28		0.01	c0.41	
v/s Ratio Perm		0.37										0.34
v/c Ratio		1.62					0.66	0.45		0.65	0.72	0.60
Uniform Delay, d1		49.9					59.2	13.0		64.0	20.9	18.7
Progression Factor		1.00					1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		290.1					10.5	0.3		49.2	1.6	1.7
Delay (s)		339.9					69.7	13.3		113.2	22.5	20.5
Level of Service		F					E	B		F	C	C
Approach Delay (s)		339.9			0.0			17.4			22.1	
Approach LOS		F			A			B			C	

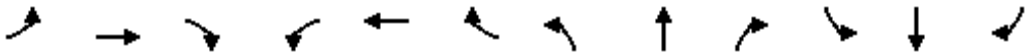
Intersection Summary			
HCM 2000 Control Delay	75.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	129.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	92.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	50	10	30	90	120	10	670	30	80	620	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00		0.98		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.93		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.99	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1847	1583		1695		1769	1848		1770	1863	1545
Flt Permitted		0.91	1.00		0.95		0.32	1.00		0.19	1.00	1.00
Satd. Flow (perm)		1687	1583		1622		599	1848		355	1863	1545
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	54	11	33	98	130	11	728	33	87	674	11
RTOR Reduction (vph)	0	0	9	0	28	0	0	1	0	0	0	4
Lane Group Flow (vph)	0	65	2	0	233	0	11	760	0	87	674	7
Confl. Peds. (#/hr)	1					1	2		5	5		2
Confl. Bikes (#/hr)						8						
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		17.1	17.1		17.6		49.6	48.9		57.7	53.0	53.0
Effective Green, g (s)		17.1	17.1		17.6		49.6	48.9		57.7	53.0	53.0
Actuated g/C Ratio		0.20	0.20		0.20		0.57	0.56		0.66	0.61	0.61
Clearance Time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0		2.0		2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		330	310		327		349	1035		312	1131	937
v/s Ratio Prot							0.00	c0.41		c0.02	c0.36	
v/s Ratio Perm		0.04	0.00		c0.14		0.02			0.17		0.00
v/c Ratio		0.20	0.01		0.71		0.03	0.73		0.28	0.60	0.01
Uniform Delay, d1		29.4	28.3		32.5		8.8	14.3		9.7	10.6	6.8
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.1	0.0		6.0		0.0	3.3		0.2	1.3	0.0
Delay (s)		29.5	28.3		38.5		8.8	17.7		9.9	11.8	6.8
Level of Service		C	C		D		A	B		A	B	A
Approach Delay (s)		29.3			38.5			17.5			11.6	
Approach LOS		C			D			B			B	

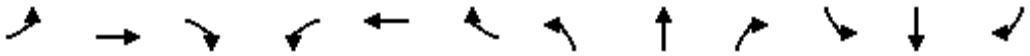
Intersection Summary			
HCM 2000 Control Delay	18.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	87.3	Sum of lost time (s)	16.5
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	150	10	80	210	240	20	70	100	260	210	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1767	1843		1767	1863	1549	1767	1863	1549	1767	1835	
Flt Permitted	0.62	1.00		0.65	1.00	1.00	0.60	1.00	1.00	0.71	1.00	
Satd. Flow (perm)	1146	1843		1204	1863	1549	1124	1863	1549	1316	1835	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	163	11	87	228	261	22	76	109	283	228	22
RTOR Reduction (vph)	0	6	0	0	0	176	0	0	62	0	7	0
Lane Group Flow (vph)	11	168	0	87	228	85	22	76	47	283	243	0
Confl. Peds. (#/hr)	2		2	2		2	2		2	2		2
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	10.6	10.6		10.6	10.6	10.6	13.9	13.9	13.9	13.9	13.9	
Effective Green, g (s)	10.6	10.6		10.6	10.6	10.6	13.9	13.9	13.9	13.9	13.9	
Actuated g/C Ratio	0.33	0.33		0.33	0.33	0.33	0.43	0.43	0.43	0.43	0.43	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	373	601		392	607	505	480	796	662	562	784	
v/s Ratio Prot		0.09			c0.12			0.04			0.13	
v/s Ratio Perm	0.01			0.07		0.05	0.02		0.03	c0.22		
v/c Ratio	0.03	0.28		0.22	0.38	0.17	0.05	0.10	0.07	0.50	0.31	
Uniform Delay, d1	7.5	8.1		8.0	8.4	7.8	5.4	5.5	5.5	6.8	6.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.3		0.3	0.4	0.2	0.0	0.1	0.0	0.7	0.2	
Delay (s)	7.5	8.4		8.2	8.8	8.0	5.5	5.6	5.5	7.5	6.4	
Level of Service	A	A		A	A	A	A	A	A	A	A	
Approach Delay (s)		8.3			8.3			5.6			7.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	32.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	45.7%	ICU Level of Service	A
Analysis Period (min)	15		

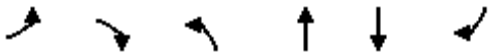
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	150	100	180	20	140	130	110	80	10	100	130	190
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	163	109	196	22	152	141	120	87	11	109	141	207
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	293			304			1005	870	207	755	897	223
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	293			304			1005	870	207	755	897	223
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	87			98			0	65	99	48	41	75
cM capacity (veh/h)	1268			1256			79	248	834	209	239	817

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	163	304	22	293	120	98	109	348
Volume Left	163	0	22	0	120	0	109	0
Volume Right	0	196	0	141	0	11	0	207
cSH	1268	1700	1256	1700	79	269	209	412
Volume to Capacity	0.13	0.18	0.02	0.17	1.52	0.36	0.52	0.84
Queue Length 95th (ft)	11	0	1	0	243	40	67	202
Control Delay (s)	8.3	0.0	7.9	0.0	379.8	25.8	39.4	46.0
Lane LOS	A		A		F	D	E	E
Approach Delay (s)	2.9		0.5		220.5		44.4	
Approach LOS					F		E	

Intersection Summary				
Average Delay	47.9			
Intersection Capacity Utilization	61.5%	ICU Level of Service	B	
Analysis Period (min)	15			

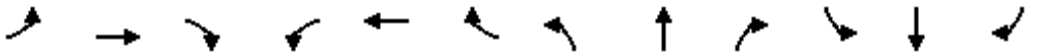


Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	200	90	100	630	700	400
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8		5.0	6.3	6.3	6.3
Lane Util. Factor	1.00		1.00	0.95	0.95	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	0.97		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1725		1770	3539	3539	1583
Flt Permitted	0.97		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1725		1770	3539	3539	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	220	99	110	692	769	440
RTOR Reduction (vph)	13	0	0	0	0	271
Lane Group Flow (vph)	306	0	110	692	769	169
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases						6
Actuated Green, G (s)	19.3		8.1	41.4	28.3	28.3
Effective Green, g (s)	19.3		8.1	41.4	28.3	28.3
Actuated g/C Ratio	0.26		0.11	0.56	0.38	0.38
Clearance Time (s)	6.8		5.0	6.3	6.3	6.3
Vehicle Extension (s)	2.0		2.0	3.0	3.0	3.0
Lane Grp Cap (vph)	451		194	1985	1357	607
v/s Ratio Prot	c0.18		c0.06	0.20	c0.22	
v/s Ratio Perm						0.11
v/c Ratio	0.68		0.57	0.35	0.57	0.28
Uniform Delay, d1	24.5		31.2	8.8	17.9	15.7
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	3.2		2.3	0.1	0.5	0.3
Delay (s)	27.7		33.4	8.9	18.5	16.0
Level of Service	C		C	A	B	B
Approach Delay (s)	27.7			12.3	17.6	
Approach LOS	C			B	B	

Intersection Summary			
HCM 2000 Control Delay	17.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	73.8	Sum of lost time (s)	18.1
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	310	0	930	110	0	710
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0		4.0
Lane Util. Factor	1.00		1.00	1.00		1.00
Frt	1.00		1.00	0.85		1.00
Flt Protected	0.95		1.00	1.00		1.00
Satd. Flow (prot)	1770		1863	1583		1863
Flt Permitted	0.95		1.00	1.00		1.00
Satd. Flow (perm)	1770		1863	1583		1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	337	0	1011	120	0	772
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	337	0	1011	120	0	772
Turn Type	NA	custom	NA	Free	Perm	NA
Protected Phases			2			6
Permitted Phases	8	8		Free	6	
Actuated Green, G (s)	14.4		35.1	57.5		35.1
Effective Green, g (s)	14.4		35.1	57.5		35.1
Actuated g/C Ratio	0.25		0.61	1.00		0.61
Clearance Time (s)	4.0		4.0			4.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	443		1137	1583		1137
v/s Ratio Prot			c0.54			0.41
v/s Ratio Perm	c0.19			0.08		
v/c Ratio	0.76		0.89	0.08		0.68
Uniform Delay, d1	20.0		9.5	0.0		7.5
Progression Factor	1.00		1.00	1.00		1.00
Incremental Delay, d2	7.5		8.7	0.1		1.6
Delay (s)	27.5		18.3	0.1		9.1
Level of Service	C		B	A		A
Approach Delay (s)	27.5		16.3			9.1
Approach LOS	C		B			A

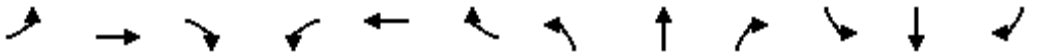
Intersection Summary			
HCM 2000 Control Delay	15.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	57.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	10	10	760	10	10	10	770	710	10	940	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1817	1583	1681	1688	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1817	1583	1681	1688	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	11	11	11	809	11	11	11	819	755	11	1000	11
RTOR Reduction (vph)	0	0	11	0	0	0	0	0	0	0	0	7
Lane Group Flow (vph)	0	22	0	413	407	11	11	819	755	11	1000	4
Turn Type	Split	NA	Perm	Split	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			Free			Free			6
Actuated Green, G (s)		4.0	4.0	37.8	37.8	105.7	1.9	43.0	105.7	1.9	43.0	43.0
Effective Green, g (s)		4.0	4.0	37.8	37.8	105.7	1.9	43.0	105.7	1.9	43.0	43.0
Actuated g/C Ratio		0.04	0.04	0.36	0.36	1.00	0.02	0.41	1.00	0.02	0.41	0.41
Clearance Time (s)		5.0	5.0	5.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0		2.0	4.0		2.0	4.0	4.0
Lane Grp Cap (vph)		68	59	601	603	1583	31	1439	1583	31	1439	643
v/s Ratio Prot		0.01		c0.25	0.24		0.01	0.23		0.01	c0.28	
v/s Ratio Perm			0.00			0.01			c0.48			0.00
v/c Ratio		0.32	0.01	0.69	0.67	0.01	0.35	0.57	0.48	0.35	0.69	0.01
Uniform Delay, d1		49.5	48.9	28.9	28.7	0.0	51.3	24.2	0.0	51.3	25.9	18.6
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.8	0.0	3.3	3.0	0.0	2.5	0.6	1.0	2.5	1.6	0.0
Delay (s)		52.3	49.0	32.2	31.7	0.0	53.8	24.8	1.0	53.8	27.5	18.7
Level of Service		D	D	C	C	A	D	C	A	D	C	B
Approach Delay (s)		51.2			31.5			13.7			27.7	
Approach LOS		D			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	22.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	105.7	Sum of lost time (s)	19.0
Intersection Capacity Utilization	64.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

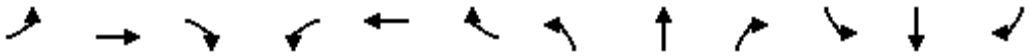
LOS Worksheets – Year 2026 with Project Conditions



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	210	81	303	150	320	61	572	439	460	592	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.98		1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1848	1550		1801	1583	1770	1863	1547	1770	1863	1583
Flt Permitted		0.59	1.00		0.51	1.00	0.21	1.00	1.00	0.09	1.00	1.00
Satd. Flow (perm)		1091	1550		954	1583	385	1863	1547	166	1863	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	45	236	91	340	169	360	69	643	493	517	665	11
RTOR Reduction (vph)	0	0	58	0	0	164	0	0	219	0	0	6
Lane Group Flow (vph)	0	281	33	0	509	196	69	643	274	517	665	5
Confl. Peds. (#/hr)			1	1					1			
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		40.0	40.0		40.0	40.0	46.3	40.8	40.8	59.8	50.3	50.3
Effective Green, g (s)		40.0	40.0		40.0	40.0	46.3	40.8	40.8	59.8	50.3	50.3
Actuated g/C Ratio		0.36	0.36		0.36	0.36	0.42	0.37	0.37	0.54	0.46	0.46
Clearance Time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		397	564		347	576	231	692	574	309	853	725
v/s Ratio Prot							0.01	0.35		c0.23	0.36	
v/s Ratio Perm		0.26	0.02		c0.53	0.12	0.11		0.18	c0.68		0.00
v/c Ratio		0.71	0.06		1.47	0.34	0.30	0.93	0.48	1.67	0.78	0.01
Uniform Delay, d1		29.9	22.7		34.9	25.3	21.2	33.1	26.3	33.9	25.1	16.2
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		5.3	0.0		225.3	0.3	0.3	19.5	1.3	316.8	5.3	0.0
Delay (s)		35.2	22.7		260.2	25.6	21.4	52.6	27.7	350.7	30.4	16.2
Level of Service		D	C		F	C	C	D	C	F	C	B
Approach Delay (s)		32.1			163.0			40.6			169.1	
Approach LOS		C			F			D			F	

Intersection Summary			
HCM 2000 Control Delay	111.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.63		
Actuated Cycle Length (s)	109.8	Sum of lost time (s)	14.0
Intersection Capacity Utilization	109.4%	ICU Level of Service	H
Analysis Period (min)	15		

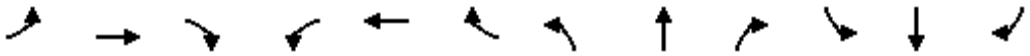
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	372	667	70	171	453	400	140	587	262	250	244	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.97	1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.95		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1832		1770	1863	1538	1770	1760		1770	1748	
Flt Permitted	0.09	1.00		0.10	1.00	1.00	0.27	1.00		0.09	1.00	
Satd. Flow (perm)	172	1832		195	1863	1538	495	1760		165	1748	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	388	695	73	178	472	417	146	611	273	260	254	177
RTOR Reduction (vph)	0	3	0	0	0	135	0	11	0	0	18	0
Lane Group Flow (vph)	388	765	0	178	472	282	146	873	0	260	413	0
Confl. Peds. (#/hr)	3		1	1		3			4	4		
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	70.4	51.0		52.6	38.2	38.2	48.0	40.1		58.1	45.2	
Effective Green, g (s)	70.4	51.0		52.6	38.2	38.2	48.0	40.1		58.1	45.2	
Actuated g/C Ratio	0.51	0.37		0.38	0.28	0.28	0.35	0.29		0.42	0.33	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	401	674		237	513	424	244	509		219	570	
v/s Ratio Prot	c0.19	c0.42		0.08	0.25		0.03	c0.50		c0.11	0.24	
v/s Ratio Perm	0.30			0.21		0.18	0.17			0.38		
v/c Ratio	0.97	1.14		0.75	0.92	0.66	0.60	1.71		1.19	0.73	
Uniform Delay, d1	43.4	43.8		34.3	48.7	44.5	34.2	49.2		40.9	41.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	35.9	78.5		11.2	21.9	3.9	2.6	329.8		120.6	4.6	
Delay (s)	79.3	122.2		45.5	70.6	48.4	36.9	379.0		161.5	45.7	
Level of Service	E	F		D	E	D	D	F		F	D	
Approach Delay (s)		107.8			57.7			330.5			89.3	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM 2000 Control Delay	149.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.34		
Actuated Cycle Length (s)	138.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	126.3%	ICU Level of Service	H
Analysis Period (min)	15		

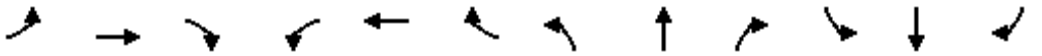
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	189	490	160	70	488	230	250	653	80	120	503	195
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	199	516	168	74	514	242	263	687	84	126	529	205

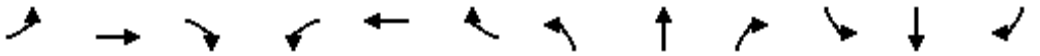
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	883	829	263	772	126	735
Volume Left (vph)	199	74	263	0	126	0
Volume Right (vph)	168	242	0	84	0	205
Hadj (s)	-0.04	-0.12	0.53	-0.04	0.53	-0.16
Departure Headway (s)	9.4	9.3	10.2	9.6	10.2	9.5
Degree Utilization, x	2.31	2.15	0.74	2.05	0.36	1.93
Capacity (veh/h)	390	393	349	382	351	386
Control Delay (s)	618.8	547.3	36.2	503.9	17.5	449.6
Approach Delay (s)	618.8	547.3	385.0		386.2	
Approach LOS	F	F	F		F	

Intersection Summary				
Delay	479.8			
Level of Service	F			
Intersection Capacity Utilization	151.3%	ICU Level of Service	H	
Analysis Period (min)	15			



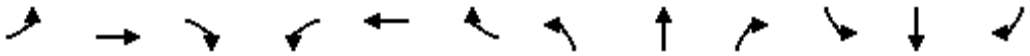
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	910	0	50	0	0	0	110	1335	0	0	940	668
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0					5.0	7.0			7.0	7.0
Lane Util. Factor		1.00					1.00	0.95			0.95	1.00
Frt		0.99					1.00	1.00			1.00	0.85
Flt Protected		0.95					0.95	1.00			1.00	1.00
Satd. Flow (prot)		1766					1770	3539			3539	1583
Flt Permitted		0.95					0.95	1.00			1.00	1.00
Satd. Flow (perm)		1766					1770	3539			3539	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	948	0	52	0	0	0	115	1391	0	0	979	696
RTOR Reduction (vph)	0	52	0	0	0	0	0	0	0	0	0	362
Lane Group Flow (vph)	0	948	0	0	0	0	115	1391	0	0	979	334
Turn Type	Perm	NA					Prot	NA		Prot	NA	Perm
Protected Phases		4					5	2		1	6	
Permitted Phases	4											6
Actuated Green, G (s)		30.7					12.1	73.1			56.0	56.0
Effective Green, g (s)		30.7					12.1	73.1			56.0	56.0
Actuated g/C Ratio		0.26					0.10	0.63			0.48	0.48
Clearance Time (s)		6.0					5.0	7.0			7.0	7.0
Vehicle Extension (s)		2.0					2.0	5.0			5.0	5.0
Lane Grp Cap (vph)		464					183	2214			1696	758
v/s Ratio Prot							0.06	c0.39			0.28	
v/s Ratio Perm		0.54										0.21
v/c Ratio		2.04					0.63	0.63			0.58	0.44
Uniform Delay, d1		43.0					50.2	13.5			21.9	20.1
Progression Factor		1.00					1.00	1.00			1.00	1.00
Incremental Delay, d2		477.3					4.8	0.8			0.8	0.9
Delay (s)		520.3					55.0	14.3			22.6	20.9
Level of Service		F					D	B			C	C
Approach Delay (s)		520.3			0.0			17.4			21.9	
Approach LOS		F			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	139.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	116.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	108.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	120	11	59	60	60	11	911	90	200	816	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.98		0.99		1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.95		1.00	0.99		1.00	1.00	0.85
Flt Protected		1.00	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1856	1547		1725		1770	1838		1770	1863	1547
Flt Permitted		0.96	1.00		0.73		0.22	1.00		0.05	1.00	1.00
Satd. Flow (perm)		1783	1547		1271		410	1838		97	1863	1547
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	11	136	12	67	68	68	12	1035	102	227	927	11
RTOR Reduction (vph)	0	0	10	0	15	0	0	2	0	0	0	3
Lane Group Flow (vph)	0	147	2	0	188	0	12	1135	0	227	927	8
Confl. Peds. (#/hr)	1		1	1		1	1					1
Confl. Bikes (#/hr)						8						
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		19.7	19.7		20.2		74.7	72.8		90.0	84.1	84.1
Effective Green, g (s)		19.7	19.7		20.2		74.7	72.8		90.0	84.1	84.1
Actuated g/C Ratio		0.16	0.16		0.17		0.61	0.60		0.74	0.69	0.69
Clearance Time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0		2.0		2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		287	249		210		271	1094		252	1282	1064
v/s Ratio Prot							0.00	c0.62		c0.10	0.50	
v/s Ratio Perm		0.08	0.00		c0.15		0.03			0.57		0.00
v/c Ratio		0.51	0.01		0.90		0.04	1.04		0.90	0.72	0.01
Uniform Delay, d1		46.9	43.0		50.0		11.5	24.7		42.9	11.8	6.0
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.6	0.0		34.1		0.0	37.3		31.3	2.5	0.0
Delay (s)		47.5	43.0		84.0		11.6	62.0		74.2	14.3	6.0
Level of Service		D	D		F		B	E		E	B	A
Approach Delay (s)		47.2			84.0			61.5			25.9	
Approach LOS		D			F			E			C	

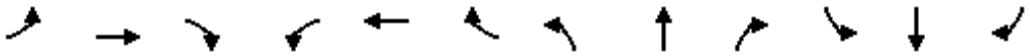
Intersection Summary			
HCM 2000 Control Delay	46.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	122.2	Sum of lost time (s)	16.5
Intersection Capacity Utilization	94.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	28	383	20	159	162	360	10	418	205	290	210	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.97	1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1752	1846		1759	1863	1532	1753	1863	1532	1759	1834	
Flt Permitted	0.65	1.00		0.33	1.00	1.00	0.60	1.00	1.00	0.41	1.00	
Satd. Flow (perm)	1191	1846		608	1863	1532	1116	1863	1532	754	1834	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.82
Adj. Flow (vph)	30	416	22	173	176	391	11	454	223	315	228	21
RTOR Reduction (vph)	0	4	0	0	0	197	0	0	116	0	7	0
Lane Group Flow (vph)	30	434	0	173	176	194	11	454	107	315	242	0
Confl. Peds. (#/hr)	10		10	10		10	10		10	10		10
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	16.2	16.2		16.2	16.2	16.2	22.3	22.3	22.3	22.3	22.3	
Effective Green, g (s)	16.2	16.2		16.2	16.2	16.2	22.3	22.3	22.3	22.3	22.3	
Actuated g/C Ratio	0.35	0.35		0.35	0.35	0.35	0.48	0.48	0.48	0.48	0.48	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	414	643		211	649	533	535	893	734	361	879	
v/s Ratio Prot		0.24			0.09			0.24			0.13	
v/s Ratio Perm	0.03			c0.28		0.13	0.01		0.07	c0.42		
v/c Ratio	0.07	0.68		0.82	0.27	0.36	0.02	0.51	0.15	0.87	0.28	
Uniform Delay, d1	10.1	12.9		13.8	10.9	11.3	6.4	8.3	6.8	10.8	7.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	2.8		21.4	0.2	0.4	0.0	0.5	0.1	20.0	0.2	
Delay (s)	10.2	15.7		35.2	11.1	11.7	6.4	8.8	6.9	30.9	7.4	
Level of Service	B	B		D	B	B	A	A	A	C	A	
Approach Delay (s)		15.4			17.1			8.1			20.5	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	46.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		

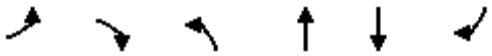
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	280	232	160	10	132	50	259	180	10	100	90	206
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	304	252	174	11	143	54	282	196	11	109	98	224
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	198			426			1386	1167	339	1162	1227	171
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	198			426			1386	1167	339	1162	1227	171
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	78			99			0	0	98	0	29	74
cM capacity (veh/h)	1375			1133			32	149	703	0	137	873

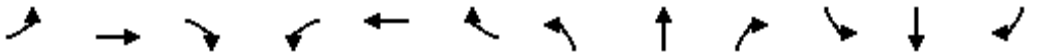
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	304	426	11	198	282	207	109	322
Volume Left	304	0	11	0	282	0	109	0
Volume Right	0	174	0	54	0	11	0	224
cSH	1375	1700	1133	1700	32	156	0	332
Volume to Capacity	0.22	0.25	0.01	0.12	8.77	1.33	Err	0.97
Queue Length 95th (ft)	21	0	1	0	Err	313	Err	259
Control Delay (s)	8.4	0.0	8.2	0.0	Err	240.2	Err	77.7
Lane LOS	A		A		F	F	F	F
Approach Delay (s)	3.5		0.4		5869.4		Err	
Approach LOS					F		F	

Intersection Summary				
Average Delay	Err			
Intersection Capacity Utilization	70.6%	ICU Level of Service	C	
Analysis Period (min)	15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	575	180	90	600	570	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8		5.0	6.3	6.3	6.3
Lane Util. Factor	1.00		1.00	0.95	0.95	1.00
Frt	0.97		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1737		1770	3539	3539	1583
Flt Permitted	0.96		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1737		1770	3539	3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	639	200	100	667	633	300
RTOR Reduction (vph)	7	0	0	0	0	214
Lane Group Flow (vph)	832	0	100	667	633	86
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases						6
Actuated Green, G (s)	32.5		7.8	36.2	23.4	23.4
Effective Green, g (s)	32.5		7.8	36.2	23.4	23.4
Actuated g/C Ratio	0.40		0.10	0.44	0.29	0.29
Clearance Time (s)	6.8		5.0	6.3	6.3	6.3
Vehicle Extension (s)	2.0		2.0	3.0	3.0	3.0
Lane Grp Cap (vph)	690		168	1566	1012	452
v/s Ratio Prot	c0.48		c0.06	0.19	c0.18	
v/s Ratio Perm						0.05
v/c Ratio	1.21		0.60	0.43	0.63	0.19
Uniform Delay, d1	24.6		35.5	15.7	25.4	22.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	106.2		3.7	0.2	1.2	0.2
Delay (s)	130.8		39.2	15.8	26.6	22.2
Level of Service	F		D	B	C	C
Approach Delay (s)	130.8			18.9	25.2	
Approach LOS	F			B	C	

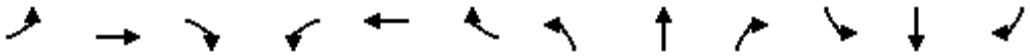
Intersection Summary			
HCM 2000 Control Delay	58.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	81.8	Sum of lost time (s)	18.1
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	108	30	38	31	22	54	30	899	33	50	910	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.98		1.00	1.00	0.97	1.00	1.00	0.97
Flpb, ped/bikes	0.99	1.00		0.99	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.92		1.00	0.89		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1758	1683		1760	1632		1768	1863	1539	1768	1863	1539
Flt Permitted	0.70	1.00		0.71	1.00		0.17	1.00	1.00	0.18	1.00	1.00
Satd. Flow (perm)	1301	1683		1313	1632		316	1863	1539	328	1863	1539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	117	33	41	34	24	59	33	977	36	54	989	60
RTOR Reduction (vph)	0	34	0	0	49	0	0	0	11	0	0	18
Lane Group Flow (vph)	117	40	0	34	34	0	33	977	25	54	989	42
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	9.9	9.9		9.9	9.9		40.3	40.3	40.3	40.3	40.3	40.3
Effective Green, g (s)	9.9	9.9		9.9	9.9		40.3	40.3	40.3	40.3	40.3	40.3
Actuated g/C Ratio	0.17	0.17		0.17	0.17		0.69	0.69	0.69	0.69	0.69	0.69
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	221	286		223	277		218	1290	1065	227	1290	1065
v/s Ratio Prot		0.02			0.02			0.52			c0.53	
v/s Ratio Perm	c0.09			0.03			0.10		0.02	0.16		0.03
v/c Ratio	0.53	0.14		0.15	0.12		0.15	0.76	0.02	0.24	0.77	0.04
Uniform Delay, d1	22.0	20.5		20.6	20.5		3.1	5.8	2.8	3.3	5.9	2.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.3	0.2		0.3	0.2		0.3	2.6	0.0	0.5	2.8	0.0
Delay (s)	24.3	20.8		20.9	20.7		3.4	8.4	2.8	3.8	8.7	2.8
Level of Service	C	C		C	C		A	A	A	A	A	A
Approach Delay (s)		22.9			20.7			8.0			8.1	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	58.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



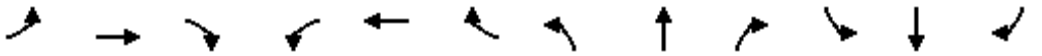
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized												
Volume (veh/h)	90	0	24	10	0	10	24	474	10	90	164	55
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	98	0	26	11	0	11	26	515	11	98	178	60
Approach Volume (veh/h)		124			22			552			336	
Crossing Volume (veh/h)		287			639			196			37	
High Capacity (veh/h)		1106			835			1188			1345	
High v/c (veh/h)		0.11			0.03			0.46			0.25	
Low Capacity (veh/h)		908			667			983			1125	
Low v/c (veh/h)		0.14			0.03			0.56			0.30	

Intersection Summary				
Maximum v/c High	0.46			
Maximum v/c Low	0.56			
Intersection Capacity Utilization	63.8%	ICU Level of Service	B	

Intersection	
Intersection Delay, s/veh	9.9
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	124	22	552	336
Demand Flow Rate, veh/h	127	22	563	343
Vehicles Circulating, veh/h	293	652	200	38
Vehicles Exiting, veh/h	88	111	220	636
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	5.9	6.5	13.0	6.5
Approach LOS	A	A	B	A

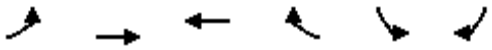
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	127	22	563	343
Cap Entry Lane, veh/h	843	589	925	1088
Entry HV Adj Factor	0.976	1.000	0.980	0.981
Flow Entry, veh/h	124	22	552	336
Cap Entry, veh/h	823	589	907	1067
V/C Ratio	0.151	0.037	0.609	0.315
Control Delay, s/veh	5.9	6.5	13.0	6.5
LOS	A	A	B	A
95th %tile Queue, veh	1	0	4	1



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	86	6	24	15	1	25	9	852	7	8	934	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.98		1.00	0.97		1.00	1.00	0.97	1.00	1.00	0.97
Flpb, ped/bikes	0.99	1.00		0.99	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.88		1.00	0.86		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1756	1608		1758	1551		1770	1863	1538	1767	1863	1538
Flt Permitted	0.74	1.00		0.74	1.00		0.17	1.00	1.00	0.22	1.00	1.00
Satd. Flow (perm)	1366	1608		1362	1551		324	1863	1538	407	1863	1538
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	93	7	26	16	1	27	10	926	8	9	1015	41
RTOR Reduction (vph)	0	22	0	0	23	0	0	0	2	0	0	11
Lane Group Flow (vph)	93	11	0	16	5	0	10	926	6	9	1015	30
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	9.3	9.3		9.3	9.3		44.4	44.4	44.4	44.4	44.4	44.4
Effective Green, g (s)	9.3	9.3		9.3	9.3		44.4	44.4	44.4	44.4	44.4	44.4
Actuated g/C Ratio	0.15	0.15		0.15	0.15		0.72	0.72	0.72	0.72	0.72	0.72
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	205	242		205	233		233	1340	1106	292	1340	1106
v/s Ratio Prot		0.01			0.00			0.50			c0.54	
v/s Ratio Perm	c0.07			0.01			0.03		0.00	0.02		0.02
v/c Ratio	0.45	0.05		0.08	0.02		0.04	0.69	0.01	0.03	0.76	0.03
Uniform Delay, d1	23.9	22.4		22.5	22.3		2.5	4.8	2.4	2.5	5.3	2.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	0.1		0.2	0.0		0.1	1.6	0.0	0.0	2.5	0.0
Delay (s)	25.5	22.5		22.7	22.4		2.6	6.4	2.4	2.5	7.8	2.5
Level of Service	C	C		C	C		A	A	A	A	A	A
Approach Delay (s)		24.7			22.5			6.3			7.6	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	61.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		

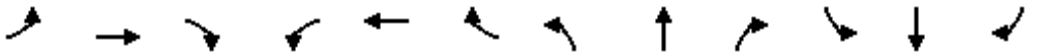
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	28	374	148	51	133	77
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	30	407	161	55	145	84
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1047				
pX, platoon unblocked						
vC, conflicting volume	216				656	189
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	216				656	189
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				66	90
cM capacity (veh/h)	1353				421	853

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	437	216	228
Volume Left	30	0	145
Volume Right	0	55	84
cSH	1353	1700	517
Volume to Capacity	0.02	0.13	0.44
Queue Length 95th (ft)	2	0	56
Control Delay (s)	0.8	0.0	17.4
Lane LOS	A		C
Approach Delay (s)	0.8	0.0	17.4
Approach LOS			C

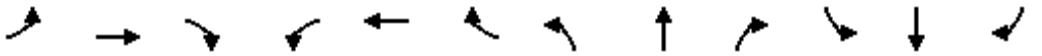
Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	54.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	17	16	6	199	5	20	2	830	381	6	955	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	0.98		1.00	1.00	0.98	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.96		1.00	0.88		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1781		1770	1604		1770	1863	1550	1770	1863	1583
Flt Permitted	0.93	1.00		0.48	1.00		0.11	1.00	1.00	0.19	1.00	1.00
Satd. Flow (perm)	1733	1781		898	1604		202	1863	1550	345	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	18	17	7	216	5	22	2	902	414	7	1038	12
RTOR Reduction (vph)	0	7	0	0	18	0	0	0	0	0	0	4
Lane Group Flow (vph)	18	17	0	216	9	0	2	902	414	7	1038	8
Confl. Peds. (#/hr)						2			2			
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Free	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2		Free	6		6
Actuated Green, G (s)	4.9	4.3		16.5	11.9		46.9	46.9	71.4	46.9	46.9	46.9
Effective Green, g (s)	4.9	4.3		16.5	11.9		46.9	46.9	71.4	46.9	46.9	46.9
Actuated g/C Ratio	0.07	0.06		0.23	0.17		0.66	0.66	1.00	0.66	0.66	0.66
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	119	107		307	267		132	1223	1550	226	1223	1039
v/s Ratio Prot	0.00	0.01		c0.08	0.01			0.48			c0.56	
v/s Ratio Perm	0.01			c0.08			0.01		0.27	0.02		0.00
v/c Ratio	0.15	0.16		0.70	0.03		0.02	0.74	0.27	0.03	0.85	0.01
Uniform Delay, d1	31.3	31.8		24.2	24.9		4.2	8.2	0.0	4.3	9.5	4.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.7		7.1	0.0		0.0	2.4	0.4	0.1	5.7	0.0
Delay (s)	31.9	32.6		31.3	25.0		4.3	10.5	0.4	4.3	15.2	4.2
Level of Service	C	C		C	C		A	B	A	A	B	A
Approach Delay (s)		32.3			30.6			7.3			15.0	
Approach LOS		C			C			A			B	

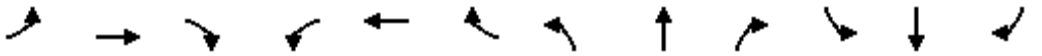
Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	71.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	10	10	740	10	10	10	1124	700	10	971	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1817	1583	1681	1687	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1817	1583	1681	1687	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	10	10	10	771	10	10	10	1171	729	10	1011	10
RTOR Reduction (vph)	0	0	10	0	0	0	0	0	0	0	0	5
Lane Group Flow (vph)	0	20	0	393	388	10	10	1171	729	10	1011	5
Turn Type	Split	NA	Perm	Split	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			Free			Free			6
Actuated Green, G (s)		3.9	3.9	37.8	37.8	114.3	1.9	51.7	114.3	1.9	51.7	51.7
Effective Green, g (s)		3.9	3.9	37.8	37.8	114.3	1.9	51.7	114.3	1.9	51.7	51.7
Actuated g/C Ratio		0.03	0.03	0.33	0.33	1.00	0.02	0.45	1.00	0.02	0.45	0.45
Clearance Time (s)		5.0	5.0	5.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0		2.0	4.0		2.0	4.0	4.0
Lane Grp Cap (vph)		61	54	555	557	1583	29	1600	1583	29	1600	716
v/s Ratio Prot		0.01		c0.23	0.23		0.01	c0.33		0.01	0.29	
v/s Ratio Perm			0.00			0.01			c0.46			0.00
v/c Ratio		0.33	0.01	0.71	0.70	0.01	0.34	0.73	0.46	0.34	0.63	0.01
Uniform Delay, d1		53.9	53.3	33.4	33.3	0.0	55.6	25.6	0.0	55.6	24.0	17.2
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		3.1	0.0	4.1	3.8	0.0	2.6	1.9	1.0	2.6	0.9	0.0
Delay (s)		57.1	53.4	37.5	37.0	0.0	58.2	27.5	1.0	58.2	24.9	17.2
Level of Service		E	D	D	D	A	E	C	A	E	C	B
Approach Delay (s)		55.8			36.8			17.5			25.2	
Approach LOS		E			D			B			C	

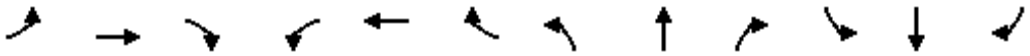
Intersection Summary			
HCM 2000 Control Delay	24.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	114.3	Sum of lost time (s)	19.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	100	32	367	170	410	73	596	336	400	640	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1847	1583		1801	1526	1770	1863	1583	1770	1863	1583
Flt Permitted		0.63	1.00		0.71	1.00	0.18	1.00	1.00	0.09	1.00	1.00
Satd. Flow (perm)		1172	1583		1321	1526	329	1863	1583	167	1863	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	22	108	34	395	183	441	78	641	361	430	688	43
RTOR Reduction (vph)	0	0	22	0	0	177	0	0	227	0	0	23
Lane Group Flow (vph)	0	130	12	0	578	264	78	641	134	430	688	20
Confl. Peds. (#/hr)	6					6						
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		40.0	40.0		40.0	40.0	46.4	40.6	40.6	59.6	49.8	49.8
Effective Green, g (s)		40.0	40.0		40.0	40.0	46.4	40.6	40.6	59.6	49.8	49.8
Actuated g/C Ratio		0.36	0.36		0.36	0.36	0.42	0.37	0.37	0.54	0.45	0.45
Clearance Time (s)		5.0	5.0		5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		427	577		482	556	215	690	586	310	846	719
v/s Ratio Prot							0.02	0.34		c0.19	0.37	
v/s Ratio Perm		0.11	0.01		c0.44	0.17	0.13		0.08	c0.56		0.01
v/c Ratio		0.30	0.02		1.20	0.47	0.36	0.93	0.23	1.39	0.81	0.03
Uniform Delay, d1		24.9	22.3		34.8	26.7	21.7	33.1	23.7	33.9	25.9	16.5
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.3	0.0		108.2	0.5	0.4	19.5	0.4	193.0	6.8	0.0
Delay (s)		25.2	22.3		143.0	27.2	22.1	52.6	24.1	226.8	32.7	16.6
Level of Service		C	C		F	C	C	D	C	F	C	B
Approach Delay (s)		24.6			92.9			40.9			104.0	
Approach LOS		C			F			D			F	

Intersection Summary			
HCM 2000 Control Delay	77.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	109.6	Sum of lost time (s)	14.0
Intersection Capacity Utilization	101.1%	ICU Level of Service	G
Analysis Period (min)	15		

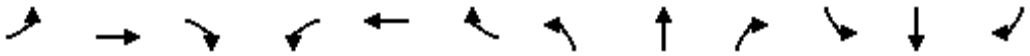
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	199	506	80	215	720	400	30	287	157	360	526	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.95		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1818		1770	1863	1583	1770	1750		1770	1790	
Flt Permitted	0.10	1.00		0.10	1.00	1.00	0.11	1.00		0.15	1.00	
Satd. Flow (perm)	185	1818		181	1863	1583	196	1750		271	1790	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	205	522	82	222	742	412	31	296	162	371	542	152
RTOR Reduction (vph)	0	4	0	0	0	214	0	14	0	0	7	0
Lane Group Flow (vph)	205	600	0	222	742	198	31	444	0	371	687	0
Confl. Peds. (#/hr)			3	3			3		1	1		3
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	55.3	40.3		57.1	41.2	41.2	41.7	38.0		56.1	47.4	
Effective Green, g (s)	55.3	40.3		57.1	41.2	41.2	41.7	38.0		56.1	47.4	
Actuated g/C Ratio	0.43	0.32		0.45	0.32	0.32	0.33	0.30		0.44	0.37	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	267	575		279	602	512	109	522		273	666	
v/s Ratio Prot	0.09	0.33		c0.10	c0.40		0.01	0.25		c0.14	0.38	
v/s Ratio Perm	0.24			0.26		0.12	0.08			c0.46		
v/c Ratio	0.77	1.04		0.80	1.23	0.39	0.28	0.85		1.36	1.03	
Uniform Delay, d1	31.4	43.5		33.1	43.0	33.3	33.9	42.0		28.9	40.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	11.3	49.3		13.6	118.6	0.5	0.5	12.6		183.5	43.3	
Delay (s)	42.6	92.8		46.7	161.7	33.8	34.4	54.5		212.4	83.2	
Level of Service	D	F		D	F	C	C	D		F	F	
Approach Delay (s)		80.1			104.8			53.3			128.2	
Approach LOS		F			F			D			F	

Intersection Summary			
HCM 2000 Control Delay	99.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	127.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	110.2%	ICU Level of Service	H
Analysis Period (min)	15		

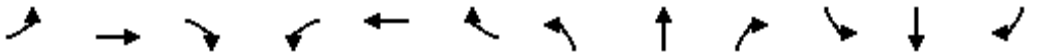
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	271	523	170	30	555	90	130	410	40	100	503	351
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	277	534	173	31	566	92	133	418	41	102	513	358

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	984	689	133	459	102	871
Volume Left (vph)	277	31	133	0	102	0
Volume Right (vph)	173	92	0	41	0	358
Hadj (s)	-0.02	-0.04	0.53	-0.03	0.53	-0.25
Departure Headway (s)	9.4	9.4	10.2	9.6	10.2	9.4
Degree Utilization, x	2.58	1.80	0.37	1.22	0.29	2.27
Capacity (veh/h)	391	387	351	380	350	392
Control Delay (s)	738.6	393.6	17.9	150.5	16.0	598.8
Approach Delay (s)	738.6	393.6	120.8		537.7	
Approach LOS	F	F	F		F	

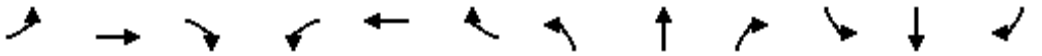
Intersection Summary				
Delay	491.9			
Level of Service	F			
Intersection Capacity Utilization	157.7%	ICU Level of Service		H
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	743	0	10	0	0	0	70	947	0	10	1405	965
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0					5.0	7.0		5.0	7.0	7.0
Lane Util. Factor		1.00					1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes		1.00					1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes		1.00					1.00	1.00		1.00	1.00	1.00
Frt		1.00					1.00	1.00		1.00	1.00	0.85
Flt Protected		0.95					0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1772					1770	3539		1770	3539	1550
Flt Permitted		0.95					0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1772					1770	3539		1770	3539	1550
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	808	0	11	0	0	0	76	1029	0	11	1527	1049
RTOR Reduction (vph)	0	54	0	0	0	0	0	0	0	0	0	396
Lane Group Flow (vph)	0	765	0	0	0	0	76	1029	0	11	1527	653
Confl. Peds. (#/hr)												1
Turn Type	Perm	NA					Prot	NA		Prot	NA	Perm
Protected Phases		4					5	2		1	6	
Permitted Phases	4											6
Actuated Green, G (s)		30.1					8.5	80.4		1.3	73.2	73.2
Effective Green, g (s)		30.1					8.5	80.4		1.3	73.2	73.2
Actuated g/C Ratio		0.23					0.07	0.62		0.01	0.56	0.56
Clearance Time (s)		6.0					5.0	7.0		5.0	7.0	7.0
Vehicle Extension (s)		2.0					2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		410					115	2192		17	1995	874
v/s Ratio Prot							c0.04	0.29		0.01	c0.43	
v/s Ratio Perm		0.43										0.42
v/c Ratio		1.87					0.66	0.47		0.65	0.77	0.75
Uniform Delay, d1		49.9					59.2	13.3		64.0	21.7	21.3
Progression Factor		1.00					1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		399.1					10.5	0.3		49.2	2.1	4.2
Delay (s)		449.0					69.7	13.6		113.2	23.8	25.6
Level of Service		F					E	B		F	C	C
Approach Delay (s)		449.0			0.0			17.5			24.9	
Approach LOS		F			A			B			C	

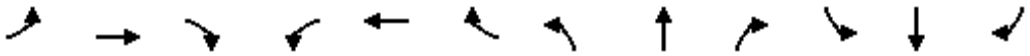
Intersection Summary			
HCM 2000 Control Delay	100.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	129.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	99.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	50	12	103	90	120	13	854	77	80	860	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00		0.99		1.00	1.00		1.00	1.00	0.97
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.95		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.99	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1847	1583		1713		1770	1835		1770	1863	1542
Flt Permitted		0.88	1.00		0.86		0.16	1.00		0.07	1.00	1.00
Satd. Flow (perm)		1645	1583		1506		303	1835		124	1863	1542
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	54	13	112	98	130	14	928	84	87	935	11
RTOR Reduction (vph)	0	0	10	0	17	0	0	2	0	0	0	4
Lane Group Flow (vph)	0	65	3	0	323	0	14	1010	0	87	935	7
Confl. Peds. (#/hr)	1					1	2		5	5		2
Confl. Bikes (#/hr)						8						
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		24.5	24.5		25.0		74.5	72.5		83.3	77.3	77.3
Effective Green, g (s)		24.5	24.5		25.0		74.5	72.5		83.3	77.3	77.3
Actuated g/C Ratio		0.20	0.20		0.21		0.62	0.60		0.69	0.64	0.64
Clearance Time (s)		6.5	6.5		6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0		2.0		2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)		335	322		312		212	1105		178	1197	990
v/s Ratio Prot							0.00	c0.55		c0.03	c0.50	
v/s Ratio Perm		0.04	0.00		c0.21		0.04			0.31		0.00
v/c Ratio		0.19	0.01		1.03		0.07	0.91		0.49	0.78	0.01
Uniform Delay, d1		39.7	38.2		47.6		14.2	21.1		23.4	15.4	7.7
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.1	0.0		60.0		0.0	12.0		0.8	3.9	0.0
Delay (s)		39.8	38.2		107.6		14.3	33.1		24.1	19.4	7.7
Level of Service		D	D		F		B	C		C	B	A
Approach Delay (s)		39.6			107.6			32.9			19.6	
Approach LOS		D			F			C			B	

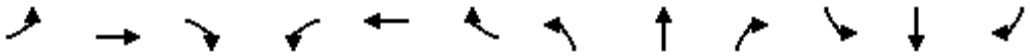
Intersection Summary			
HCM 2000 Control Delay	37.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	120.3	Sum of lost time (s)	16.5
Intersection Capacity Utilization	91.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	21	186	10	207	265	240	20	220	185	260	402	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.97	1.00	1.00	0.97	1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.99	1.00	1.00	1.00	1.00	1.00	0.99	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1758	1845		1756	1863	1536	1761	1863	1536	1757	1835	
Flt Permitted	0.57	1.00		0.62	1.00	1.00	0.37	1.00	1.00	0.61	1.00	
Satd. Flow (perm)	1051	1845		1155	1863	1536	686	1863	1536	1128	1835	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	23	202	11	225	288	261	22	239	201	283	437	40
RTOR Reduction (vph)	0	4	0	0	0	165	0	0	118	0	8	0
Lane Group Flow (vph)	23	209	0	225	288	96	22	239	83	283	469	0
Confl. Peds. (#/hr)	10		10	10		10	10		10	10		10
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	13.2	13.2		13.2	13.2	13.2	14.8	14.8	14.8	14.8	14.8	
Effective Green, g (s)	13.2	13.2		13.2	13.2	13.2	14.8	14.8	14.8	14.8	14.8	
Actuated g/C Ratio	0.37	0.37		0.37	0.37	0.37	0.41	0.41	0.41	0.41	0.41	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	385	676		423	683	563	282	765	631	463	754	
v/s Ratio Prot		0.11			0.15			0.13			c0.26	
v/s Ratio Perm	0.02			c0.19		0.06	0.03		0.05	0.25		
v/c Ratio	0.06	0.31		0.53	0.42	0.17	0.08	0.31	0.13	0.61	0.62	
Uniform Delay, d1	7.4	8.1		9.0	8.5	7.7	6.4	7.2	6.6	8.3	8.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.3		1.3	0.4	0.1	0.1	0.2	0.1	2.4	1.6	
Delay (s)	7.4	8.4		10.3	9.0	7.8	6.6	7.4	6.7	10.7	10.0	
Level of Service	A	A		B	A	A	A	A	A	B	A	
Approach Delay (s)		8.3			9.0			7.1			10.3	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	36.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		

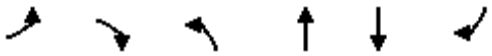
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	196	151	198	20	222	130	135	80	10	100	130	257
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	213	164	215	22	241	141	147	87	11	109	141	279
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	383			379			1333	1124	272	1000	1161	312
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	383			379			1333	1124	272	1000	1161	312
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	82			98			0	47	99	2	10	62
cM capacity (veh/h)	1176			1179			16	165	767	110	157	728

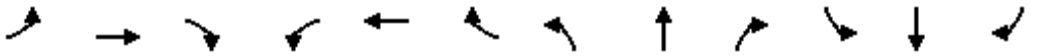
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	213	379	22	383	147	98	109	421
Volume Left	213	0	22	0	147	0	109	0
Volume Right	0	215	0	141	0	11	0	279
cSH	1176	1700	1179	1700	16	181	110	328
Volume to Capacity	0.18	0.22	0.02	0.23	9.27	0.54	0.98	1.28
Queue Length 95th (ft)	17	0	1	0	Err	70	157	491
Control Delay (s)	8.7	0.0	8.1	0.0	Err	46.2	154.4	182.0
Lane LOS	A		A		F	E	F	F
Approach Delay (s)	3.1		0.4		6017.9		176.4	
Approach LOS					F		F	

Intersection Summary				
Average Delay	885.1			
Intersection Capacity Utilization	73.9%	ICU Level of Service	D	
Analysis Period (min)	15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	247	90	100	630	700	475
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8		5.0	6.3	6.3	6.3
Lane Util. Factor	1.00		1.00	0.95	0.95	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	0.96		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1732		1770	3539	3539	1583
Flt Permitted	0.96		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1732		1770	3539	3539	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	271	99	110	692	769	522
RTOR Reduction (vph)	9	0	0	0	0	333
Lane Group Flow (vph)	361	0	110	692	769	189
Turn Type	NA		Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases						6
Actuated Green, G (s)	22.9		10.2	44.3	29.1	29.1
Effective Green, g (s)	22.9		10.2	44.3	29.1	29.1
Actuated g/C Ratio	0.29		0.13	0.55	0.36	0.36
Clearance Time (s)	6.8		5.0	6.3	6.3	6.3
Vehicle Extension (s)	2.0		2.0	3.0	3.0	3.0
Lane Grp Cap (vph)	493		224	1952	1282	573
v/s Ratio Prot	c0.21		c0.06	0.20	c0.22	
v/s Ratio Perm						0.12
v/c Ratio	0.73		0.49	0.35	0.60	0.33
Uniform Delay, d1	25.9		32.6	10.0	20.9	18.5
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	4.8		0.6	0.1	0.8	0.3
Delay (s)	30.7		33.3	10.1	21.6	18.9
Level of Service	C		C	B	C	B
Approach Delay (s)	30.7			13.3	20.5	
Approach LOS	C			B	C	

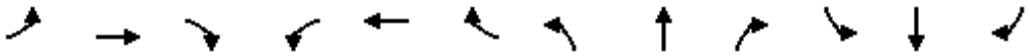
Intersection Summary			
HCM 2000 Control Delay	19.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	80.3	Sum of lost time (s)	18.1
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	117	41	59	31	42	69	64	980	32	74	803	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.98		1.00	0.98		1.00	1.00	0.97	1.00	1.00	0.97
Flpb, ped/bikes	0.99	1.00		0.99	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.91		1.00	0.91		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1756	1671		1758	1659		1767	1863	1536	1770	1863	1536
Flt Permitted	0.67	1.00		0.69	1.00		0.23	1.00	1.00	0.13	1.00	1.00
Satd. Flow (perm)	1243	1671		1271	1659		422	1863	1536	235	1863	1536
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	127	45	64	34	46	75	70	1065	35	80	873	160
RTOR Reduction (vph)	0	52	0	0	61	0	0	0	11	0	0	49
Lane Group Flow (vph)	127	57	0	34	60	0	70	1065	24	80	873	111
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	13.7	13.7		13.7	13.7		49.5	49.5	49.5	49.5	49.5	49.5
Effective Green, g (s)	13.7	13.7		13.7	13.7		49.5	49.5	49.5	49.5	49.5	49.5
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.70	0.70	0.70	0.70	0.70	0.70
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	239	321		244	319		293	1295	1067	163	1295	1067
v/s Ratio Prot		0.03			0.04			c0.57			0.47	
v/s Ratio Perm	c0.10			0.03			0.17		0.02	0.34		0.07
v/c Ratio	0.53	0.18		0.14	0.19		0.24	0.82	0.02	0.49	0.67	0.10
Uniform Delay, d1	25.9	24.0		23.9	24.1		4.0	7.7	3.4	5.0	6.2	3.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.3	0.3		0.3	0.3		0.4	4.3	0.0	2.3	1.4	0.0
Delay (s)	28.1	24.3		24.1	24.4		4.4	12.1	3.4	7.3	7.6	3.6
Level of Service	C	C		C	C		A	B	A	A	A	A
Approach Delay (s)		26.4			24.3			11.3			7.0	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	11.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	71.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



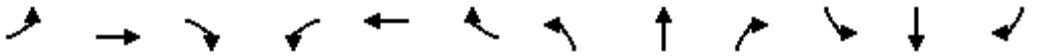
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized												
Volume (veh/h)	149	0	65	10	0	90	66	170	10	10	413	168
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	162	0	71	11	0	98	72	185	11	11	449	183
Approach Volume (veh/h)		233			109			267			642	
Crossing Volume (veh/h)		471			418			173			83	
High Capacity (veh/h)		956			996			1210			1298	
High v/c (veh/h)		0.24			0.11			0.22			0.49	
Low Capacity (veh/h)		774			810			1002			1083	
Low v/c (veh/h)		0.30			0.13			0.27			0.59	

Intersection Summary				
Maximum v/c High	0.49			
Maximum v/c Low	0.59			
Intersection Capacity Utilization	74.6%	ICU Level of Service	D	

Intersection	
Intersection Delay, s/veh	10.3
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	233	109	268	643
Demand Flow Rate, veh/h	237	111	273	656
Vehicles Circulating, veh/h	480	427	176	84
Vehicles Exiting, veh/h	260	22	541	454
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.6	6.6	6.9	12.5
Approach LOS	A	A	A	B

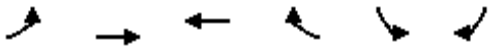
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	237	111	273	656
Cap Entry Lane, veh/h	699	737	948	1039
Entry HV Adj Factor	0.983	0.982	0.983	0.980
Flow Entry, veh/h	233	109	268	643
Cap Entry, veh/h	687	724	931	1018
V/C Ratio	0.339	0.151	0.288	0.631
Control Delay, s/veh	9.6	6.6	6.9	12.5
LOS	A	A	A	B
95th %tile Queue, veh	1	1	1	5



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	47	4	13	12	7	14	23	1014	17	24	792	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.98		1.00	0.98		1.00	1.00	0.97	1.00	1.00	0.97
Flpb, ped/bikes	0.99	1.00		0.99	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.88		1.00	0.90		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1755	1611		1757	1650		1766	1863	1537	1770	1863	1537
Flt Permitted	0.74	1.00		0.75	1.00		0.28	1.00	1.00	0.17	1.00	1.00
Satd. Flow (perm)	1372	1611		1379	1650		520	1863	1537	319	1863	1537
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	51	4	14	13	8	15	25	1102	18	26	861	83
RTOR Reduction (vph)	0	13	0	0	13	0	0	0	4	0	0	18
Lane Group Flow (vph)	51	5	0	13	10	0	25	1102	14	26	861	65
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	6.8	6.8		6.8	6.8		51.9	51.9	51.9	51.9	51.9	51.9
Effective Green, g (s)	6.8	6.8		6.8	6.8		51.9	51.9	51.9	51.9	51.9	51.9
Actuated g/C Ratio	0.10	0.10		0.10	0.10		0.78	0.78	0.78	0.78	0.78	0.78
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	139	164		140	168		404	1449	1195	248	1449	1195
v/s Ratio Prot		0.00			0.01			c0.59			0.46	
v/s Ratio Perm	c0.04			0.01			0.05		0.01	0.08		0.04
v/c Ratio	0.37	0.03		0.09	0.06		0.06	0.76	0.01	0.10	0.59	0.05
Uniform Delay, d1	27.9	27.0		27.2	27.1		1.7	4.0	1.7	1.8	3.1	1.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	0.1		0.3	0.1		0.1	2.4	0.0	0.2	0.7	0.0
Delay (s)	29.6	27.1		27.4	27.2		1.8	6.4	1.7	2.0	3.7	1.7
Level of Service	C	C		C	C		A	A	A	A	A	A
Approach Delay (s)		28.9			27.3			6.3			3.5	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	6.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	66.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

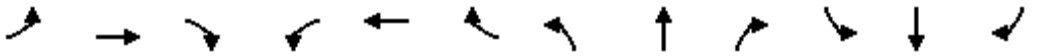
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	74	172	376	126	74	43
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	80	187	409	137	80	47
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1047				
pX, platoon unblocked						
vC, conflicting volume	546				825	477
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	546				825	477
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				74	92
cM capacity (veh/h)	1024				315	588

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	267	546	127
Volume Left	80	0	80
Volume Right	0	137	47
cSH	1024	1700	380
Volume to Capacity	0.08	0.32	0.33
Queue Length 95th (ft)	6	0	36
Control Delay (s)	3.2	0.0	19.2
Lane LOS	A		C
Approach Delay (s)	3.2	0.0	19.2
Approach LOS			C

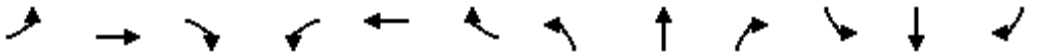
Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	8	9	3	394	15	11	6	1035	218	21	787	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00	0.98	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.96		1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1793		1770	1724		1770	1863	1550	1770	1863	1583
Flt Permitted	1.00	1.00		0.68	1.00		0.24	1.00	1.00	0.11	1.00	1.00
Satd. Flow (perm)	1863	1793		1263	1724		451	1863	1550	198	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	8	9	3	415	16	12	6	1089	229	22	828	11
RTOR Reduction (vph)	0	3	0	0	10	0	0	0	0	0	0	3
Lane Group Flow (vph)	8	9	0	415	18	0	6	1089	229	22	828	8
Confl. Peds. (#/hr)						2			2			
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Free	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2		Free	6		6
Actuated Green, G (s)	3.1	1.9		22.0	16.8		68.1	68.1	98.1	68.1	68.1	68.1
Effective Green, g (s)	3.1	1.9		22.0	16.8		68.1	68.1	98.1	68.1	68.1	68.1
Actuated g/C Ratio	0.03	0.02		0.22	0.17		0.69	0.69	1.00	0.69	0.69	0.69
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	57	34		366	295		313	1293	1550	137	1293	1098
v/s Ratio Prot	0.00	0.01		c0.19	0.01			c0.58			0.44	
v/s Ratio Perm	0.00			c0.07			0.01		0.15	0.11		0.00
v/c Ratio	0.14	0.27		1.13	0.06		0.02	0.84	0.15	0.16	0.64	0.01
Uniform Delay, d1	46.2	47.4		37.6	34.0		4.6	11.0	0.0	5.2	8.3	4.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	4.2		88.6	0.1		0.0	5.2	0.2	0.6	1.1	0.0
Delay (s)	47.4	51.6		126.1	34.1		4.7	16.2	0.2	5.7	9.4	4.6
Level of Service	D	D		F	C		A	B	A	A	A	A
Approach Delay (s)		49.9			120.3			13.4			9.2	
Approach LOS		D			F			B			A	

Intersection Summary			
HCM 2000 Control Delay	30.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	98.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.6%	ICU Level of Service	E
Analysis Period (min)	15		

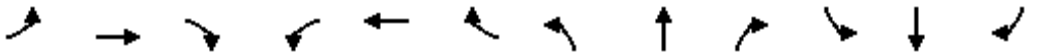
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	10	10	760	10	10	10	988	710	10	1104	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	4.0	4.0	5.0	4.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1817	1583	1681	1688	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.98	1.00	0.95	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1817	1583	1681	1688	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	11	11	11	809	11	11	11	1051	755	11	1174	11
RTOR Reduction (vph)	0	0	11	0	0	0	0	0	0	0	0	6
Lane Group Flow (vph)	0	22	0	413	407	11	11	1051	755	11	1174	5
Turn Type	Split	NA	Perm	Split	NA	Free	Prot	NA	Free	Prot	NA	Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4			Free			Free			6
Actuated Green, G (s)		4.0	4.0	40.2	40.2	117.8	2.0	52.6	117.8	2.0	52.6	52.6
Effective Green, g (s)		4.0	4.0	40.2	40.2	117.8	2.0	52.6	117.8	2.0	52.6	52.6
Actuated g/C Ratio		0.03	0.03	0.34	0.34	1.00	0.02	0.45	1.00	0.02	0.45	0.45
Clearance Time (s)		5.0	5.0	5.0	5.0		4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0		2.0	4.0		2.0	4.0	4.0
Lane Grp Cap (vph)		61	53	573	576	1583	30	1580	1583	30	1580	706
v/s Ratio Prot		0.01		c0.25	0.24		0.01	0.30		0.01	c0.33	
v/s Ratio Perm			0.00			0.01			c0.48			0.00
v/c Ratio		0.36	0.01	0.72	0.71	0.01	0.37	0.67	0.48	0.37	0.74	0.01
Uniform Delay, d1		55.6	55.0	33.9	33.7	0.0	57.3	25.7	0.0	57.3	27.0	18.1
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		3.6	0.1	4.4	3.9	0.0	2.8	1.2	1.0	2.8	2.1	0.0
Delay (s)		59.3	55.0	38.3	37.6	0.0	60.0	26.8	1.0	60.0	29.1	18.1
Level of Service		E	E	D	D	A	E	C	A	E	C	B
Approach Delay (s)		57.9			37.5			16.3			29.2	
Approach LOS		E			D			B			C	

Intersection Summary			
HCM 2000 Control Delay	25.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	117.8	Sum of lost time (s)	19.0
Intersection Capacity Utilization	68.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

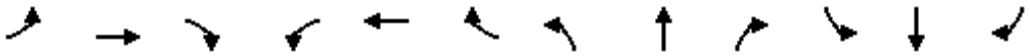
LOS Worksheets – Year 2022 with Partial Development with Mitigation (Pre-Project or Better) Conditions



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	170	71	330	80	280	31	561	454	440	556	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00
Frpb, ped/bikes		1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1849	1549	1767	1863	1583	1770	1863	1562	3433	1863	1583
Flt Permitted		0.95	1.00	0.55	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1768	1549	1030	1863	1583	1770	1863	1562	3433	1863	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	34	191	80	371	90	315	35	630	510	494	625	11
RTOR Reduction (vph)	0	0	54	0	0	211	0	0	264	0	0	6
Lane Group Flow (vph)	0	225	26	371	90	104	35	630	246	494	625	5
Confl. Peds. (#/hr)			1	1					1			
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		27.0	27.0	27.0	27.0	27.0	3.0	28.6	28.6	12.0	37.6	37.6
Effective Green, g (s)		27.0	27.0	27.0	27.0	27.0	3.0	28.6	28.6	12.0	37.6	37.6
Actuated g/C Ratio		0.33	0.33	0.33	0.33	0.33	0.04	0.35	0.35	0.15	0.46	0.46
Clearance Time (s)		5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5	2.5	2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		585	512	340	616	523	65	652	547	504	858	729
v/s Ratio Prot					0.05		0.02	c0.34		c0.14	0.34	
v/s Ratio Perm		0.13	0.02	c0.36		0.07			0.16			0.00
v/c Ratio		0.38	0.05	1.09	0.15	0.20	0.54	0.97	0.45	0.98	0.73	0.01
Uniform Delay, d1		20.9	18.6	27.3	19.2	19.6	38.6	26.0	20.4	34.7	17.9	11.9
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.3	0.0	75.5	0.1	0.1	4.2	27.2	1.2	34.8	3.8	0.0
Delay (s)		21.2	18.6	102.8	19.3	19.7	42.9	53.2	21.7	69.4	21.7	11.9
Level of Service		C	B	F	B	B	D	D	C	E	C	B
Approach Delay (s)		20.6			59.4			39.2			42.5	
Approach LOS		C			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	43.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	81.6	Sum of lost time (s)	14.0
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		

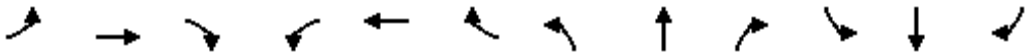
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	364	620	70	148	438	420	70	514	206	240	205	172
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.97	1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1769	3539	1548	1769	3539	1540	1770	1768		1770	1735	
Flt Permitted	0.22	1.00	1.00	0.25	1.00	1.00	0.50	1.00		0.08	1.00	
Satd. Flow (perm)	409	3539	1548	475	3539	1540	934	1768		140	1735	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	379	646	73	154	456	438	73	535	215	250	214	179
RTOR Reduction (vph)	0	0	55	0	0	209	0	12	0	0	24	0
Lane Group Flow (vph)	379	646	18	154	456	229	73	738	0	250	369	0
Confl. Peds. (#/hr)	3		1	1		3			4	4		
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	44.1	29.7	29.7	31.5	22.1	22.1	50.5	48.1		65.1	57.7	
Effective Green, g (s)	44.1	29.7	29.7	31.5	22.1	22.1	50.5	48.1		65.1	57.7	
Actuated g/C Ratio	0.37	0.25	0.25	0.26	0.19	0.19	0.42	0.40		0.55	0.48	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	345	881	385	227	656	285	412	713		240	839	
v/s Ratio Prot	c0.16	0.18		0.05	0.13		0.00	0.42		c0.10	0.21	
v/s Ratio Perm	c0.25		0.01	0.13		0.15	0.07			c0.46		
v/c Ratio	1.10	0.73	0.05	0.68	0.70	0.80	0.18	1.04		1.04	0.44	
Uniform Delay, d1	31.9	41.1	34.0	35.7	45.4	46.5	21.0	35.5		37.4	20.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	77.6	3.2	0.1	6.2	3.2	14.9	0.1	43.1		69.4	0.4	
Delay (s)	109.5	44.3	34.1	41.9	48.6	61.4	21.1	78.7		106.8	20.5	
Level of Service	F	D	C	D	D	E	C	E		F	C	
Approach Delay (s)		66.1			53.0			73.5			54.1	
Approach LOS		E			D			E			D	

Intersection Summary			
HCM 2000 Control Delay	61.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	119.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	102.7%	ICU Level of Service	G
Analysis Period (min)	15		

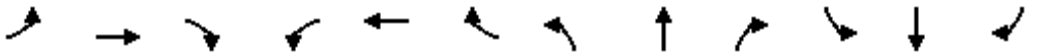
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	169	417	170	70	483	210	220	571	80	100	475	203
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes		0.99			0.99		1.00	1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.97			0.96		1.00	0.98		1.00	0.96	
Flt Protected		0.99			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1776			1774		1766	1828		1770	1767	
Flt Permitted		0.61			0.89		0.22	1.00		0.22	1.00	
Satd. Flow (perm)		1103			1578		413	1828		414	1767	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	178	439	179	74	508	221	232	601	84	105	500	214
RTOR Reduction (vph)	0	23	0	0	31	0	0	11	0	0	34	0
Lane Group Flow (vph)	0	773	0	0	772	0	232	674	0	105	680	0
Confl. Peds. (#/hr)	2		3	3		2	12					12
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		19.0			19.0		18.0	18.0		18.0	18.0	
Effective Green, g (s)		19.0			19.0		18.0	18.0		18.0	18.0	
Actuated g/C Ratio		0.42			0.42		0.40	0.40		0.40	0.40	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		465			666		165	731		165	706	
v/s Ratio Prot								0.37			0.38	
v/s Ratio Perm		c0.70			0.49		c0.56			0.25		
v/c Ratio		1.66			1.16		1.41	0.92		0.64	0.96	
Uniform Delay, d1		13.0			13.0		13.5	12.8		10.9	13.2	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		307.4			87.9		214.9	17.0		7.8	24.9	
Delay (s)		320.4			100.9		228.4	29.8		18.7	38.0	
Level of Service		F			F		F	C		B	D	
Approach Delay (s)		320.4			100.9			80.1			35.6	
Approach LOS		F			F			F			D	

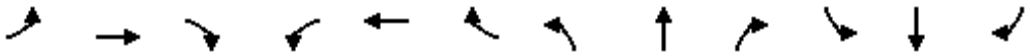
Intersection Summary			
HCM 2000 Control Delay	131.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.54		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	139.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



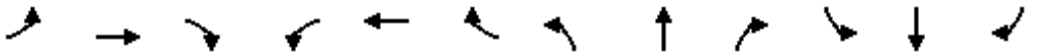
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	837	0	50	0	0	0	60	1114	0	0	891	613
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0				5.0	7.0			7.0	7.0
Lane Util. Factor	0.95	0.95	1.00				1.00	0.95			0.95	1.00
Frt	1.00	1.00	0.85				1.00	1.00			1.00	0.85
Flt Protected	0.95	0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)	1681	1681	1583				1770	3539			3539	1583
Flt Permitted	0.95	0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)	1681	1681	1583				1770	3539			3539	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	872	0	52	0	0	0	62	1160	0	0	928	639
RTOR Reduction (vph)	0	0	37	0	0	0	0	0	0	0	0	393
Lane Group Flow (vph)	436	436	15	0	0	0	62	1160	0	0	928	246
Turn Type	Split	NA	Perm				Prot	NA		Prot	NA	Perm
Protected Phases	4	4					5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)	18.2	18.2	18.2				2.2	31.2			24.0	24.0
Effective Green, g (s)	18.2	18.2	18.2				2.2	31.2			24.0	24.0
Actuated g/C Ratio	0.29	0.29	0.29				0.04	0.50			0.38	0.38
Clearance Time (s)	6.0	6.0	6.0				5.0	7.0			7.0	7.0
Vehicle Extension (s)	2.0	2.0	2.0				2.0	5.0			5.0	5.0
Lane Grp Cap (vph)	490	490	461				62	1769			1361	608
v/s Ratio Prot	c0.26	0.26					0.04	c0.33			0.26	
v/s Ratio Perm			0.01									0.16
v/c Ratio	0.89	0.89	0.03				1.00	0.66			0.68	0.40
Uniform Delay, d1	21.1	21.1	15.8				30.1	11.6			16.0	14.0
Progression Factor	1.00	1.00	1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2	17.3	17.3	0.0				114.3	1.2			1.8	0.9
Delay (s)	38.4	38.4	15.8				144.4	12.8			17.9	14.9
Level of Service	D	D	B				F	B			B	B
Approach Delay (s)		37.1			0.0			19.5			16.7	
Approach LOS		D			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	22.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	62.4	Sum of lost time (s)	18.0
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	196	157	141	10	112	50	246	160	10	100	90	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.93		1.00	0.95		1.00	0.99		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1731		1770	1777		1770	1846		1770	1678	
Flt Permitted	0.65	1.00		0.52	1.00		0.58	1.00		0.64	1.00	
Satd. Flow (perm)	1204	1731		976	1777		1087	1846		1194	1678	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	213	171	153	11	122	54	267	174	11	109	98	190
RTOR Reduction (vph)	0	88	0	0	36	0	0	5	0	0	110	0
Lane Group Flow (vph)	213	236	0	11	140	0	267	180	0	109	178	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	11.3	11.3		11.3	11.3		13.9	13.9		13.9	13.9	
Effective Green, g (s)	11.3	11.3		11.3	11.3		13.9	13.9		13.9	13.9	
Actuated g/C Ratio	0.34	0.34		0.34	0.34		0.42	0.42		0.42	0.42	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	409	589		332	604		455	772		499	702	
v/s Ratio Prot		0.14			0.08			0.10			0.11	
v/s Ratio Perm	c0.18			0.01			c0.25			0.09		
v/c Ratio	0.52	0.40		0.03	0.23		0.59	0.23		0.22	0.25	
Uniform Delay, d1	8.8	8.4		7.3	7.8		7.4	6.2		6.2	6.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	0.4		0.0	0.2		1.9	0.2		0.2	0.2	
Delay (s)	10.0	8.8		7.3	8.0		9.4	6.4		6.4	6.5	
Level of Service	A	A		A	A		A	A		A	A	
Approach Delay (s)		9.3			8.0			8.1			6.4	
Approach LOS		A			A			A			A	

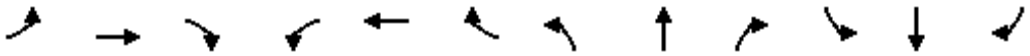
Intersection Summary			
HCM 2000 Control Delay	8.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	33.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	80	32	384	140	390	43	568	351	370	582	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1840	1583	1770	1863	1533	1770	1863	1583	3433	1863	1583
Flt Permitted		0.93	1.00	0.69	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1733	1583	1280	1863	1533	1770	1863	1583	3433	1863	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	22	86	34	413	151	419	46	611	377	398	626	32
RTOR Reduction (vph)	0	0	23	0	0	190	0	0	236	0	0	17
Lane Group Flow (vph)	0	108	11	413	151	229	46	611	141	398	626	15
Confl. Peds. (#/hr)	6					6						
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		26.8	26.8	26.8	26.8	26.8	3.0	30.2	30.2	10.0	37.2	37.2
Effective Green, g (s)		26.8	26.8	26.8	26.8	26.8	3.0	30.2	30.2	10.0	37.2	37.2
Actuated g/C Ratio		0.33	0.33	0.33	0.33	0.33	0.04	0.37	0.37	0.12	0.46	0.46
Clearance Time (s)		5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5	2.5	2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		573	523	423	616	507	65	694	590	423	855	727
v/s Ratio Prot					0.08		0.03	c0.33		c0.12	0.34	
v/s Ratio Perm		0.06	0.01	c0.32		0.15			0.09			0.01
v/c Ratio		0.19	0.02	0.98	0.25	0.45	0.71	0.88	0.24	0.94	0.73	0.02
Uniform Delay, d1		19.3	18.3	26.8	19.7	21.3	38.6	23.7	17.5	35.2	17.8	12.0
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.1	0.0	37.2	0.2	0.5	24.8	13.4	0.4	28.9	4.0	0.0
Delay (s)		19.5	18.3	64.0	19.9	21.8	63.4	37.1	17.9	64.1	21.8	12.0
Level of Service		B	B	E	B	C	E	D	B	E	C	B
Approach Delay (s)		19.2			39.2			31.3			37.5	
Approach LOS		B			D			C			D	

Intersection Summary			
HCM 2000 Control Delay	35.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	81.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	80.1%	ICU Level of Service	D
Analysis Period (min)	15		

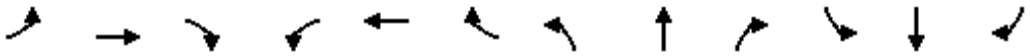
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	231	480	50	171	645	400	30	238	127	340	446	199
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3539	1543	1768	3539	1583	1769	1752		1769	1768	
Flt Permitted	0.21	1.00	1.00	0.36	1.00	1.00	0.16	1.00		0.25	1.00	
Satd. Flow (perm)	393	3539	1543	675	3539	1583	296	1752		471	1768	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	238	495	52	176	665	412	31	245	131	351	460	205
RTOR Reduction (vph)	0	0	38	0	0	304	0	22	0	0	18	0
Lane Group Flow (vph)	238	495	14	176	665	108	31	354	0	351	647	0
Confl. Peds. (#/hr)			3	3			3		1	1		3
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	31.0	22.9	22.9	30.0	22.4	22.4	26.9	25.2		40.3	33.6	
Effective Green, g (s)	31.0	22.9	22.9	30.0	22.4	22.4	26.9	25.2		40.3	33.6	
Actuated g/C Ratio	0.36	0.27	0.27	0.35	0.26	0.26	0.31	0.29		0.47	0.39	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	271	944	411	332	923	413	121	514		374	692	
v/s Ratio Prot	c0.08	0.14		0.05	0.19		0.01	0.20		c0.11	0.37	
v/s Ratio Perm	c0.23		0.01	0.14		0.07	0.07			c0.33		
v/c Ratio	0.88	0.52	0.03	0.53	0.72	0.26	0.26	0.69		0.94	0.94	
Uniform Delay, d1	21.7	26.8	23.3	20.3	28.9	25.1	22.4	26.8		18.7	25.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	25.2	0.5	0.0	0.8	2.8	0.3	0.4	3.8		30.5	19.9	
Delay (s)	46.9	27.3	23.3	21.2	31.6	25.5	22.8	30.7		49.3	44.9	
Level of Service	D	C	C	C	C	C	C	C		D	D	
Approach Delay (s)		33.0			28.1			30.1			46.4	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	34.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	85.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	15		

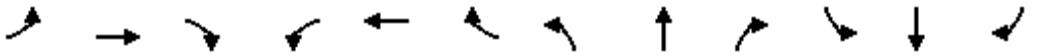
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	286	501	140	30	484	70	150	368	40	100	412	341
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.98			0.98		1.00	0.99		1.00	0.93	
Flt Protected		0.98			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1791			1828		1770	1835		1770	1725	
Flt Permitted		0.64			0.93		0.20	1.00		0.31	1.00	
Satd. Flow (perm)		1158			1713		373	1835		576	1725	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	292	511	143	31	494	71	153	376	41	102	420	348
RTOR Reduction (vph)	0	11	0	0	8	0	0	7	0	0	50	0
Lane Group Flow (vph)	0	935	0	0	588	0	153	410	0	102	718	0
Confl. Peds. (#/hr)			1	1			2					2
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		32.0			32.0		20.0	20.0		20.0	20.0	
Effective Green, g (s)		32.0			32.0		20.0	20.0		20.0	20.0	
Actuated g/C Ratio		0.53			0.53		0.33	0.33		0.33	0.33	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		617			913		124	611		192	575	
v/s Ratio Prot								0.22			c0.42	
v/s Ratio Perm		c0.81			0.34		0.41			0.18		
v/c Ratio		1.52			0.64		1.23	0.67		0.53	1.25	
Uniform Delay, d1		14.0			10.0		20.0	17.2		16.2	20.0	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		240.4			1.6		156.7	2.9		2.8	125.9	
Delay (s)		254.4			11.5		176.7	20.1		19.0	145.9	
Level of Service		F			B		F	C		B	F	
Approach Delay (s)		254.4			11.5			62.1			131.0	
Approach LOS		F			B			E			F	

Intersection Summary			
HCM 2000 Control Delay	133.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.41		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	146.4%	ICU Level of Service	H
Analysis Period (min)	15		

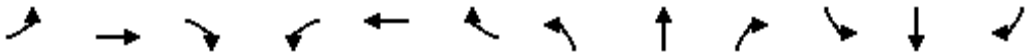
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	671	0	10	0	0	0	60	899	0	10	1237	884
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0				5.0	7.0		5.0	7.0	7.0
Lane Util. Factor	0.95	0.95	1.00				1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00				1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00				1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85				1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00				0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1681	1681	1583				1770	3539		1770	3539	1550
Flt Permitted	0.95	0.95	1.00				0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1681	1681	1583				1770	3539		1770	3539	1550
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	729	0	11	0	0	0	65	977	0	11	1345	961
RTOR Reduction (vph)	0	0	8	0	0	0	0	0	0	0	0	504
Lane Group Flow (vph)	364	365	3	0	0	0	65	977	0	11	1345	457
Confl. Peds. (#/hr)												1
Turn Type	Split	NA	Perm				Prot	NA		Prot	NA	Perm
Protected Phases	4	4					5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)	15.2	15.2	15.2				2.3	32.8		0.6	31.1	31.1
Effective Green, g (s)	15.2	15.2	15.2				2.3	32.8		0.6	31.1	31.1
Actuated g/C Ratio	0.23	0.23	0.23				0.03	0.49		0.01	0.47	0.47
Clearance Time (s)	6.0	6.0	6.0				5.0	7.0		5.0	7.0	7.0
Vehicle Extension (s)	2.0	2.0	2.0				2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)	383	383	361				61	1742		15	1652	723
v/s Ratio Prot	0.22	c0.22					c0.04	0.28		0.01	c0.38	
v/s Ratio Perm			0.00									0.30
v/c Ratio	0.95	0.95	0.01				1.07	0.56		0.73	0.81	0.63
Uniform Delay, d1	25.3	25.3	19.9				32.1	11.9		32.9	15.3	13.4
Progression Factor	1.00	1.00	1.00				1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	33.0	33.5	0.0				134.6	0.7		93.0	3.6	2.5
Delay (s)	58.4	58.9	19.9				166.8	12.5		125.9	18.9	15.9
Level of Service	E	E	B				F	B		F	B	B
Approach Delay (s)		58.1			0.0			22.2			18.2	
Approach LOS		E			A			C			B	

Intersection Summary			
HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	66.6	Sum of lost time (s)	18.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		

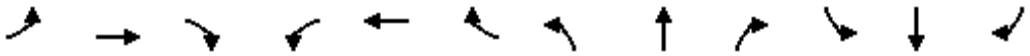
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	158	120	183	20	160	130	126	80	10	100	130	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.91		1.00	0.93		1.00	0.98		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1694		1770	1738		1770	1831		1770	1702	
Flt Permitted	0.55	1.00		0.53	1.00		0.56	1.00		0.69	1.00	
Satd. Flow (perm)	1033	1694		992	1738		1045	1831		1292	1702	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	172	130	199	22	174	141	137	87	11	109	141	190
RTOR Reduction (vph)	0	138	0	0	85	0	0	6	0	0	111	0
Lane Group Flow (vph)	172	191	0	22	230	0	137	92	0	109	220	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	8.7	8.7		8.7	8.7		11.9	11.9		11.9	11.9	
Effective Green, g (s)	8.7	8.7		8.7	8.7		11.9	11.9		11.9	11.9	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.42	0.42		0.42	0.42	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	314	515		301	528		434	761		537	708	
v/s Ratio Prot		0.11			0.13			0.05			0.13	
v/s Ratio Perm	c0.17			0.02			c0.13			0.08		
v/c Ratio	0.55	0.37		0.07	0.44		0.32	0.12		0.20	0.31	
Uniform Delay, d1	8.3	7.8		7.1	8.0		5.6	5.1		5.3	5.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.0	0.5		0.1	0.6		0.4	0.1		0.2	0.3	
Delay (s)	10.3	8.3		7.2	8.6		6.0	5.2		5.5	5.9	
Level of Service	B	A		A	A		A	A		A	A	
Approach Delay (s)		8.9			8.5			5.7			5.8	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	28.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

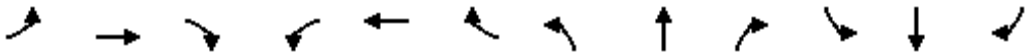
LOS Worksheets – Year 2022 with Partial Development with Mitigation (LOS D or Better) Conditions



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	364	620	70	148	438	420	70	514	206	240	205	172
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1768	3539	1549	1769	3539	1543	1770	1863	1558	1769	1735	
Flt Permitted	0.33	1.00	1.00	0.25	1.00	1.00	0.41	1.00	1.00	0.12	1.00	
Satd. Flow (perm)	619	3539	1549	463	3539	1543	773	1863	1558	231	1735	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	379	646	73	154	456	438	73	535	215	250	214	179
RTOR Reduction (vph)	0	0	54	0	0	170	0	0	145	0	32	0
Lane Group Flow (vph)	379	646	19	154	456	268	73	535	70	250	361	0
Confl. Peds. (#/hr)	3		1	1		3			4	4		
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Actuated Green, G (s)	32.6	22.5	22.5	28.6	20.5	20.5	32.1	28.2	28.2	40.3	32.3	
Effective Green, g (s)	32.6	22.5	22.5	28.6	20.5	20.5	32.1	28.2	28.2	40.3	32.3	
Actuated g/C Ratio	0.38	0.26	0.26	0.33	0.24	0.24	0.37	0.32	0.32	0.46	0.37	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0	
Lane Grp Cap (vph)	366	917	401	274	835	364	330	605	506	249	645	
v/s Ratio Prot	c0.12	0.18		0.05	0.13		0.01	0.29		c0.09	0.21	
v/s Ratio Perm	c0.27		0.01	0.13		0.17	0.07		0.04	c0.37		
v/c Ratio	1.04	0.70	0.05	0.56	0.55	0.74	0.22	0.88	0.14	1.00	0.56	
Uniform Delay, d1	24.6	29.1	24.1	21.8	29.1	30.6	18.2	27.8	20.7	20.5	21.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	56.5	2.5	0.0	1.6	0.7	7.5	0.1	14.4	0.1	58.1	1.1	
Delay (s)	81.1	31.6	24.2	23.4	29.8	38.2	18.3	42.1	20.8	78.6	22.7	
Level of Service	F	C	C	C	C	D	B	D	C	E	C	
Approach Delay (s)		48.2			32.4			34.5			44.4	
Approach LOS		D			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	39.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	86.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	90.0%	ICU Level of Service	E
Analysis Period (min)	15		

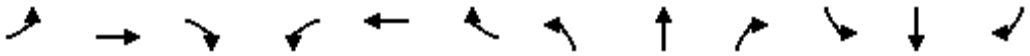
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	169	417	170	70	483	210	220	571	80	100	475	203
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	1.00	0.98	1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.98		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1768	1770		1768	1863	1548	1766	1828		1770	1768	
Flt Permitted	0.31	1.00		0.26	1.00	1.00	0.25	1.00		0.25	1.00	
Satd. Flow (perm)	568	1770		493	1863	1548	465	1828		466	1768	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	178	439	179	74	508	221	232	601	84	105	500	214
RTOR Reduction (vph)	0	37	0	0	0	93	0	12	0	0	38	0
Lane Group Flow (vph)	178	581	0	74	508	128	232	673	0	105	676	0
Confl. Peds. (#/hr)	2		3	3		2	12					12
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	15.1	15.1		15.1	15.1	15.1	16.0	16.0		16.0	16.0	
Effective Green, g (s)	15.1	15.1		15.1	15.1	15.1	16.0	16.0		16.0	16.0	
Actuated g/C Ratio	0.39	0.39		0.39	0.39	0.39	0.41	0.41		0.41	0.41	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	219	683		190	719	597	190	748		190	723	
v/s Ratio Prot		c0.33			0.27			0.37			0.38	
v/s Ratio Perm	0.31			0.15		0.08	c0.50			0.23		
v/c Ratio	0.81	0.85		0.39	0.71	0.21	1.22	0.90		0.55	0.94	
Uniform Delay, d1	10.7	11.0		8.7	10.1	8.0	11.6	10.8		8.8	11.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	20.1	9.9		1.3	3.2	0.2	137.4	13.6		3.5	19.2	
Delay (s)	30.8	20.9		10.0	13.3	8.2	148.9	24.4		12.3	30.3	
Level of Service	C	C		A	B	A	F	C		B	C	
Approach Delay (s)		23.1			11.6			55.9			28.0	
Approach LOS		C			B			E			C	

Intersection Summary			
HCM 2000 Control Delay	30.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	39.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	99.5%	ICU Level of Service	F
Analysis Period (min)	15		

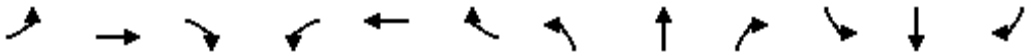
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	231	480	50	171	645	400	30	238	127	340	446	199
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1543	1768	3539	1583	1769	1863	1563	1769	1768	
Flt Permitted	0.21	1.00	1.00	0.36	1.00	1.00	0.16	1.00	1.00	0.41	1.00	
Satd. Flow (perm)	394	3539	1543	677	3539	1583	298	1863	1563	770	1768	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	238	495	52	176	665	412	31	245	131	351	460	205
RTOR Reduction (vph)	0	0	38	0	0	304	0	0	93	0	18	0
Lane Group Flow (vph)	238	495	14	176	665	108	31	245	38	351	647	0
Confl. Peds. (#/hr)			3	3			3		1	1		3
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Actuated Green, G (s)	31.0	22.9	22.9	30.0	22.4	22.4	26.7	25.0	25.0	40.1	33.4	
Effective Green, g (s)	31.0	22.9	22.9	30.0	22.4	22.4	26.7	25.0	25.0	40.1	33.4	
Actuated g/C Ratio	0.36	0.27	0.27	0.35	0.26	0.26	0.31	0.29	0.29	0.47	0.39	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0	
Lane Grp Cap (vph)	272	946	412	334	926	414	122	544	456	478	689	
v/s Ratio Prot	c0.08	0.14		0.05	0.19		0.01	0.13		c0.09	c0.37	
v/s Ratio Perm	c0.23		0.01	0.14		0.07	0.07		0.02	0.26		
v/c Ratio	0.88	0.52	0.03	0.53	0.72	0.26	0.25	0.45	0.08	0.73	0.94	
Uniform Delay, d1	21.6	26.7	23.2	20.2	28.7	25.0	22.4	24.7	22.0	16.6	25.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	24.7	0.5	0.0	0.7	2.7	0.3	0.4	0.6	0.1	5.0	20.5	
Delay (s)	46.2	27.2	23.2	20.9	31.4	25.4	22.8	25.3	22.1	21.6	45.7	
Level of Service	D	C	C	C	C	C	C	C	C	C	D	
Approach Delay (s)		32.7			28.0			24.1			37.4	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	31.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	85.6	Sum of lost time (s)	20.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

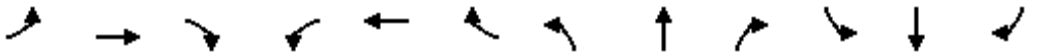


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	286	501	140	30	484	70	150	368	40	100	412	341
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.99		1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1793		1769	1863	1583	1770	1835		1770	1725	
Flt Permitted	0.35	1.00		0.20	1.00	1.00	0.24	1.00		0.38	1.00	
Satd. Flow (perm)	654	1793		377	1863	1583	438	1835		713	1725	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	292	511	143	31	494	71	153	376	41	102	420	348
RTOR Reduction (vph)	0	22	0	0	0	39	0	9	0	0	67	0
Lane Group Flow (vph)	292	632	0	31	494	32	153	408	0	102	701	0
Confl. Peds. (#/hr)			1	1			2					2
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	20.0	20.0		20.0	20.0	20.0	17.0	17.0		17.0	17.0	
Effective Green, g (s)	20.0	20.0		20.0	20.0	20.0	17.0	17.0		17.0	17.0	
Actuated g/C Ratio	0.44	0.44		0.44	0.44	0.44	0.38	0.38		0.38	0.38	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	290	796		167	828	703	165	693		269	651	
v/s Ratio Prot		0.35			0.27			0.22			c0.41	
v/s Ratio Perm	c0.45			0.08		0.02	0.35			0.14		
v/c Ratio	1.01	0.79		0.19	0.60	0.04	0.93	0.59		0.38	1.08	
Uniform Delay, d1	12.5	10.7		7.6	9.5	7.1	13.4	11.2		10.2	14.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	54.6	5.5		0.5	1.2	0.0	48.7	1.3		0.9	58.0	
Delay (s)	67.1	16.2		8.1	10.6	7.1	62.1	12.5		11.1	72.0	
Level of Service	E	B		A	B	A	E	B		B	E	
Approach Delay (s)		31.9			10.1			25.8			64.8	
Approach LOS		C			B			C			E	

Intersection Summary			
HCM 2000 Control Delay	36.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	105.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

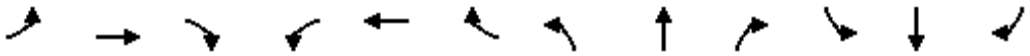
LOS Worksheets – Year 2026 with Project with Mitigation (Pre-Project or Better) Conditions



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	210	81	303	150	320	61	572	439	460	592	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00
Frpb, ped/bikes		1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1848	1549	1767	1863	1583	1770	1863	1562	3433	1863	1583
Flt Permitted		0.93	1.00	0.47	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1729	1549	880	1863	1583	1770	1863	1562	3433	1863	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	45	236	91	340	169	360	69	643	493	517	665	11
RTOR Reduction (vph)	0	0	59	0	0	214	0	0	231	0	0	6
Lane Group Flow (vph)	0	281	33	340	169	146	69	643	262	517	665	5
Confl. Peds. (#/hr)			1	1					1			
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		36.0	36.0	36.0	36.0	36.0	4.0	35.8	35.8	15.0	46.8	46.8
Effective Green, g (s)		36.0	36.0	36.0	36.0	36.0	4.0	35.8	35.8	15.0	46.8	46.8
Actuated g/C Ratio		0.36	0.36	0.36	0.36	0.36	0.04	0.36	0.36	0.15	0.46	0.46
Clearance Time (s)		5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5	2.5	2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		617	553	314	665	565	70	661	554	510	864	734
v/s Ratio Prot					0.09		0.04	c0.35		c0.15	0.36	
v/s Ratio Perm		0.16	0.02	c0.39		0.09			0.17			0.00
v/c Ratio		0.46	0.06	1.08	0.25	0.26	0.99	0.97	0.47	1.01	0.77	0.01
Uniform Delay, d1		24.9	21.3	32.4	22.9	22.9	48.4	32.0	25.2	42.9	22.5	14.5
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.4	0.0	74.7	0.1	0.2	101.7	28.4	1.3	43.3	4.9	0.0
Delay (s)		25.3	21.3	107.1	23.1	23.1	150.1	60.4	26.5	86.2	27.4	14.5
Level of Service		C	C	F	C	C	F	E	C	F	C	B
Approach Delay (s)		24.3			56.0			51.7			52.8	
Approach LOS		C			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	50.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	100.8	Sum of lost time (s)	14.0
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		

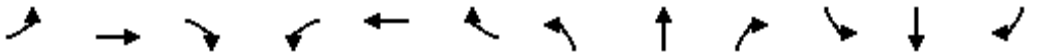
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	372	667	70	171	453	400	140	587	262	250	244	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.97	1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1769	3539	1547	1769	3539	1539	1770	1760		1770	1748	
Flt Permitted	0.19	1.00	1.00	0.17	1.00	1.00	0.40	1.00		0.07	1.00	
Satd. Flow (perm)	351	3539	1547	325	3539	1539	748	1760		122	1748	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	388	695	73	178	472	417	146	611	273	260	254	177
RTOR Reduction (vph)	0	0	56	0	0	194	0	12	0	0	19	0
Lane Group Flow (vph)	388	695	17	178	472	223	146	872	0	260	412	0
Confl. Peds. (#/hr)	3		1	1		3			4	4		
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	45.9	29.3	29.3	34.5	22.9	22.9	63.9	57.0		72.1	61.1	
Effective Green, g (s)	45.9	29.3	29.3	34.5	22.9	22.9	63.9	57.0		72.1	61.1	
Actuated g/C Ratio	0.36	0.23	0.23	0.27	0.18	0.18	0.50	0.44		0.56	0.47	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	323	804	351	216	628	273	425	778		208	828	
v/s Ratio Prot	c0.17	0.20		0.07	0.13		0.02	0.50		c0.11	0.24	
v/s Ratio Perm	c0.26		0.01	0.15		0.14	0.15			c0.59		
v/c Ratio	1.20	0.86	0.05	0.82	0.75	0.82	0.34	1.12		1.25	0.50	
Uniform Delay, d1	34.9	47.9	38.9	39.4	50.3	51.0	18.5	36.0		41.1	23.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	116.4	9.6	0.1	20.9	5.1	16.9	0.2	70.7		145.9	0.5	
Delay (s)	151.4	57.5	39.0	60.3	55.4	67.9	18.7	106.7		186.9	23.8	
Level of Service	F	E	D	E	E	E	B	F		F	C	
Approach Delay (s)		87.8			61.1			94.2			85.2	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM 2000 Control Delay	81.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.29		
Actuated Cycle Length (s)	128.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	111.3%	ICU Level of Service	H
Analysis Period (min)	15		

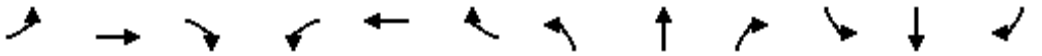
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	189	490	160	70	488	230	250	653	80	120	503	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00			0.99		1.00	1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.97			0.96		1.00	0.98		1.00	0.96	
Flt Protected		0.99			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1786			1770		1766	1832		1770	1774	
Flt Permitted		0.58			0.88		0.22	1.00		0.22	1.00	
Satd. Flow (perm)		1055			1559		413	1832		414	1774	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	199	516	168	74	514	242	263	687	84	126	529	205
RTOR Reduction (vph)	0	19	0	0	33	0	0	10	0	0	31	0
Lane Group Flow (vph)	0	864	0	0	797	0	263	761	0	126	703	0
Confl. Peds. (#/hr)	2		3	3		2	12					12
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		19.0			19.0		18.0	18.0		18.0	18.0	
Effective Green, g (s)		19.0			19.0		18.0	18.0		18.0	18.0	
Actuated g/C Ratio		0.42			0.42		0.40	0.40		0.40	0.40	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		445			658		165	732		165	709	
v/s Ratio Prot								0.42			0.40	
v/s Ratio Perm		c0.82			0.51		c0.64			0.30		
v/c Ratio		1.94			1.21		1.59	1.04		0.76	0.99	
Uniform Delay, d1		13.0			13.0		13.5	13.5		11.7	13.4	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		431.8			108.8		293.9	44.1		18.7	31.5	
Delay (s)		444.8			121.8		307.4	57.6		30.4	44.9	
Level of Service		F			F		F	E		C	D	
Approach Delay (s)		444.8			121.8			121.2			42.8	
Approach LOS		F			F			F			D	

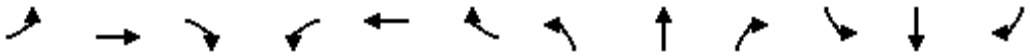
Intersection Summary			
HCM 2000 Control Delay	181.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.77		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	151.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



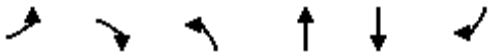
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	910	0	50	0	0	0	110	1335	0	0	940	668
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0				5.0	7.0			7.0	7.0
Lane Util. Factor	0.95	0.95	1.00				1.00	0.95			0.95	1.00
Frt	1.00	1.00	0.85				1.00	1.00			1.00	0.85
Flt Protected	0.95	0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)	1681	1681	1583				1770	3539			3539	1583
Flt Permitted	0.95	0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)	1681	1681	1583				1770	3539			3539	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	948	0	52	0	0	0	115	1391	0	0	979	696
RTOR Reduction (vph)	0	0	36	0	0	0	0	0	0	0	0	422
Lane Group Flow (vph)	474	474	16	0	0	0	115	1391	0	0	979	274
Turn Type	Split	NA	Perm				Prot	NA		Prot	NA	Perm
Protected Phases	4	4					5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)	27.3	27.3	27.3				7.6	46.9			34.3	34.3
Effective Green, g (s)	27.3	27.3	27.3				7.6	46.9			34.3	34.3
Actuated g/C Ratio	0.31	0.31	0.31				0.09	0.54			0.39	0.39
Clearance Time (s)	6.0	6.0	6.0				5.0	7.0			7.0	7.0
Vehicle Extension (s)	2.0	2.0	2.0				2.0	5.0			5.0	5.0
Lane Grp Cap (vph)	526	526	495				154	1903			1392	622
v/s Ratio Prot	c0.28	0.28					0.06	c0.39			0.28	
v/s Ratio Perm			0.01									0.17
v/c Ratio	0.90	0.90	0.03				0.75	0.73			0.70	0.44
Uniform Delay, d1	28.7	28.7	20.8				38.9	15.3			22.2	19.4
Progression Factor	1.00	1.00	1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2	18.2	18.2	0.0				15.7	1.8			2.1	1.0
Delay (s)	46.8	46.8	20.8				54.6	17.1			24.2	20.4
Level of Service	D	D	C				D	B			C	C
Approach Delay (s)		45.5			0.0			20.0			22.7	
Approach LOS		D			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	27.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	87.2	Sum of lost time (s)	18.0
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



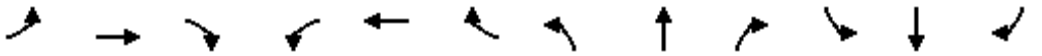
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	280	232	160	10	132	50	259	180	10	100	90	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	0.96		1.00	0.99		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1749		1770	1786		1770	1848		1770	1668	
Flt Permitted	0.63	1.00		0.41	1.00		0.54	1.00		0.63	1.00	
Satd. Flow (perm)	1181	1749		765	1786		1002	1848		1170	1668	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	304	252	174	11	143	54	282	196	11	109	98	224
RTOR Reduction (vph)	0	64	0	0	33	0	0	5	0	0	137	0
Lane Group Flow (vph)	304	362	0	11	164	0	282	202	0	109	185	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	13.4	13.4		13.4	13.4		13.6	13.6		13.6	13.6	
Effective Green, g (s)	13.4	13.4		13.4	13.4		13.6	13.6		13.6	13.6	
Actuated g/C Ratio	0.38	0.38		0.38	0.38		0.39	0.39		0.39	0.39	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	452	669		292	683		389	718		454	648	
v/s Ratio Prot		0.21			0.09			0.11			0.11	
v/s Ratio Perm	c0.26			0.01			c0.28			0.09		
v/c Ratio	0.67	0.54		0.04	0.24		0.72	0.28		0.24	0.29	
Uniform Delay, d1	9.0	8.4		6.8	7.3		9.1	7.3		7.2	7.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.9	0.9		0.1	0.2		6.6	0.2		0.3	0.2	
Delay (s)	12.9	9.3		6.8	7.5		15.7	7.6		7.5	7.6	
Level of Service	B	A		A	A		B	A		A	A	
Approach Delay (s)		10.8			7.5			12.2			7.6	
Approach LOS		B			A			B			A	

Intersection Summary			
HCM 2000 Control Delay	10.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	35.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	575	180	90	600	570	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8	6.8	5.0	6.3	6.3	6.3
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	639	200	100	667	633	300
RTOR Reduction (vph)	0	121	0	0	0	214
Lane Group Flow (vph)	639	79	100	667	633	86
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	28.9	28.9	5.2	31.1	20.9	20.9
Effective Green, g (s)	28.9	28.9	5.2	31.1	20.9	20.9
Actuated g/C Ratio	0.40	0.40	0.07	0.43	0.29	0.29
Clearance Time (s)	6.8	6.8	5.0	6.3	6.3	6.3
Vehicle Extension (s)	2.0	2.0	2.0	3.0	3.0	3.0
Lane Grp Cap (vph)	699	625	125	1505	1011	452
v/s Ratio Prot	c0.36		c0.06	0.19	c0.18	
v/s Ratio Perm		0.05				0.05
v/c Ratio	0.91	0.13	0.80	0.44	0.63	0.19
Uniform Delay, d1	20.9	14.1	33.4	14.9	22.7	19.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	16.2	0.0	28.1	0.2	1.2	0.2
Delay (s)	37.1	14.1	61.5	15.1	23.9	19.9
Level of Service	D	B	E	B	C	B
Approach Delay (s)	31.6			21.1	22.6	
Approach LOS	C			C	C	

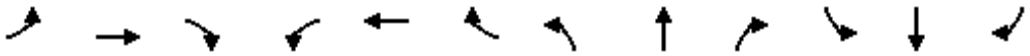
Intersection Summary			
HCM 2000 Control Delay	25.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	73.1	Sum of lost time (s)	18.1
Intersection Capacity Utilization	68.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	100	32	367	170	410	73	596	336	400	640	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1844	1583	1770	1863	1533	1770	1863	1583	3433	1863	1583
Flt Permitted		0.94	1.00	0.67	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1742	1583	1255	1863	1533	1770	1863	1583	3433	1863	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	22	108	34	395	183	441	78	641	361	430	688	43
RTOR Reduction (vph)	0	0	23	0	0	205	0	0	224	0	0	23
Lane Group Flow (vph)	0	130	11	395	183	236	78	641	137	430	688	20
Confl. Peds. (#/hr)	6					6						
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		25.0	25.0	25.0	25.0	25.0	4.0	30.5	30.5	11.0	37.5	37.5
Effective Green, g (s)		25.0	25.0	25.0	25.0	25.0	4.0	30.5	30.5	11.0	37.5	37.5
Actuated g/C Ratio		0.31	0.31	0.31	0.31	0.31	0.05	0.38	0.38	0.14	0.47	0.47
Clearance Time (s)		5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5	2.5	2.5	2.5	2.5	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		540	491	389	578	476	87	705	599	469	867	737
v/s Ratio Prot					0.10		0.04	c0.34		c0.13	0.37	
v/s Ratio Perm		0.07	0.01	c0.31		0.15			0.09			0.01
v/c Ratio		0.24	0.02	1.02	0.32	0.49	0.90	0.91	0.23	0.92	0.79	0.03
Uniform Delay, d1		20.7	19.3	27.8	21.2	22.6	38.0	23.7	17.0	34.3	18.2	11.6
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.2	0.0	49.6	0.2	0.6	61.8	16.4	0.4	22.2	5.8	0.0
Delay (s)		20.8	19.3	77.3	21.4	23.2	99.8	40.1	17.4	56.5	24.0	11.7
Level of Service		C	B	E	C	C	F	D	B	E	C	B
Approach Delay (s)		20.5			43.9			36.8			35.6	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	37.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	80.5	Sum of lost time (s)	14.0
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		

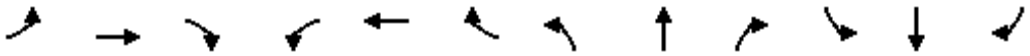
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	199	506	80	215	720	400	30	287	157	360	526	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3539	1543	1768	3539	1583	1769	1750		1769	1795	
Flt Permitted	0.17	1.00	1.00	0.32	1.00	1.00	0.15	1.00		0.16	1.00	
Satd. Flow (perm)	321	3539	1543	604	3539	1583	281	1750		303	1795	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	205	522	82	222	742	412	31	296	162	371	542	152
RTOR Reduction (vph)	0	0	61	0	0	300	0	22	0	0	11	0
Lane Group Flow (vph)	205	522	21	222	742	112	31	436	0	371	683	0
Confl. Peds. (#/hr)			3	3			3		1	1		3
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	30.2	23.2	23.2	30.2	23.2	23.2	28.2	26.5		43.5	36.8	
Effective Green, g (s)	30.2	23.2	23.2	30.2	23.2	23.2	28.2	26.5		43.5	36.8	
Actuated g/C Ratio	0.34	0.26	0.26	0.34	0.26	0.26	0.32	0.30		0.49	0.41	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	223	925	403	297	925	414	117	522		346	744	
v/s Ratio Prot	c0.07	0.15		0.06	0.21		0.01	0.25		c0.14	0.38	
v/s Ratio Perm	c0.24		0.01	0.20		0.07	0.08			c0.38		
v/c Ratio	0.92	0.56	0.05	0.75	0.80	0.27	0.26	0.84		1.07	0.92	
Uniform Delay, d1	24.2	28.4	24.5	23.5	30.6	26.0	22.7	29.1		20.8	24.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	37.8	0.8	0.1	8.7	5.1	0.4	0.4	11.1		68.9	16.1	
Delay (s)	62.0	29.2	24.6	32.2	35.7	26.4	23.2	40.2		89.7	40.6	
Level of Service	E	C	C	C	D	C	C	D		F	D	
Approach Delay (s)		37.0			32.3			39.1			57.7	
Approach LOS		D			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	41.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	88.7	Sum of lost time (s)	20.0
Intersection Capacity Utilization	92.3%	ICU Level of Service	F
Analysis Period (min)	15		

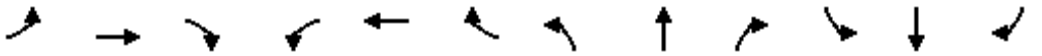
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	271	523	170	30	555	90	130	410	40	100	503	351
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.98			0.98		1.00	0.99		1.00	0.94	
Flt Protected		0.99			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1786			1825		1770	1838		1770	1737	
Flt Permitted		0.60			0.94		0.17	1.00		0.25	1.00	
Satd. Flow (perm)		1094			1718		310	1838		474	1737	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	277	534	173	31	566	92	133	418	41	102	513	358
RTOR Reduction (vph)	0	11	0	0	8	0	0	5	0	0	36	0
Lane Group Flow (vph)	0	973	0	0	681	0	133	454	0	102	835	0
Confl. Peds. (#/hr)			1	1			2					2
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		38.0			38.0		24.0	24.0		24.0	24.0	
Effective Green, g (s)		38.0			38.0		24.0	24.0		24.0	24.0	
Actuated g/C Ratio		0.54			0.54		0.34	0.34		0.34	0.34	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		593			932		106	630		162	595	
v/s Ratio Prot								0.25			c0.48	
v/s Ratio Perm		c0.89			0.40		0.43			0.22		
v/c Ratio		1.64			0.73		1.25	0.72		0.63	1.40	
Uniform Delay, d1		16.0			12.1		23.0	20.1		19.3	23.0	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		296.0			3.0		170.8	4.0		7.4	191.4	
Delay (s)		312.0			15.1		193.8	24.1		26.7	214.4	
Level of Service		F			B		F	C		C	F	
Approach Delay (s)		312.0			15.1			62.2			194.7	
Approach LOS		F			B			E			F	

Intersection Summary			
HCM 2000 Control Delay	167.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.55		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	157.7%	ICU Level of Service	H
Analysis Period (min)	15		

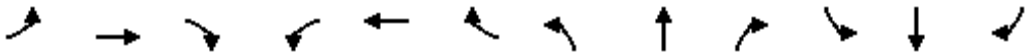
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	743	0	10	0	0	0	70	947	0	10	1405	965
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0				5.0	7.0		5.0	7.0	7.0
Lane Util. Factor	0.95	0.95	1.00				1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00				1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00				1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85				1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00				0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1681	1681	1583				1770	3539		1770	3539	1550
Flt Permitted	0.95	0.95	1.00				0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1681	1681	1583				1770	3539		1770	3539	1550
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	808	0	11	0	0	0	76	1029	0	11	1527	1049
RTOR Reduction (vph)	0	0	8	0	0	0	0	0	0	0	0	487
Lane Group Flow (vph)	404	404	3	0	0	0	76	1029	0	11	1527	562
Confl. Peds. (#/hr)												1
Turn Type	Split	NA	Perm				Prot	NA		Prot	NA	Perm
Protected Phases	4	4					5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)	22.8	22.8	22.8				3.9	49.4		0.6	46.1	46.1
Effective Green, g (s)	22.8	22.8	22.8				3.9	49.4		0.6	46.1	46.1
Actuated g/C Ratio	0.25	0.25	0.25				0.04	0.54		0.01	0.51	0.51
Clearance Time (s)	6.0	6.0	6.0				5.0	7.0		5.0	7.0	7.0
Vehicle Extension (s)	2.0	2.0	2.0				2.0	5.0		2.0	5.0	5.0
Lane Grp Cap (vph)	422	422	397				76	1925		11	1796	786
v/s Ratio Prot	c0.24	0.24					c0.04	c0.29		0.01	c0.43	
v/s Ratio Perm			0.00									0.36
v/c Ratio	0.96	0.96	0.01				1.00	0.53		1.00	0.85	0.71
Uniform Delay, d1	33.5	33.5	25.5				43.4	13.3		45.1	19.4	17.3
Progression Factor	1.00	1.00	1.00				1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	32.4	32.4	0.0				103.2	0.5		271.4	4.5	3.8
Delay (s)	65.9	65.9	25.5				146.7	13.8		316.5	23.8	21.1
Level of Service	E	E	C				F	B		F	C	C
Approach Delay (s)		65.4			0.0			23.0			24.0	
Approach LOS		E			A			C			C	

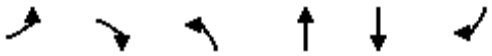
Intersection Summary			
HCM 2000 Control Delay	31.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	90.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	196	151	198	20	222	130	135	80	10	100	130	257
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.91		1.00	0.94		1.00	0.98		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1704		1770	1760		1770	1831		1770	1677	
Flt Permitted	0.49	1.00		0.49	1.00		0.41	1.00		0.69	1.00	
Satd. Flow (perm)	908	1704		914	1760		767	1831		1292	1677	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	213	164	215	22	241	141	147	87	11	109	141	279
RTOR Reduction (vph)	0	119	0	0	53	0	0	7	0	0	182	0
Lane Group Flow (vph)	213	260	0	22	329	0	147	91	0	109	238	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	12.5	12.5		12.5	12.5		11.0	11.0		11.0	11.0	
Effective Green, g (s)	12.5	12.5		12.5	12.5		11.0	11.0		11.0	11.0	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.35	0.35		0.35	0.35	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	360	676		362	698		267	639		451	585	
v/s Ratio Prot		0.15			0.19			0.05			0.14	
v/s Ratio Perm	c0.23			0.02			c0.19			0.08		
v/c Ratio	0.59	0.38		0.06	0.47		0.55	0.14		0.24	0.41	
Uniform Delay, d1	7.5	6.8		5.9	7.0		8.3	7.0		7.3	7.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.6	0.4		0.1	0.5		2.4	0.1		0.3	0.5	
Delay (s)	10.1	7.1		5.9	7.6		10.7	7.1		7.6	8.2	
Level of Service	B	A		A	A		B	A		A	A	
Approach Delay (s)		8.2			7.5			9.3			8.1	
Approach LOS		A			A			A			A	

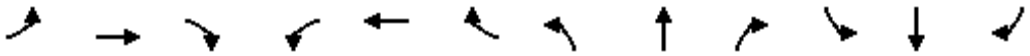
Intersection Summary			
HCM 2000 Control Delay	8.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	31.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	247	90	100	630	700	475
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8	6.8	5.0	6.3	6.3	6.3
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	271	99	110	692	769	522
RTOR Reduction (vph)	0	73	0	0	0	334
Lane Group Flow (vph)	271	26	110	692	769	188
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	15.9	15.9	5.3	32.5	22.2	22.2
Effective Green, g (s)	15.9	15.9	5.3	32.5	22.2	22.2
Actuated g/C Ratio	0.26	0.26	0.09	0.53	0.36	0.36
Clearance Time (s)	6.8	6.8	5.0	6.3	6.3	6.3
Vehicle Extension (s)	2.0	2.0	2.0	3.0	3.0	3.0
Lane Grp Cap (vph)	457	409	152	1870	1277	571
v/s Ratio Prot	c0.15		c0.06	0.20	c0.22	
v/s Ratio Perm		0.02				0.12
v/c Ratio	0.59	0.06	0.72	0.37	0.60	0.33
Uniform Delay, d1	20.0	17.2	27.4	8.5	16.0	14.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.0	13.4	0.1	0.8	0.3
Delay (s)	21.3	17.2	40.8	8.6	16.9	14.6
Level of Service	C	B	D	A	B	B
Approach Delay (s)	20.2			13.0	15.9	
Approach LOS	C			B	B	

Intersection Summary			
HCM 2000 Control Delay	15.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	18.1
Intersection Capacity Utilization	53.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

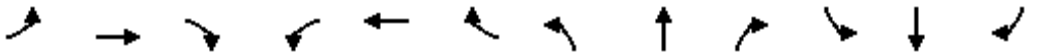
LOS Worksheets – Year 2026 with Project with Mitigation (LOS D or Better) Conditions



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	372	667	70	171	453	400	140	587	262	250	244	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1768	3539	1549	1769	3539	1543	1770	1863	1558	1769	1748	
Flt Permitted	0.33	1.00	1.00	0.21	1.00	1.00	0.32	1.00	1.00	0.13	1.00	
Satd. Flow (perm)	614	3539	1549	386	3539	1543	603	1863	1558	240	1748	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	388	695	73	178	472	417	146	611	273	260	254	177
RTOR Reduction (vph)	0	0	54	0	0	154	0	0	182	0	28	0
Lane Group Flow (vph)	388	695	19	178	472	263	146	611	91	260	403	0
Confl. Peds. (#/hr)	3		1	1		3			4	4		
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Actuated Green, G (s)	32.8	22.8	22.8	29.6	21.2	21.2	34.1	29.1	29.1	38.1	31.1	
Effective Green, g (s)	32.8	22.8	22.8	29.6	21.2	21.2	34.1	29.1	29.1	38.1	31.1	
Actuated g/C Ratio	0.38	0.26	0.26	0.34	0.24	0.24	0.39	0.33	0.33	0.44	0.36	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0	
Lane Grp Cap (vph)	362	924	404	263	859	374	302	621	519	227	622	
v/s Ratio Prot	c0.12	0.20		0.06	0.13		0.03	0.33		c0.09	0.23	
v/s Ratio Perm	c0.28		0.01	0.16		0.17	0.16		0.06	c0.41		
v/c Ratio	1.07	0.75	0.05	0.68	0.55	0.70	0.48	0.98	0.18	1.15	0.65	
Uniform Delay, d1	24.6	29.7	24.1	21.9	28.9	30.2	18.4	28.9	20.6	21.2	23.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	67.7	3.5	0.0	5.3	0.7	5.9	0.4	31.8	0.2	104.5	2.3	
Delay (s)	92.4	33.1	24.2	27.3	29.6	36.1	18.9	60.7	20.8	125.8	25.9	
Level of Service	F	C	C	C	C	D	B	E	C	F	C	
Approach Delay (s)		52.5			31.8			44.2			63.4	
Approach LOS		D			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	46.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	87.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		

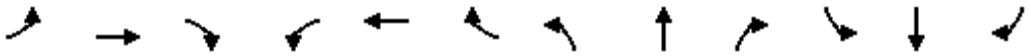
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	189	490	160	70	488	230	250	653	80	120	503	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1767	1783		1770	1863	1546	1762	1832		1770	1863	1545
Flt Permitted	0.28	1.00		0.18	1.00	1.00	0.31	1.00		0.16	1.00	1.00
Satd. Flow (perm)	514	1783		339	1863	1546	573	1832		298	1863	1545
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	199	516	168	74	514	242	263	687	84	126	529	205
RTOR Reduction (vph)	0	22	0	0	0	89	0	8	0	0	0	109
Lane Group Flow (vph)	199	662	0	74	514	153	263	763	0	126	529	96
Confl. Peds. (#/hr)	2		3	3		2	12					12
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	22.0	22.0		22.0	22.0	22.0	25.0	25.0		25.0	25.0	25.0
Effective Green, g (s)	22.0	22.0		22.0	22.0	22.0	25.0	25.0		25.0	25.0	25.0
Actuated g/C Ratio	0.40	0.40		0.40	0.40	0.40	0.45	0.45		0.45	0.45	0.45
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	205	713		135	745	618	260	832		135	846	702
v/s Ratio Prot		0.37			0.28			0.42			0.28	
v/s Ratio Perm	c0.39			0.22		0.10	c0.46			0.42		0.06
v/c Ratio	0.97	0.93		0.55	0.69	0.25	1.01	0.92		0.93	0.63	0.14
Uniform Delay, d1	16.2	15.8		12.7	13.7	11.0	15.0	14.0		14.2	11.4	8.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	54.2	18.3		4.5	2.7	0.2	58.8	14.7		57.1	1.5	0.1
Delay (s)	70.4	34.1		17.2	16.4	11.2	73.8	28.7		71.3	12.9	8.8
Level of Service	E	C		B	B	B	E	C		E	B	A
Approach Delay (s)		42.3			14.9			40.2			20.5	
Approach LOS		D			B			D			C	

Intersection Summary			
HCM 2000 Control Delay	30.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	98.7%	ICU Level of Service	F
Analysis Period (min)	15		

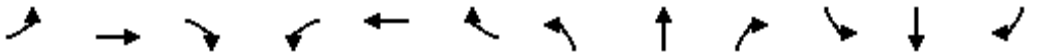
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	199	506	80	215	720	400	30	287	157	360	526	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1543	1768	3539	1583	1769	1863	1563	1769	1795	
Flt Permitted	0.17	1.00	1.00	0.33	1.00	1.00	0.16	1.00	1.00	0.35	1.00	
Satd. Flow (perm)	323	3539	1543	616	3539	1583	294	1863	1563	649	1795	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	205	522	82	222	742	412	31	296	162	371	542	152
RTOR Reduction (vph)	0	0	60	0	0	290	0	0	115	0	11	0
Lane Group Flow (vph)	205	522	22	222	742	122	31	296	47	371	683	0
Confl. Peds. (#/hr)			3	3			3		1	1		3
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Actuated Green, G (s)	30.2	23.1	23.1	30.2	23.1	23.1	27.0	25.3	25.3	41.4	34.7	
Effective Green, g (s)	30.2	23.1	23.1	30.2	23.1	23.1	27.0	25.3	25.3	41.4	34.7	
Actuated g/C Ratio	0.35	0.27	0.27	0.35	0.27	0.27	0.31	0.29	0.29	0.48	0.40	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0	
Lane Grp Cap (vph)	231	944	411	309	944	422	120	544	456	453	719	
v/s Ratio Prot	c0.07	0.15		0.06	0.21		0.01	0.16		c0.10	c0.38	
v/s Ratio Perm	c0.24		0.01	0.19		0.08	0.07		0.03	0.29		
v/c Ratio	0.89	0.55	0.05	0.72	0.79	0.29	0.26	0.54	0.10	0.82	0.95	
Uniform Delay, d1	22.5	27.3	23.6	22.1	29.5	25.2	22.8	25.8	22.4	16.9	25.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	30.2	0.7	0.1	6.5	4.4	0.4	0.4	1.1	0.1	10.5	21.7	
Delay (s)	52.7	28.0	23.7	28.6	33.8	25.6	23.3	26.9	22.5	27.4	46.8	
Level of Service	D	C	C	C	C	C	C	C	C	C	D	
Approach Delay (s)		33.8			30.5			25.2			40.1	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	33.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	86.6	Sum of lost time (s)	20.0
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	271	523	170	30	555	90	130	410	40	100	503	351
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00	1.00	1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1785		1769	1863	1583	1768	1838		1770	1863	1561
Flt Permitted	0.32	1.00		0.21	1.00	1.00	0.25	1.00		0.28	1.00	1.00
Satd. Flow (perm)	595	1785		384	1863	1583	457	1838		525	1863	1561
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	277	534	173	31	566	92	133	418	41	102	513	358
RTOR Reduction (vph)	0	23	0	0	0	46	0	7	0	0	0	166
Lane Group Flow (vph)	277	684	0	31	566	46	133	452	0	102	513	192
Confl. Peds. (#/hr)			1	1			2					2
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	24.4	24.4		24.4	24.4	24.4	16.3	16.3		16.3	16.3	16.3
Effective Green, g (s)	24.4	24.4		24.4	24.4	24.4	16.3	16.3		16.3	16.3	16.3
Actuated g/C Ratio	0.50	0.50		0.50	0.50	0.50	0.33	0.33		0.33	0.33	0.33
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	298	894		192	933	793	152	615		175	623	522
v/s Ratio Prot		0.38			0.30			0.25			0.28	
v/s Ratio Perm	c0.47			0.08		0.03	c0.29			0.19		0.12
v/c Ratio	0.93	0.76		0.16	0.61	0.06	0.88	0.73		0.58	0.82	0.37
Uniform Delay, d1	11.3	9.8		6.6	8.7	6.2	15.2	14.3		13.4	14.9	12.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	33.7	3.9		0.4	1.1	0.0	38.8	4.5		4.9	8.7	0.4
Delay (s)	45.0	13.8		7.0	9.8	6.3	54.1	18.8		18.3	23.5	12.7
Level of Service	D	B		A	A	A	D	B		B	C	B
Approach Delay (s)		22.6			9.2			26.7			19.0	
Approach LOS		C			A			C			B	

Intersection Summary			
HCM 2000 Control Delay	19.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	48.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX C: RELATED PROJECTS

Residential Projects Status Report

Applicant	Acres	Tax Map Key	SF Units	MF Units	Visitor Units
Maui -- Central					
Committed *					
`Aina o Kane Condos					
A&B Properties	0	3-7-005:003,11,23	0	100	0
Hale Mua					
Sterling Kim	240	3-3-002:031	466	0	0
Imi Ikena Affordable Rentals					
Elleair Hawai'I Inc., sold 2009, now CHP Matt Slepin	0.76	3-8-037:028	0	28	0
Kahawai Condos					
Habitat For Humanity, Sherri Dodson	0.257	2-3-4-033:002	0	16	0
Kahului Town Center Redevelopment					
A & B Properties	17	3-7-007:005,8,9,10,27,50	0	442	0
Kehalani (C-12)					
Kehalani Mauka LLC	28	3-5-001:067	150	0	0
Kehalani (C-13)					
Kehalani Mauka LLC	11	3-5-001:067	0	77	0
Kehalani (C-14)					
Kehalani Mauka LLC	20	3-5-001:067	80	0	0
Kehalani (C-18)					
Kehalani Mauka LLC	9.23		0	83	0
Kehalani (C-19)					
Kehalani Mauka LLC	16.77		76	0	0
Kehalani (C-3)					
Kehalani Mauka LLC	10	3-5-001:067	30	0	0
Kehalani (C-6)					
Kehalani Mauka LLC	16	3-5-001:067	0	80	0
Kehalani (C-7)					
Kehalani Mauka LLC	10	3-5-001:067	35	0	0
Kehalani (C-8)					
Kehalani Mauka LLC	14	3-5-001:067	0	84	0
Kehalani (C-9)					
Kehalani Mauka LLC	26	3-5-001:067	90	0	0
Kehalani Ho'olea Terrace					
Kehalani Mauka LLC	12.25		0	112	0
Kehalani Wai'olu Estates					
Kehalani Mauka LLC	23.72		60	0	0

Applicant	Acres	Tax Map Key	SF Units	MF Units	Visitor Units
Maui Beach Hotel Addition					
KI Concepts Eric Matsuda	0	3-7-003:007,9	0	0	136
Maui Lani Lot 4					
D.R.Horton Schuler Homes	13.8	3-8-007:109,130 (por)	0	238	0
Maui Lani The Fairways					
Maui Lani Homes, LLC; DR Horton/Schuller Homes	13	3-8-007:141	50	0	0
Maui Lani The Parkways					
Maui Lani Homes, LLC; DR Horton/Schuller Homes	45.168	3-8-007:141	225	0	0
Maui Lani Traditions					
Maui Lani 100	20	3-8-007:131	153	0	0
Maui Lani Village					
Maui Lani 100 LLC	0	3-8-007:151,152,155(por)	79	0	0
Mission Street Affordable Apts.					
Kahealani LTD Part., Joseph Kealoha, CHP	0.92	234-018:088	0	10	0
Pi`ihana Project District 2					
Hawaii Land & Farming Co. Inc., Jay Nakamura	78	3-4-032:1,10,18. 3-4-7:2. 3-3-1:16,33.	95	440	0
Waikapu Gardens II					
Spencer Homes	10.5	235-002:016	56	0	
***MIP and CP** *					
Habitat For Humanity Condos					
Habitat For Humanity, Sheri Dodson	0.6	3-8-037:047	0	40	0
Ka Lima O Maui Affordable Housing					
Ka Lima O Maui, County of Maui, Munekiyo & Hiraga Inc.	2	2-3-8-046:016	0	16	0
Maui Lani Homes I					
Maui Lani 100	40	3-8-007:130	240	0	0
Maui Lani Lot 7B					
DR Horton; Schuler homes	24.879	3-8-007:141	120	0	0
Maui Lani MF7 Condos					
Maui Lani 100	16	3-8-007:130	0	68	0
Waikapu Mauka Country Town					
Mike Atherton	115	3-6-002:003	228	195	0
Waikapu Mauka Rural Lots					
THP Assoc., Waikapu Mauka Partners	288	236:004:004,5,9,13	304	0	0
***MIP Only** *					
Pu`unani Residences					
Towne Dev of Hawaii, Endurance Investors, II Wai Hui	210	3-5-002:002,3	150	450	0

Applicant	Acres	Tax Map Key	SF Units	MF Units	Visitor Units
Wai`ale					
A & B Properties	826	3-8-007:101,102,104,105,71, 3-8-005:023,37	1127	1127	0
Wai'ale Affordable Homes					
A & B Properties	50	3-8-007:101	0	300	0
Waikapu Makai Village					
Mike Atherton, Maui Tropical Plantation	225	3-6-002:003(por)	468	513	0
Waikapu Rural Village					
Mike Atherton	23	3-6-004:003	29	0	0

* Definitions of Status Categories:

The development projects shown are those projects that have come to the attention of the Department of Planning. There are certain to be other developments being contemplated or planned by private individuals or corporations of which the Department has not been informed. Further, the Department is not attempting to track housing projects smaller than 6 dwelling units and subdivisions of less than 4 lots. Therefore, this is not a complete depiction of the development projects for the county.

Projects identified as "Committed" have inclusion in the Maui Island Plan Growth Boundaries and generally have conforming Community Plan and zoning entitlements; or are approved 201G/H projects. "Committed" refers to the status of the land relative to the primary county land use entitlements, but is in no way intended to convey the level of commitment by the land owner or the developer to proceed with development or convey any time frame for development.

Projects identified as "MIP and CP" have inclusion in the Maui Island Plan Growth Boundaries and the appropriate urban or rural Community Plan designations but not the conforming zoning entitlements to proceed.

Projects identified as "MIP Only" do have inclusion in the Maui Island Plan Growth Boundaries but do not have the appropriate Community Plan designation nor zoning to proceed.

Projects identified as "Agricultural Subdivisions" are projects permitted through Maui County Code 19.30A Agricultural District Ordinance.

Projects identified as "DHHL Near Term" are Department of Hawaiian Homelands (DHHL) projects planned to be initiated within the current planning horizon.

Projects identified as "DHHL Long Term" are Department of Hawaiian Homelands (DHHL) projects with projections beyond the current planning horizon.

Projects identified as "Recently Completed" include those where the subdivision process is complete, total build-out of the project has been reached or nearly reached, and real property is being actively marketed. These projects remain "Recently Completed" until other map layers show the completed project.

Lastly, the classifications above are in reference to the general level of county land use entitlements for the entire project. Project plans frequently change over time, and specific portions of the projects may gain or loose conformity in the process. Also, state entitlement and various county permits may be required before all or particular portions of a project can be developed. Please consult with the Department of Planning's Zoning Administration and Enforcement Division to confirm Maui Island Plan, Community Plan, Zoning and other land use entitlements.

Central Maui North Development Projects - Waihe`e to Maui Lani February 15, 2011 Long Range Planning Division - Department of Planning - County of Maui

WCT TIAR Note: This map used only for the purpose of locating cumulative projects.

Projects by Geographic Map Extent	Unit Types		
	Single Family	Multi Family	Time Share and Hotel
Recently Completed			
Kehalani Alkiloa	97	0	0
Kehalani Cottages	109	0	0
Kehalani Kola	72	0	0
Kehalani Mile Court	0	89	0
Kehalani Onio II	44	0	0
Kehalani Villas	0	103	0
M.C.C. Student Housing	0	160	0
Maui Lani Legends 2	180	0	0
Maui Lani Na Hoku	116	0	0
Maui Lani Sandhills Estates	109	0	0
Waiehu Kou DHHL	211	0	0
TOTAL	937	292	0
Planned/Committed			
Aina o Kane Condos	0	165	0
E Pasipas Ka Pukoa Spreckelsville	16	0	0
Hale Kapili Project	0	4	0
Hale Mua	466	0	0
Imi Ikena Affordable Rentals	0	28	0
Kahawai Condos	0	16	0
Kehalui Town Center Redevelopment	0	442	0
Ke Hoku AG Lots	17	0	0
Kehalani (C-12)	56	0	0
Kehalani (C-13)	0	77	0
Kehalani (C-14)	80	0	0
Kehalani (C-15)	0	83	0
Kehalani (C-16)	75	0	0
Kehalani (C-3)	30	0	0
Kehalani (C-6)	0	80	0
Kehalani (C-7)	35	0	0
Kehalani (C-8)	0	84	0
Kehalani (C-9)	90	0	0
Kehalani Ho'olea Terrace	0	112	0
Kehalani Wai'olu Estates	60	0	0
Mikahi Ag Subdivision	10	0	0
Mikahi Mauka Ag Subdivision	2	0	0
Marriott Courtyard Hotel Kahului Airport	0	0	140
Maui Lani Lot 4	0	235	0
Maui Lani Sandhills -- Commercial	15	0	0
Maui Lani The Pathways	50	0	0
Maui Lani The Parkways	225	0	0
Maui Lani Townhome	150	0	0
Maui Lani Village	79	0	0
Maui Palms Expansion	0	0	136
MEO B.E.S.T. House	0	12	0
Mission Street Affordable Apts.	0	16	0
Na Mala o Waihee	5	0	0
Pi'ihana Project District 2	95	449	0
Waihee Mauka AG Lots	14	0	0
Waihee Valley Large Lot Subdivision	24	0	0
Wins 4-lot	4	0	0
SUB-TOTAL	1,497	1,729	276
Planned/Designated			
Church Street Professional Center	0	8	0
Habitat For Humanity Condos	0	46	0
Hale Ho'omalu Mental Health Kokua	0	6	0
Ka Lima O Maui Affordable Housing	0	16	0
Maui Lani Homes 1	240	0	0
Maui Lani Lot 7E	20	0	0
Maui Lani MF7 Condos	0	56	0
Waiehu Mauka Affordable Townhomes	0	100	0
SUB-TOTAL	360	234	0
Proposed			
Central Maui Senior Housing	0	36	0
Hale Kilinahe Project	80	0	0
Pu`unani Residences	276	476	0
Pu`unene Village A&B	1,700	0	0
Spreckelsville Mauka A&B	399	0	0
Valley Isle Fellowship Condos	0	100	0
Waiale Affordable Homes	300	300	0
Waihere Neighborhood Center	25	82	0
SUB-TOTAL	2,261	997	0
TOTAL	4,318	2,961	276

The development projects shown are those that have come to the attention of the Department of Planning. There are certain to be other developments being contemplated or planned by private individuals or corporations of which the Department has not been informed. Further, the Department is not attempting to track housing projects smaller than 6 dwelling units and subdivisions of less than 4 lots. Therefore, this is not a complete depiction of the development projects for the county.

Projects identified as "Planned/Committed" have the appropriate conforming Community Plan and zoning entitlements, are approved agricultural subdivisions, are approved 201G/M projects, or are Department of Hawaiian Homelands (DHHL) projects. Projects identified as "Planned/Designated" have urban or rural Community Plan designations but not the conforming zoning entitlements to proceed. Projects identified as "Proposed" are currently lacking urban or rural Community Plan designations. Projects identified as "Recently Completed" include those where the subdivision process is complete, total build-out of the project has been reached or nearly reached, and real property is being actively marketed. Further, these projects remain "Recently Completed" until other map layers show the completed project.

Wins 4-Lot

Waihee Valley Large Lot Subdivision

Waiehu Kou DHHL

Hale Kapili Project

Waihee Mauka AG Lots

Mikahi Ag Subdivision

Hale Mua

Pi'ihana Project District

Maui Palms Expansion

Kehalui Town Center Redevelopment

Kahului Airport Improvements

Maui Business Park Phase 2

Pu'unene Village A&B

HC&S Mill Expansion

Waena Biodiesel Refinery

Kehalani

Maui Lani

Pu'unani Residences

Waiale

SEE CENTRAL MAUI SOUTH PROJECT MAP

SEE CENTRAL MAUI SOUTH PROJECT MAP

SEE PAIA-HA'IKU PROJECT MAP

Spreckelsville Mauka A&B

E Pasipas Ka Pukoa Spreckelsville

Central Maui North Development Projects

Waihe`e to Maui Lani

Legend

Development Projects

Growth Classes

- Recently Completed
- Planned/Committed
- Planned/Designated
- Proposed
- Proposed Roads
- Phased Development
- Community Plan Area Boundaries

LOCATION MAP

This is not a zoning map or community plan map. Please contact the Planning Department for Zoning and Community Plan information.

Feet

0 1,000 2,000 4,000 6,000

PREPARED BY:

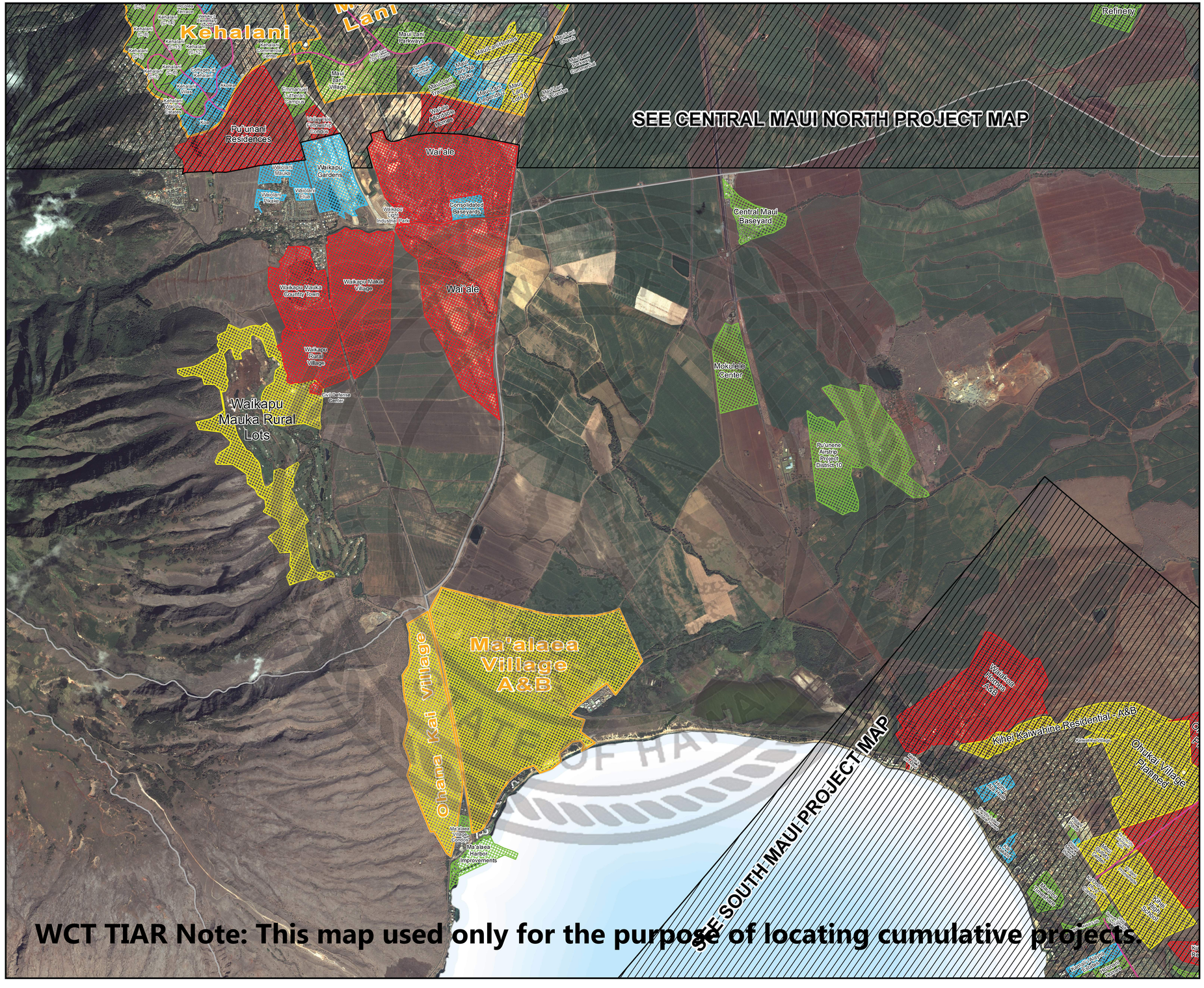
Long Range Planning Division
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Central Maui South Development Projects - Maui Lani to Ma`alaea — February 15, 2011 — Long Range Planning Division - Department of Planning - County of Maui

Projects by Geographic Map Extent	Unit Types		
	Single Family	Multi Family	Time Share and Hotel
Recently Completed			
Waikapu Gardens	410	0	0
Waiolani Elua	25	0	0
Waiolani Mauka	104	0	0
Waiolani Pikake	38	0	0
TOTAL	**577**	**0**	**0**
Planned/Committed			
Ma'alaea Village Condos	0	100	0
SUB-TOTAL	**0**	**100**	**0**
Planned/Designated			
Ma'alaea Village A&B Project District 11	2,000	0	0
Ohana Kai Village Project District 12	1,100	0	0
Waikapu Mauka Rural Lots	304	0	0
SUB-TOTAL	**3,404**	**0**	**0**
Proposed			
Wai`ale	1,065	2,715	0
Waikapu Makai Village	468	513	0
Waikapu Mauka Country Town	228	195	0
Waikapu Rural Village	29	0	0
SUB-TOTAL	**1,790**	**3,423**	**0**
TOTAL	**5,194**	**3,523**	**0**

The development projects shown are those that have come to the attention of the Department of Planning. There are certain to be other developments being contemplated or planned by private individuals or corporations of which the Department has not been informed. Further, the Department is not attempting to track housing projects smaller than 6 dwelling units and subdivisions of less than 4 lots. Therefore, this is not a complete depiction of the development projects for the county.

Projects identified as "Planned/Committed" have the appropriate conforming Community Plan and zoning entitlements, are approved agricultural subdivisions, are approved 201G/H projects, or are Department of Hawaiian Homelands (DHHL) projects. Projects identified as "Planned/Designated" have urban or rural Community Plan designations but not the conforming zoning entitlements to proceed. Projects identified as "Proposed" are currently lacking urban or rural Community Plan designations. Projects identified as "Recently Completed" include those where the subdivision process is complete, total build-out of the project has been reached or nearly reached, and real property is being actively marketed. Further, these projects remain "Recently Completed" until other map layers show the completed project.



Central Maui South Development Projects

Maui Lani to Ma`alaea

Legend

Development Projects

Growth Classes

- Recently Completed
- Planned/Committed
- Planned/Designated
- Proposed
- Proposed Roads
- Phased Development
- Community Plan Area Boundaries

LOCATION MAP

This is not a zoning map or community plan map. Please contact the Planning Department for Zoning and Community Plan information.

Feet

0 1,000 2,000 4,000 6,000

PREPARED BY:

**Long Range Planning Division
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793**

CENTRAL MAUI RELATED PROJECTS COMPLETED BY YEAR 2013 [1,2]

Project Name
• Church Street Professional Center
• Imi Ikena Affordable Rentals
• Kehalani Akolea
• Kehalani Cottages
• Kehalani Koa
• Kehalani Ho'olea Terrace
• Kehalani Milo Court
• Kehalani Ohia II
• Kehalani Villas
• Kehalani Wai'olu Estates
• Maui Lani LDS Church
• Maui Lani Legends 2
• Maui Lani Na Hoku
• Maui Lani Sandhills Estates
• Maui Lani Sandhills - Commercial
• Maui Lani Shopping Center
• Maui Lani The Fairways
• Maui Lani Traditions
• Nisei Veterans Memorial Center
• Pomaikai Elementary School
• Waikapu Gardens
• Wailuku 2 Elementary School
• Waiolani Elua
• Waiolani Mauka
• Waiolani Pikake
• Walgreens

Notes:

[1]The list above of development projects in Central Maui were pulled from multiple sources, including: conversations with County staff and developers, a residential project list for Central Maui provided by the County of Maui in December 2013, available and relevant environmental assessments or impact studies available on the State's website for Maui, and the 2011 Central Maui Development Project maps and Development Project GIS layer available on the County website.

[2]During the related project review process, the projects listed above were found to have been completed. The socioeconomic and land use data in the TDFM Base Year (2007) was reviewed and in some areas adjusted to appropriately model the above related projects and to further update the Base Year (2007) model to a Base Year (2013) model.

APPENDIX D: MXD+ WORKSHEETS

MXD+ Worksheets – Year 2022 Phase 1 Project Conditions

MIXED USE TRIP GENERATION MODEL - BASIC INPUT

All shaded cells are inputs
Regular inputs (project-specific)
Inputs that may depend on regional values from census data, travel demand model, etc…
Treat like other inputs, but please send values and source to Mackenzie Watten so that a library of values can be compiled in future versions!

Section 1 - General Site Information

Site Name	Waikapu Country Town *Phase 1 (2017-2021)*	int/sq mi	**50**

Geographic		**Notes / Instructions**
Developed Area (in acres)	244.72	Include streets, ROW, parking lots, pocket parks. Do not include open space, vacant lots.
Number of Intersections	19	Count intersections either within or on the perimeter of the MXD. Check resulting intersections per square mile in blue above
Is Transit (bus or rail) present within the site or across the street?	Yes	Note: This is only used as a way to zero out the probability of external trips if no transit is present.
Proportion of households within 1/4 mile of a transit stop	25%	Enter as a percentage
Land Use - Surrounding Area		
Is the site in a Central Business District and/or TOD?	No	Answering "Yes" will reduce the HBO and NHB purpose splits for retail use to those found in smaller stores. The nature of the stores (large vs. small) should be the primary factor in the selection here.
Employment within one mile of the MXD	**3,503**	Do not include employment within the MXD itself
Employment within a 30 minute Transit Trip (Door-to-door)	**7,686**	Include employment within the MXD itself
Total Regional Employment	**90,855**	Employment at MPO or similar level
Site Demographics		
Enter Population Directly?	No	If "No", will apply average HH size factors (immediately below) to dwelling unit totals in section 2
Population		You do not need to enter population here. It will be calculated based on dwelling units below and average HH sizes.
Average HH Size by type within MXD		
Single Family	3.2	These HH size inputs by dwelling type are used to calculate population if it is not entered above, and are also used for average HH size if block group average HH size option is "No" below
Multi-Family	2.5	
Townhouse	2.5	
High Rise Condo	2.5	
Average Vehicles Owned per Dwelling Unit within site	2.70	
Use Surrounding Area (Block Group) Demographics for On-Site Average HH Size?	Yes	If no project-specific information exists, can use block group average HH size (see below)
Use Surrounding Area (Block Group) Demographics for On-Site Average Veh Own?	Yes	If no project-specific information exists, can use block group average veh owned (see below)
Surrounding Area (Block Group) Demographics		
Average HH size near Site	3.37	See http://factfinder2.census.gov/
Average Vehicles Owned per Dwelling Unit near Site	2.07	See http://factfinder2.census.gov/

Section 2 - Trip Generation

			Trip Equation Method			Trips			NHB Trips Outside of Project		
	Quantity	**Units**	Daily	AM Peak Hour	PM Peak Hour	Daily	AM Peak Hour	PM Peak Hour	Daily	AM Peak Hour	PM Peak Hour
Number of Dwelling Units											
Single Family	347	DU	Log Equation	Linear Equation	Log Equation	3,299	253	322	699	11	65
Multi-Family	384	DU	Linear Equation	Linear Equation	Linear Equation	2,451	192	229	773	12	71
Townhouse	0	DU	Log Equation	Log Equation	Log Equation	0	0	0	0	0	0
High Rise Condo	0	DU	Linear Equation	Linear Equation	Linear Equation	0	0	0	0	0	0
Retail (note: if you use job units for retail, the spreadsheet will convert before applying trip rates, using the rate in section 2 which you can change)											
General Retail other than those listed below	169.597	ksf	Log Equation	Log Equation	Log Equation	9,573	215	854			
Supermarket	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Bank	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Health Club	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Restaurant (non-fast food)	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Fast-Food Restaurant	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Gas Station	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Auto Repair	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Home Improvement Superstore		ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Free-Standing Discount		ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Office											
Non-Medical	0	ksf	Log Equation	Log Equation	Linear Equation	0	0	0			
Medical	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Industrial											
Light Industrial	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Manufacturing	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Warehousing / Self-Storage	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Hotel (including restaurant, facilities, etc…)	0	Rooms	Average Rate	Average Rate	Average Rate	0	0	0			
Motel		Rooms	Average Rate	Average Rate	Average Rate	0	0	0			
Movie Theater (Theater with Matinee)			Average Rate	Average Rate	Average Rate	0	0	0			
Movie Theater (Multiplex)	0	Screens	Average Rate	Average Rate	Average Rate	0	0	0			
School											
University		Students	Linear Equation	Average Rate	Average Rate	0	0	0			
High School		Students	Average Rate	Average Rate	Average Rate	0	0	0			
Middle School		Students	Average Rate	Average Rate	Average Rate	0	0	0			
Elementary	750	Students	Average Rate	Average Rate	Average Rate	968	338	113			
Trips from Land uses not covered above ==>											
Daily	61	Park related trips									
AM Peak Hour	1	Park related trips									
PM Peak Hour	2	Park related trips									
Jobs in those Land Uses	0										

	Daily	AM Peak Hour	PM Peak Hour
Total "Raw" ITE Trips	**16,351**	**998**	**1,519**

MIXED USE TRIP GENERATION MODEL - ADVANCED OUTPUT

MODEL APPLICATION - ALL TRIPS

	Daily				AM Peak Hour				PM Peak Hour			
	HBW	HBO	NHB	Total	HBW	HBO	NHB	Total	HBW	HBO	NHB	Total
Number of "Raw" ITE Trips Subject to Model												
Productions	1263	3203	1475	5940	192	104	53	349	167	258	149	575
Attractions	1016	6897	1824	9736	82	293	59	434	126	558	186	871
Total	2278	10099	3298	15676	274	397	112	783	293	817	335	1445
Predicted Probabilities:												
Productions												
Internal Capture	5.30%	10.35%	9.68%	12.49%	7.16%	14.06%	13.20%	12.91%	10.00%	19.62%	18.42%	21.92%
Walking External	3.17%	2.07%	0.51%	1.93%	4.19%	2.73%	0.51%	3.27%	3.17%	2.07%	0.51%	2.03%
Transit External	0.52%	1.08%	5.44%	2.05%	0.74%	2.33%	11.70%	2.80%	0.81%	2.16%	10.88%	4.00%
Attractions												
Internal Capture	5.30%	10.35%	9.68%	7.62%	7.16%	14.06%	13.20%	10.36%	10.00%	19.62%	18.42%	14.47%
Walking External	3.17%	2.07%	0.51%	1.90%	4.19%	2.73%	0.51%	2.70%	3.17%	2.07%	0.51%	1.91%
Transit External	0.52%	1.08%	5.44%	1.83%	0.74%	2.33%	11.70%	3.29%	0.81%	2.16%	10.88%	3.78%
Total												
Internal Capture	5.27%	10.34%	9.70%	9.47%	7.30%	14.12%	12.45%	11.50%	10.23%	19.59%	18.49%	17.43%
Walking External	3.17%	2.07%	0.51%	1.91%	4.19%	2.73%	0.51%	2.95%	3.17%	2.07%	0.51%	1.96%
Transit External	0.52%	1.08%	5.44%	1.91%	0.74%	2.33%	11.70%	3.08%	0.81%	2.16%	10.88%	3.86%
Number of Trips:												
Productions												
Internal Capture	60	522	160	742	10	28	7	45	15	80	31	126
Walking External	38	56	7	100	8	2	0	10	5	4	1	9
Transit External	6	29	72	107	1	2	5	9	1	4	13	18
Attractions												
Internal Capture	60	522	160	742	10	28	7	45	15	80	31	126
Walking External	30	132	8	171	3	7	0	11	4	10	1	14
Transit External	5	69	91	164	1	6	6	13	1	10	17	28
Total												
Internal Capture	120	1044	320	1484	20	56	14	90	30	160	62	252
Walking External	68	188	15	271	11	9	1	20	8	14	1	23
Transit External	11	98	162	271	2	8	12	21	2	14	30	46
Internal Capture including Site Specific Internal	190	1589	320	2099	44	246	14	304	38	223	62	323
Net Number of IXXI Vehicle Trips	**2079**	**8770**	**2801**	**13649**	**241**	**323**	**86**	**651**	**253**	**629**	**242**	Walkir **1124**

	External Vehicle Trips			VMT		
Results	Raw	Net	Reduction %	Raw	Net	Reduction %
Daily	16,351	13,649	17%	61,319	52,259	15%
AM Peak Hour	998	651	35%	4,235	2,990	29%
PM Peak Hour	1,519	1,124	26%	5,974	4,601	23%

NOTE: External trips are attributed half to project site uses,
internal trips all to site uses for purposes of VMT allocation.
NHB Trips by households that start and end outside the site are not included.

MODEL APPLICATION - TRIP ENDS ASSOCIATED WITH HOUSES IN THE PROJECT ONLY

	Daily				AM Peak Hour				PM Peak Hour			
	HBW	HBO	NHB	Total	HBW	HBO	NHB	Total	HBW	HBO	NHB	Total
Number of "Raw" ITE Trips Subject to Model												
Productions	1263	3203	0	4465	192	104	0	295	167	258	0	426
Attractions	-35	356	349	670	-12	-59	6	-65	-4	21	37	54
Total	1228	3558	349	5135	180	44	6	230	163	279	37	479
Predicted Probabilities:												
Productions												
Internal Capture	5.30%	10.35%	9.68%	12.49%	7.16%	14.06%	13.20%	12.91%	10.00%	19.62%	18.42%	21.92%
Walking External	3.17%	2.07%	0.51%	1.93%	4.19%	2.73%	0.51%	3.27%	3.17%	2.07%	0.51%	2.03%
Transit External	0.52%	1.08%	5.44%	2.05%	0.74%	2.33%	11.70%	2.80%	0.81%	2.16%	10.88%	4.00%
Attractions												
Internal Capture	5.30%	10.35%	9.68%	7.62%	7.16%	14.06%	13.20%	10.36%	10.00%	19.62%	18.42%	14.47%
Walking External	3.17%	2.07%	0.51%	1.90%	4.19%	2.73%	0.51%	2.70%	3.17%	2.07%	0.51%	1.91%
Transit External	0.52%	1.08%	5.44%	1.83%	0.74%	2.33%	11.70%	3.29%	0.81%	2.16%	10.88%	3.78%
Total												
Internal Capture	-5.67%	10.34%	0.00%	5.81%	-13.52%	-266.39%	0.00%	-61.95%	-4.96%	14.87%	0.00%	6.97%
Walking External	3.17%	2.07%	0.51%	2.25%	4.19%	2.73%	0.51%	3.49%	3.17%	2.07%	0.51%	2.36%
Transit External	0.52%	1.08%	5.44%	1.25%	0.74%	2.33%	11.70%	1.61%	0.81%	2.16%	10.88%	2.36%
Number of Trips:												
Productions												
Internal Capture	-35	184	0	149	-12	-59	0	-71	-4	21	0	17
Walking External	41	63	0	104	9	4	0	13	5	5	0	10
Transit External	7	33	0	39	2	4	0	5	1	5	0	7
Attractions												
Internal Capture	-35	184	0	149	-12	-59	0	-71	-4	21	0	17
Walking External	0	4	2	5	0	0	0	0	0	0	0	0
Transit External	0	2	19	21	0	0	1	1	0	0	4	4
Total												
Internal Capture	-70	368	0	298	-24	-118	0	-143	-8	42	0	33
Walking External	41	66	2	109	9	4	0	13	5	5	0	11
Transit External	7	35	19	60	2	4	1	6	1	5	4	11
Internal Capture including Site Specific Internal	-35	640	0	606	-12	-23	0	-35	-4	73	0	69
NHB trips occuring outside the project			1472				23				136	
Non-XX NHB trips based on MXD model			143				3				25	
NHB trips still occuring outside the project			1329				20				111	
Net Number of IXXI Vehicle Trips generated by Project Residences	**1249**	**3090**	**328**	**4667**	**194**	**154**	**5**	**354**	**165**	**228**	**33**	**425**

	External Vehicle Trips			VMT			VMT Per Household	
Results	Raw	Net	Reduction %	Raw	Net	Reduction %	Raw	Net
Daily	5,750	4,667	19%	56,051	48,312	14%	76.7	66.1
AM Peak Hour	445	354	20%	4,376	3,695	16%	6.0	5.1
PM Peak Hour	551	425	23%	5,635	4,698	17%	7.7	6.4

NOTE: all trips generated by project households (either produced or attracted or both)
are counted 100%. This cannot be compared directly to the VMT in the section above.

MXD+ Worksheets – Year 2026 Phase 1 and Phase 2 Project Conditions

MIXED USE TRIP GENERATION MODEL - BASIC INPUT

All shaded cells are inputs
Regular inputs (project-specific)
Inputs that may depend on regional values from census data, travel demand model, etc…
Treat like other inputs, but please send values and source to Mackenzie Watten so that a library of values can be compiled in future versions!

Section 1 - General Site Information

Site Name	Waikapu Country Town *Phase 1 & 2 (2017-2026)*	int/sq mi	**40**

Geographic		**Notes / Instructions**
Developed Area (in acres)	444.21	Include streets, ROW, parking lots, pocket parks. Do not include open space, vacant lots.
Number of Intersections	28	Count intersections either within or on the perimeter of the MXD. Check resulting intersections per square mile in blue above
Is Transit (bus or rail) present within the site or across the street?	Yes	Note: This is only used as a way to zero out the probability of external trips if no transit is present.
Proportion of households within 1/4 mile of a transit stop	25%	Enter as a percentage
Land Use - Surrounding Area		
Is the site in a Central Business District and/or TOD?	No	Answering "Yes" will reduce the HBO and NHB purpose splits for retail use to those found in smaller stores. The nature of the stores (large vs. small) should be the primary factor in the selection here.
Employment within one mile of the MXD	**3,743**	Do not include employment within the MXD itself
Employment within a 30 minute Transit Trip (Door-to-door)	**8,089**	Include employment within the MXD itself
Total Regional Employment	**94,824**	Employment at MPO or similar level
Site Demographics		
Enter Population Directly?	No	If "No", will apply average HH size factors (immediately below) to dwelling unit totals in section 2
Population		You do not need to enter population here. It will be calculated based on dwelling units below and average HH sizes.
Average HH Size by type within MXD		
Single Family	3.2	These HH size inputs by dwelling type are used to calculate population if it is not entered above, and are also used for average HH size if block group average HH size option is "No" below
Multi-Family	2.5	
Townhouse	2.5	
High Rise Condo	2.5	
Average Vehicles Owned per Dwelling Unit within site	2.70	
Use Surrounding Area (Block Group) Demographics for On-Site Average HH Size?	Yes	If no project-specific information exists, can use block group average HH size (see below)
Use Surrounding Area (Block Group) Demographics for On-Site Average Veh Own?	Yes	If no project-specific information exists, can use block group average veh owned (see below)
Surrounding Area (Block Group) Demographics		
Average HH size near Site	3.37	See http://factfinder2.census.gov/
Average Vehicles Owned per Dwelling Unit near Site	2.07	See http://factfinder2.census.gov/

Section 2 - Trip Generation

			Trip Equation Method			Trips			NHB Trips Outside of Project		
	Quantity	**Units**	Daily	AM Peak Hour	PM Peak Hour	Daily	AM Peak Hour	PM Peak Hour	Daily	AM Peak Hour	PM Peak Hour
Number of Dwelling Units											
Single Family	1,050	DU	Log Equation	Linear Equation	Log Equation	9,136	745	872	2,114	33	195
Multi-Family	529	DU	Linear Equation	Linear Equation	Linear Equation	3,329	263	309	1,065	17	98
Townhouse	0	DU	Log Equation	Log Equation	Log Equation	0	0	0	0	0	0
High Rise Condo	0	DU	Linear Equation	Linear Equation	Linear Equation	0	0	0	0	0	0
Retail (note: if you use job units for retail, the spreadsheet will convert before applying trip rates, using the rate in section 2 which you can change)											
General Retail other than those listed below	169.597	ksf	Log Equation	Log Equation	Log Equation	9,573	215	854			
Supermarket	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Bank	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Health Club	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Restaurant (non-fast food)	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Fast-Food Restaurant	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Gas Station	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Auto Repair	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Home Improvement Superstore		ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Free-Standing Discount		ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Office											
Non-Medical	0	ksf	Log Equation	Log Equation	Linear Equation	0	0	0			
Medical	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Industrial											
Light Industrial	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Manufacturing	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Warehousing / Self-Storage	0	ksf	Average Rate	Average Rate	Average Rate	0	0	0			
Hotel (including restaurant, facilities, etc…)	0	Rooms	Average Rate	Average Rate	Average Rate	0	0	0			
Motel		Rooms	Average Rate	Average Rate	Average Rate	0	0	0			
Movie Theater (Theater with Matinee)			Average Rate	Average Rate	Average Rate	0	0	0			
Movie Theater (Multiplex)	0	Screens	Average Rate	Average Rate	Average Rate	0	0	0			
School											
University		Students	Linear Equation	Average Rate	Average Rate	0	0	0			
High School		Students	Average Rate	Average Rate	Average Rate	0	0	0			
Middle School		Students	Average Rate	Average Rate	Average Rate	0	0	0			
Elementary	750	Students	Average Rate	Average Rate	Average Rate	968	338	113			
Trips from Land uses not covered above ==>											
Daily	74	Park related trips									
AM Peak Hour	1	Park related trips									
PM Peak Hour	3	Park related trips									
Jobs in those Land Uses	0										

	Daily	AM Peak Hour	PM Peak Hour
Total "Raw" ITE Trips	**23,080**	**1,561**	**2,150**

MIXED USE TRIP GENERATION MODEL - ADVANCED OUTPUT

MODEL APPLICATION - ALL TRIPS

	Daily				AM Peak Hour				PM Peak Hour			
	HBW	HBO	NHB	Total	HBW	HBO	NHB	Total	HBW	HBO	NHB	Total
Number of "Raw" ITE Trips Subject to Model												
Productions	2778	7262	1475	11514	450	355	53	859	363	590	149	1103
Attractions	1016	7630	2231	10878	82	338	67	487	126	618	228	973
Total	3794	14892	3706	22392	532	694	120	1346	489	1208	377	2075
Predicted Probabilities:												
Productions												
Internal Capture	4.42%	10.48%	11.04%	9.28%	6.05%	14.30%	15.11%	8.73%	7.36%	17.42%	18.39%	14.33%
Walking External	2.92%	1.57%	0.46%	1.79%	3.86%	2.08%	0.47%	2.97%	2.92%	1.57%	0.46%	1.93%
Transit External	0.41%	1.13%	5.45%	1.47%	0.59%	2.42%	11.71%	1.93%	0.64%	2.25%	10.89%	2.71%
Attractions												
Internal Capture	4.42%	10.48%	11.04%	9.83%	6.05%	14.30%	15.11%	15.39%	7.36%	17.42%	18.39%	16.24%
Walking External	2.92%	1.57%	0.46%	1.47%	3.86%	2.08%	0.47%	2.14%	2.92%	1.57%	0.46%	1.49%
Transit External	0.41%	1.13%	5.45%	1.95%	0.59%	2.42%	11.71%	3.43%	0.64%	2.25%	10.89%	4.09%
Total												
Internal Capture	4.43%	10.48%	11.06%	9.55%	6.01%	14.42%	14.99%	11.14%	7.36%	17.38%	18.54%	15.23%
Walking External	2.92%	1.57%	0.46%	1.63%	3.86%	2.08%	0.47%	2.68%	2.92%	1.57%	0.46%	1.73%
Transit External	0.41%	1.13%	5.45%	1.70%	0.59%	2.42%	11.71%	2.45%	0.64%	2.25%	10.89%	3.35%
Number of Trips:												
Productions												
Internal Capture	84	780	205	1069	16	50	9	75	18	105	35	158
Walking External	79	102	6	187	17	6	0	23	10	8	1	18
Transit External	11	73	69	153	3	7	5	15	2	11	12	26
Attractions												
Internal Capture	84	780	205	1069	16	50	9	75	18	105	35	158
Walking External	27	108	9	144	3	6	0	9	3	8	1	12
Transit External	4	77	110	191	0	7	7	14	1	12	21	33
Total												
Internal Capture	168	1560	410	2138	32	100	18	150	36	210	70	316
Walking External	106	210	15	331	19	12	0	32	13	16	1	30
Transit External	15	150	180	345	3	14	12	29	3	22	33	59
Internal Capture including Site Specific Internal	238	2105	410	2753	56	290	18	364	44	273	70	387
Net Number of IXXI Vehicle Trips	**3505**	**12972**	**3101**	**19578**	**478**	**567**	**90**	**1135**	**437**	**960**	**273**	**1670**

Walkir

	External Vehicle Trips			VMT		
Results	Raw	Net	Reduction %	Raw	Net	Reduction %
Daily	23,080	19,578	15%	88,254	76,475	13%
AM Peak Hour	1,561	1,135	27%	6,908	5,347	23%
PM Peak Hour	2,150	1,670	22%	8,672	7,000	19%

NOTE: External trips are attributed half to project site uses,
internal trips all to site uses for purposes of VMT allocation.
NHB Trips by households that start and end outside the site are not included.

MODEL APPLICATION - TRIP ENDS ASSOCIATED WITH HOUSES IN THE PROJECT ONLY

	Daily				AM Peak Hour				PM Peak Hour			
	HBW	HBO	NHB	Total	HBW	HBO	NHB	Total	HBW	HBO	NHB	Total
Number of "Raw" ITE Trips Subject to Model												
Productions	2778	7262	0	10040	450	355	0	805	363	590	0	953
Attractions	-35	1090	757	1812	-12	-14	14	-12	-4	81	79	156
Total	2743	8351	757	11851	438	341	14	793	359	671	79	1109
Predicted Probabilities:												
Productions												
Internal Capture	4.42%	10.48%	11.04%	9.28%	6.05%	14.30%	15.11%	8.73%	7.36%	17.42%	18.39%	14.33%
Walking External	2.92%	1.57%	0.46%	1.79%	3.86%	2.08%	0.47%	2.97%	2.92%	1.57%	0.46%	1.93%
Transit External	0.41%	1.13%	5.45%	1.47%	0.59%	2.42%	11.71%	1.93%	0.64%	2.25%	10.89%	2.71%
Attractions												
Internal Capture	4.42%	10.48%	11.04%	9.83%	6.05%	14.30%	15.11%	15.39%	7.36%	17.42%	18.39%	16.24%
Walking External	2.92%	1.57%	0.46%	1.47%	3.86%	2.08%	0.47%	2.14%	2.92%	1.57%	0.46%	1.49%
Transit External	0.41%	1.13%	5.45%	1.95%	0.59%	2.42%	11.71%	3.43%	0.64%	2.25%	10.89%	4.09%
Total												
Internal Capture	-2.54%	10.49%	0.00%	6.80%	-5.55%	-8.00%	0.00%	-6.51%	-2.25%	17.29%	0.00%	9.73%
Walking External	2.92%	1.57%	0.46%	1.84%	3.86%	2.08%	0.47%	3.03%	2.92%	1.57%	0.46%	1.98%
Transit External	0.41%	1.13%	5.45%	1.24%	0.59%	2.42%	11.71%	1.57%	0.64%	2.25%	10.89%	2.34%
Number of Trips:												
Productions												
Internal Capture	-35	438	0	403	-12	-14	0	-26	-4	58	0	54
Walking External	82	107	0	190	18	8	0	25	11	8	0	19
Transit External	12	77	0	88	3	9	0	12	2	12	0	14
Attractions												
Internal Capture	-35	438	0	403	-12	-14	0	-26	-4	58	0	54
Walking External	0	10	4	14	0	0	0	0	0	0	0	1
Transit External	0	7	41	49	0	0	2	2	0	1	9	9
Total												
Internal Capture	-70	876	0	806	-24	-27	0	-52	-8	116	0	108
Walking External	82	118	4	203	18	8	0	26	11	9	0	20
Transit External	12	84	41	137	3	9	2	13	2	12	9	23
Internal Capture including Site Specific Internal	-35	1148	0	1114	-12	68	0	56	-4	148	0	144
NHB trips occuring outside the project			3179				50				294	
Non-XX NHB trips based on MXD model			351				8				54	
NHB trips still occuring outside the project			2828				42				240	
Net Number of IXXI Vehicle Trips generated by Project Residences	**2719**	**7274**	**712**	**10705**	**442**	**352**	**12**	**806**	**354**	**534**	**70**	**958**

	External Vehicle Trips			VMT			VMT Per Household	
Results	Raw	Net	Reduction %	Raw	Net	Reduction %	Raw	Net
Daily	12,466	10,705	14%	121,445	108,392	11%	76.9	68.6
AM Peak Hour	1,008	806	20%	9,902	8,435	15%	6.3	5.3
PM Peak Hour	1,181	958	19%	12,093	10,404	14%	7.7	6.6

NOTE: all trips generated by project households (either produced or attracted or both)
are counted 100%. This cannot be compared directly to the VMT in the section above.

APPENDIX E: YEAR 2026 PROJECT TRIP GENERATION ESTIMTATES

TRIP GENERATION RATES AND ESTIMATES FOR WCT PHASE 1 ONLY

SUMMARY OF RATES

Land Use	ITE#	Rate	Daily	AM Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
Single-Family Housing	210	per Dwelling Unit	[a]	25%	75%	[a]	63%	37%	[a]
Apartments	220	per Dwelling Unit	[a]	20%	80%	[a]	65%	35%	[a]
Retail	820	per 1,000 square feet	[a]	62%	38%	[a]	48%	52%	[a]
Parks	412	per acre	2.28	61%	39%	0.02	61%	39%	0.09
Elementary School	520	per student	1.29	55%	45%	0.45	49%	51%	0.15
Quality Restaurant	931	per 1,000 square feet	89.95	82%	18%	0.81	67%	33%	7.49

Source: *ITE Trip Generation Manual,* 9th Edition, 2012.

VEHICLE TRIP ESTIMATES

Land Use	ITE#	Quantity	Unit	Daily	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
Phase 1 (2017-2021)										
Single-Family Housing	210	347	DU[1]	3,299	63	190	253	203	119	322
Apartments [b]	220	384	DU[1]	2,451	38	154	192	149	80	229
Retail [c]	820	169.597	KSF[2]	9,573	133	82	215	410	444	854
Parks	412	26.660	Acres	61	1	0	1	1	1	2
Elementary School [d]	520	750	Students	968	186	152	338	55	58	113
Internal Capture or Non-motorized Trips (15% Daily; 25% AM and PM) [e]				*-2,453*	*-105*	*-145*	*-250*	*-205*	*-175*	*-380*
Pass-by Reduction (10% Daily and AM; 20% PM) [f]				*-813*	*-10*	*-6*	*-16*	*-61*	*-67*	*-128*
Total Net New External Vehicle Trips (Phase 1 Only)				**13,086**	**306**	**427**	**733**	**552**	**460**	**1,012**

Source: Fehr & Peers, 2014; Waikapu Country Town Conceptual Land Use Plan by Planning Consultants Hawaii, LLC. (October 2014)

Notes:

[1] Dwelling Unit = DU

[2] 1,000 square feet = ksf

[a] Fitted curve equations were used to derive AM peak hour, PM peak hour, and daily trip generation.

[b] The country town mixed-use residential units and the multi-family residential units were all analyzed as apartments for conservative trip generation analysis purposes.

[c] Does not include the 29,250 square feet of existing commercial uses located in the same area as the "village center," which will remain.

[d] Elementary school student body assumed based on information provided in the latest Waikapu Country Town Land Use Plan dated March 3, 2014 and further consultation with the Planning Consultants Hawaii, LLC and Hawaii Department of Education, Facilities.

[e] Under Phase 1 conditions, it is assumed that the percentage reductions related to internal capture and non-motorized trips are different than full project buildout reductions because a smaller portion of the makai and the mauka side of the WCT project will be developed and less residential units will be constructed. An estimated 15% reduction of daily trips and 25% AM and PM peak hour trips were made to account for the mixed-use nature of the site, where vehicle trips can be linked and/or replaced with non-motorized trips. The MXD process was used to confirm and refine the initial reduction estimate. The MXD+ estimates peak hour internalization at 26% to 35% for WCT Phase 1.

[f] Based on the ITE Trip Generation Handbook, 2nd Edition, 2004, the estimated pass-by trip credit (assuming all WCT commercial space is for retail) is about 33%. However, because some space is expected to be service-oriented or small office, and to provide a more conservative analysis it is estimated that the pass-by credit is 10% and 20% of the net daily and net AM and PM peak hour retail trips, respectively.

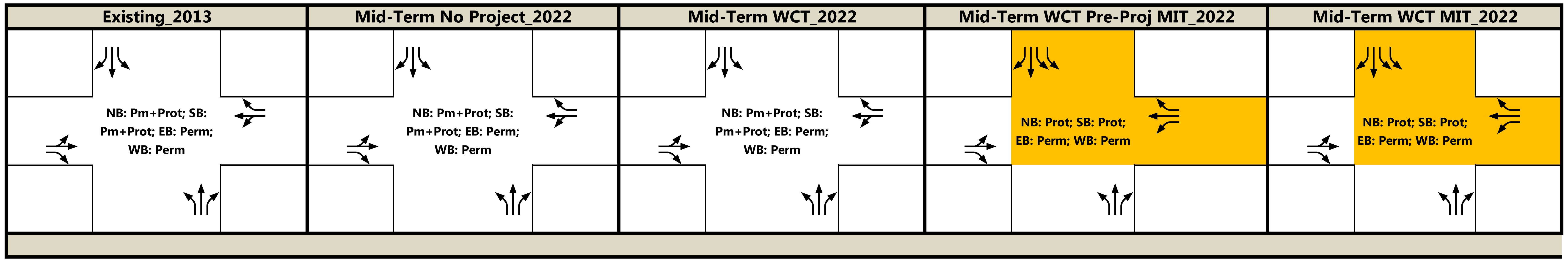
APPENDIX F: PROPOSED MITIGATION MEASURES

Proposed Year 2022 Mitigation Measures

Proposed Year 2022 Mitigation Measures for the Waikapu Country Town (WCT) Project

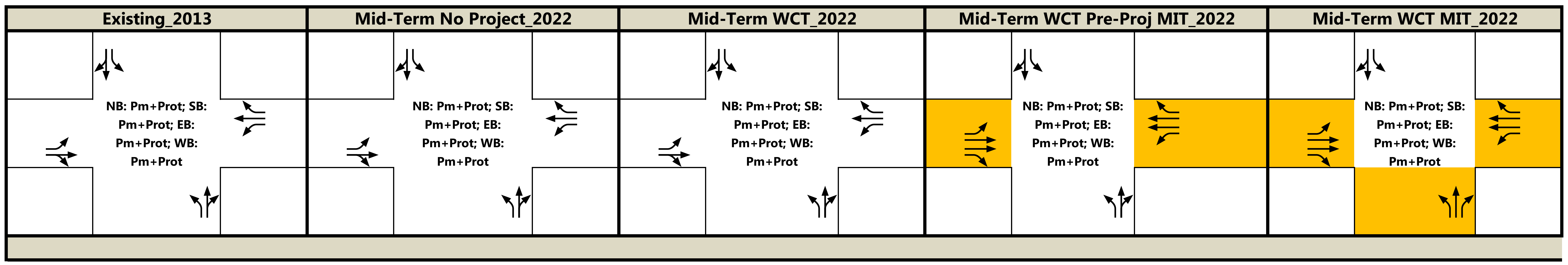
Intersection #
1

N-S : Honoapi'ilani Highway
E-W : Kuikahi Drive



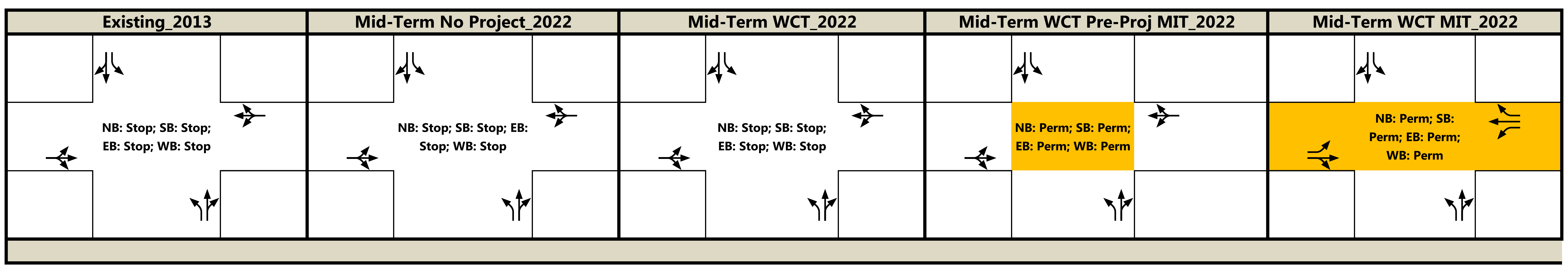
Intersection #
2

N-S : Waiale Road
E-W : Kuikahi Drive



Intersection #
3

N-S : S. Kamehameha Avenue
E-W : Maui Lani Parkway



Legend:

- Pre-Proj MIT = Mitigation measure improves intersection conditions to pre-project conditions or better.
- WCT MIT = Mitigation measure improves intersection conditions to LOS D conditions or better.

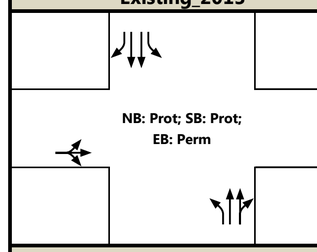
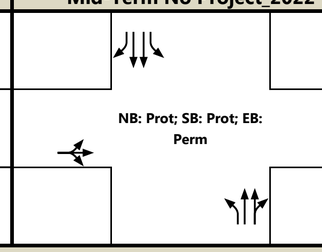
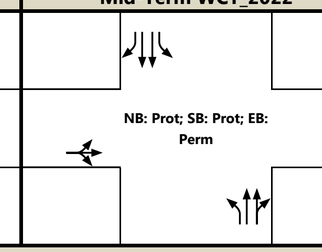
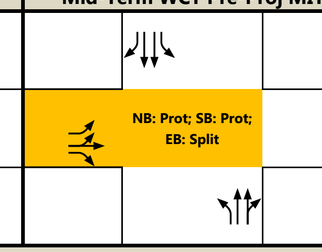
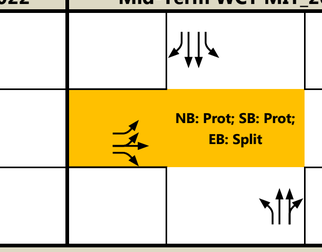
(pink box) : Indicates changes between the "pre-mitigation" scenarios

(orange box) : Illustrates proposed changes to mitigate indentified impacts

Proposed Year 2022 Mitigation Measures for the Waikapu Country Town (WCT) Project

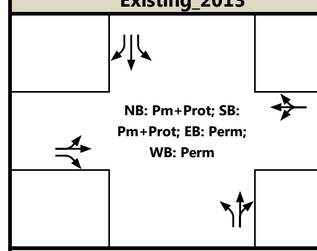
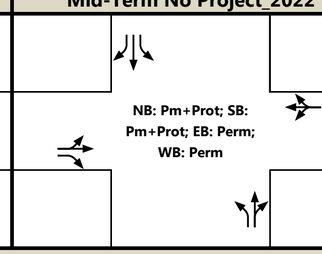
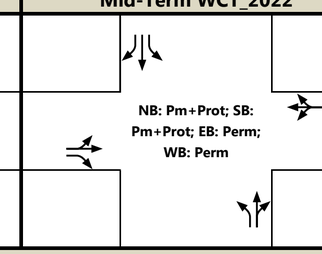
Intersection #
4

N-S : Kuihelani Highway
E-W : Maui Lani Parkway

Existing_2013	Mid-Term No Project_2022	Mid-Term WCT_2022	Mid-Term WCT Pre-Proj MIT_2022	Mid-Term WCT MIT_2022
				

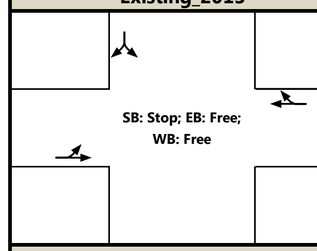
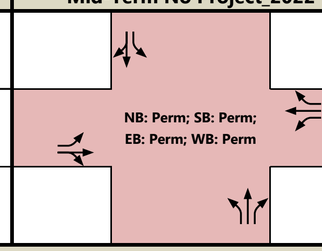
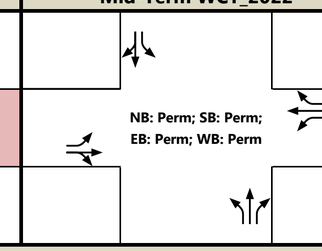
Intersection #
5

N-S : Honoapi'ilani Highway
E-W : Waiko Road

Existing_2013	Mid-Term No Project_2022	Mid-Term WCT_2022	Mid-Term WCT Pre-Proj MIT_2022	Mid-Term WCT MIT_2022
			No Impact	No Impact

Intersection #
6

N-S : Waiale Road
E-W : Waiko Road

Existing_2013	Mid-Term No Project_2022	Mid-Term WCT_2022	Mid-Term WCT Pre-Proj MIT_2022	Mid-Term WCT MIT_2022
			No Impact	No Impact

Legend:

- Pre-Proj MIT = Mitigation measure improves intersection conditions to pre-project conditions or better.
- WCT MIT = Mitigation measure improves intersection conditions to LOS D conditions or better.

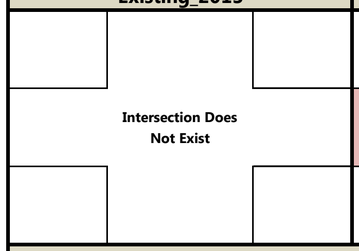
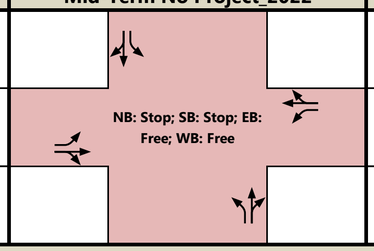
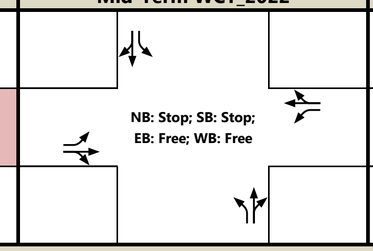
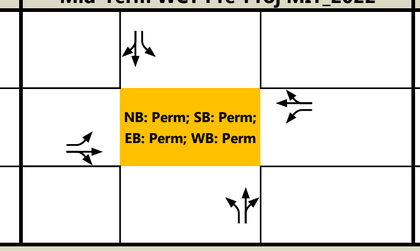
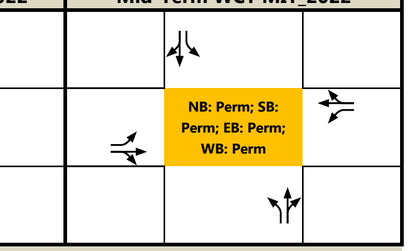
: Indicates changes between the "pre-mitigation" scenarios

: Illustrates proposed changes to mitigate indentified impacts

Proposed Year 2022 Mitigation Measures for the Waikapu Country Town (WCT) Project

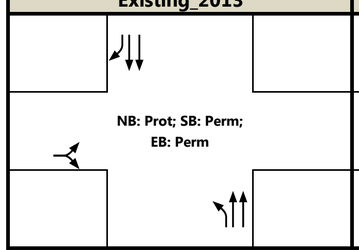
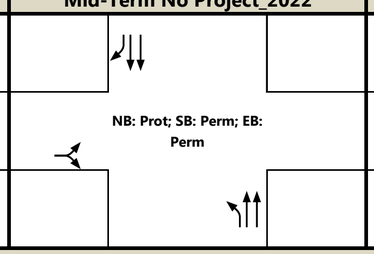
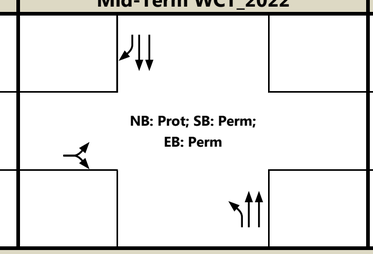
Intersection #
7

N-S : S. Kamehameha Avenue
E-W : Waiko Road

Existing_2013	Mid-Term No Project_2022	Mid-Term WCT_2022	Mid-Term WCT Pre-Proj MIT_2022	Mid-Term WCT MIT_2022
				

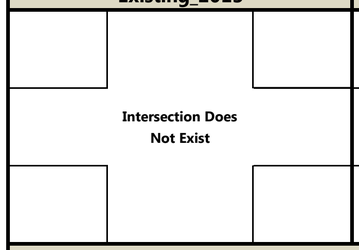
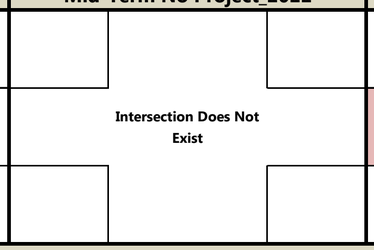
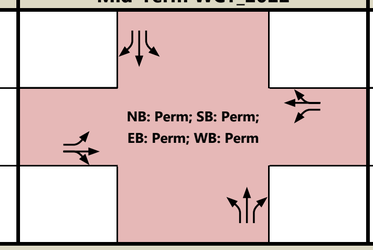
Intersection #
8

N-S : Kuihelani Highway
E-W : Waiko Road

Existing_2013	Mid-Term No Project_2022	Mid-Term WCT_2022	Mid-Term WCT Pre-Proj MIT_2022	Mid-Term WCT MIT_2022
			No Impact	No Impact

Intersection #
9

N-S : Honoapi'ilani Highway
E-W : Main Street

Existing_2013	Mid-Term No Project_2022	Mid-Term WCT_2022	Mid-Term WCT Pre-Proj MIT_2022	Mid-Term WCT MIT_2022
			No Impact	No Impact

Legend:

- Pre-Proj MIT = Mitigation measure improves intersection conditions to pre-project conditions or better.
- WCT MIT = Mitigation measure improves intersection conditions to LOS D conditions or better.

: Indicates changes between the "pre-mitigation" scenarios

: Illustrates proposed changes to mitigate indentified impacts

Proposed Year 2022 Mitigation Measures for the Waikapu Country Town (WCT) Project

Intersection #
10

N-S : Waiale Road
E-W : Main Street

Existing_2013	Mid-Term No Project_2022	Mid-Term WCT_2022	Mid-Term WCT Pre-Proj MIT_2022	Mid-Term WCT MIT_2022
Intersection Does Not Exist	Intersection Does Not Exist	Roundabout	Roundabout	Roundabout

Intersection #
11

N-S : Honoapi'ilani Highway
E-W : East-West Residential Street

Existing_2013	Mid-Term No Project_2022	Mid-Term WCT_2022	Mid-Term WCT Pre-Proj MIT_2022	Mid-Term WCT MIT_2022
Intersection Does Not Exist	Intersection Does Not Exist	Intersection Does Not Exist	Intersection Does Not Exist	Intersection Does Not Exist

Intersection #
12

N-S : North-South Residential Street
E-W : Waiale Road

Existing_2013	Mid-Term No Project_2022	Mid-Term WCT_2022	Mid-Term WCT Pre-Proj MIT_2022	Mid-Term WCT MIT_2022
Intersection Does Not Exist	Intersection Does Not Exist	Intersection Does Not Exist	Intersection Does Not Exist	Intersection Does Not Exist

Legend:

- Pre-Proj MIT = Mitigation measure improves intersection conditions to pre-project conditions or better.
- WCT MIT = Mitigation measure improves intersection conditions to LOS D conditions or better.

: Indicates changes between the "pre-mitigation" scenarios

: Illustrates proposed changes to mitigate indentified impacts

Proposed Year 2022 Mitigation Measures for the Waikapu Country Town (WCT) Project

Intersection #
13

N-S : Honoapi'ilani Highway
E-W : Waiale Road

Existing_2013	Mid-Term No Project_2022	Mid-Term WCT_2022	Mid-Term WCT Pre-Proj MIT_2022	Mid-Term WCT MIT_2022
Intersection Does Not Exist	NB: Perm; SB: Perm; WB: Perm FF	NB: Perm; SB: Perm; WB: Perm FF	No Impact	No Impact

Intersection #
14

N-S : Honoapi'ilani Highway
E-W : Kuihelani Highway

Existing_2013	Mid-Term No Project_2022	Mid-Term WCT_2022	Mid-Term WCT Pre-Proj MIT_2022	Mid-Term WCT MIT_2022
FF NB: Prot; SB: Prot; EB: Split; WB: Split FF	FF NB: Prot; SB: Prot; EB: Split; WB: Split FF	FF NB: Prot; SB: Prot; EB: Split; WB: Split FF	No Impact	No Impact

Legend:

- Pre-Proj MIT = Mitigation measure improves intersection conditions to pre-project conditions or better.
- WCT MIT = Mitigation measure improves intersection conditions to LOS D conditions or better.

: Indicates changes between the "pre-mitigation" scenarios

: Illustrates proposed changes to mitigate indentified impacts

Proposed Year 2026 Mitigation Measures

Proposed Year 2026 Mitigation Measures for the Waikapu Country Town (WCT) Project

Intersection #
1

N-S : Honoapi'ilani Highway
E-W : Kuikahi Drive

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
NB: Pm+Prot; SB: Pm+Prot; EB: Perm; WB: Perm	NB: Pm+Prot; SB: Pm+Prot; EB: Perm; WB: Perm	NB: Pm+Prot; SB: Pm+Prot; EB: Perm; WB: Perm	NB: Prot; SB: Prot; EB: Perm; WB: Perm	NB: Prot; SB: Prot; EB: Perm; WB: Perm

Intersection #
2

N-S : Waiale Road
E-W : Kuikahi Drive

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
NB: Pm+Prot; SB: Pm+Prot; EB: Pm+Prot; WB: Pm+Prot	NB: Pm+Prot; SB: Pm+Prot; EB: Pm+Prot; WB: Pm+Prot	NB: Pm+Prot; SB: Pm+Prot; EB: Pm+Prot; WB: Pm+Prot	NB: Pm+Prot; SB: Pm+Prot; EB: Pm+Prot; WB: Pm+Prot	NB: Pm+Prot; SB: Pm+Prot; EB: Pm+Prot; WB: Pm+Prot

Intersection #
3

N-S : S. Kamehameha Avenue
E-W : Maui Lani Parkway

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
NB: Stop; SB: Stop; EB: Stop; WB: Stop	NB: Stop; SB: Stop; EB: Stop; WB: Stop	NB: Stop; SB: Stop; EB: Stop; WB: Stop	NB: Perm; SB: Perm; EB: Perm; WB: Perm	NB: Perm; SB: Perm; EB: Perm; WB: Perm

Legend:

• Pre-Proj MIT = Mitigation measure improves intersection conditions to pre-project conditions or better.

• WCT MIT = Mitigation measure improves intersection conditions to LOS D conditions or better.

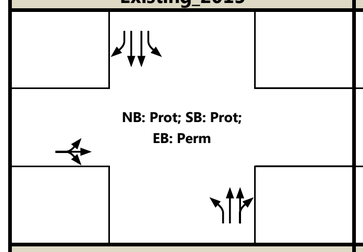
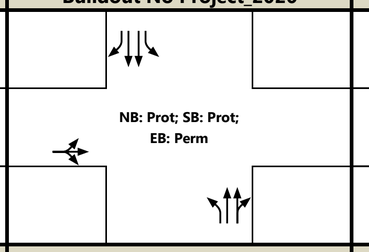
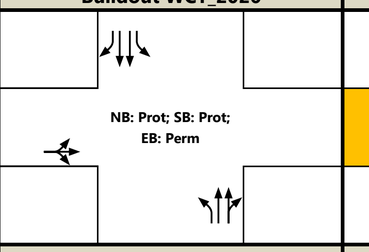
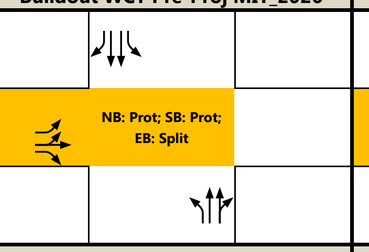
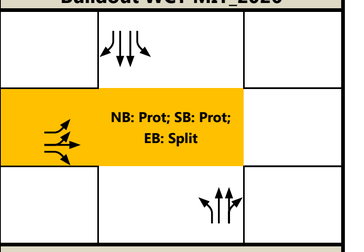
: Indicates changes between the "pre-mitigation" scenarios

: Illustrates proposed changes to mitigate indentified impacts

Proposed Year 2026 Mitigation Measures for the Waikapu Country Town (WCT) Project

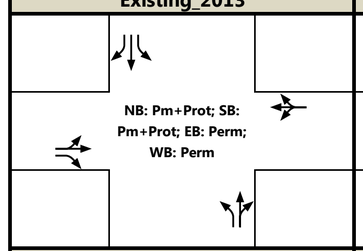
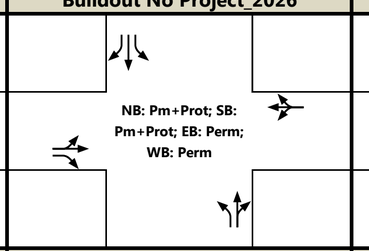
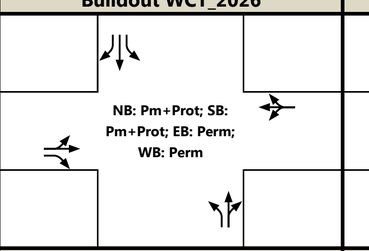
Intersection #
4

N-S : Kuihelani Highway
E-W : Maui Lani Parkway

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
				

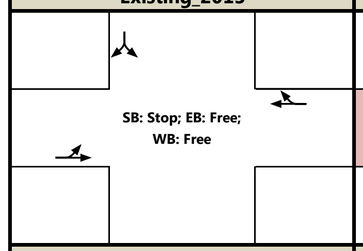
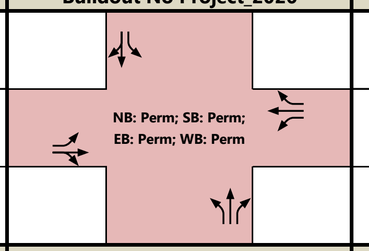
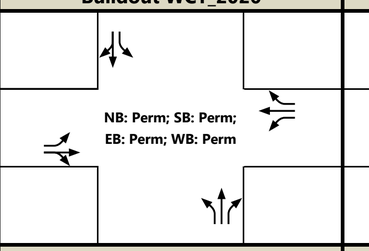
Intersection #
5

N-S : Honoapi'ilani Highway
E-W : Waiko Road

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
			No Impact	No Impact

Intersection #
6

N-S : Waiale Road
E-W : Waiko Road

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
			No Impact	No Impact

Legend:

- Pre-Proj MIT = Mitigation measure improves intersection conditions to pre-project conditions or better.
- WCT MIT = Mitigation measure improves intersection conditions to LOS D conditions or better.

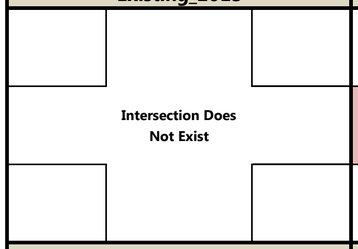
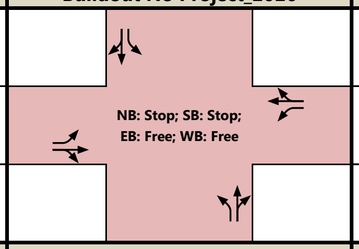
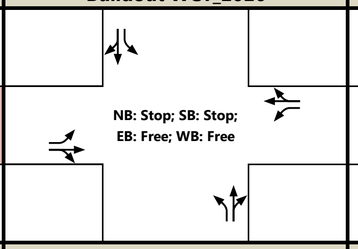
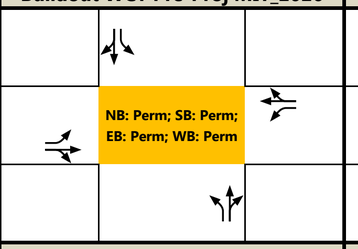
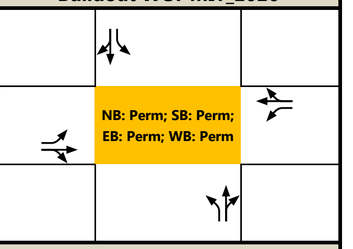
: Indicates changes between the "pre-mitigation" scenarios

: Illustrates proposed changes to mitigate indentified impacts

Proposed Year 2026 Mitigation Measures for the Waikapu Country Town (WCT) Project

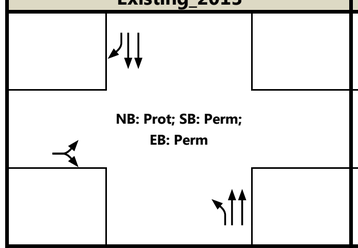
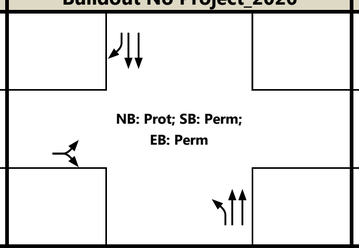
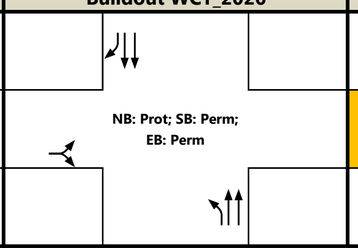
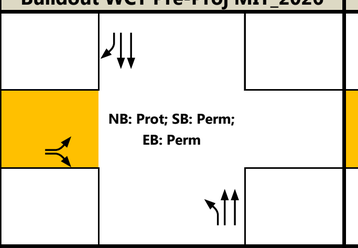
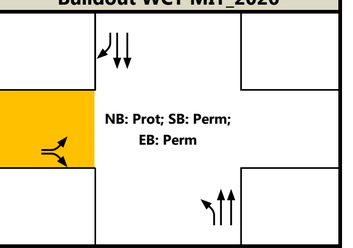
Intersection #
7

N-S : S. Kamehameha Avenue
E-W : Waiko Road

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
				

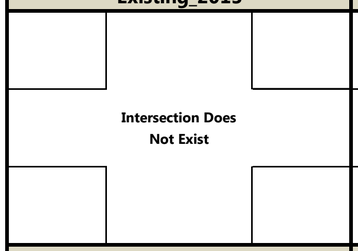
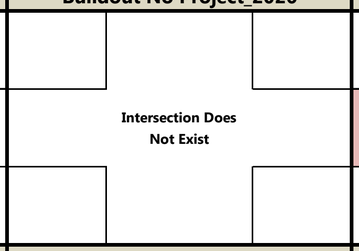
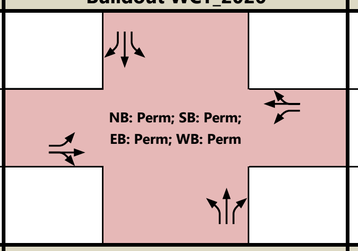
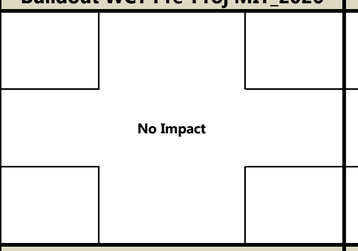
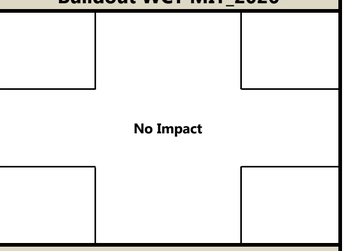
Intersection #
8

N-S : Kuihelani Highway
E-W : Waiko Road

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
				

Intersection #
9

N-S : Honoapi'ilani Highway
E-W : Main Street

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
				

Legend:

- Pre-Proj MIT = Mitigation measure improves intersection conditions to pre-project conditions or better.
- WCT MIT = Mitigation measure improves intersection conditions to LOS D conditions or better.

: Indicates changes between the "pre-mitigation" scenarios

: Illustrates proposed changes to mitigate indentified impacts

Proposed Year 2026 Mitigation Measures for the Waikapu Country Town (WCT) Project

Intersection #
10

N-S : Waiale Road
E-W : Main Street

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
Intersection Does Not Exist	Intersection Does Not Exist	Roundabout	Roundabout	Roundabout

Intersection #
11

N-S : Honoapi'ilani Highway
E-W : East-West Residential Street

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
Intersection Does Not Exist	Intersection Does Not Exist	NB: Perm; SB: Perm; EB: Perm; WB: Perm	No Impact	No Impact

Intersection #
12

N-S : North-South Residential Street
E-W : Waiale Road

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
Intersection Does Not Exist	Intersection Does Not Exist	SB: Stop; EB: Free; WB: Free	No Impact	No Impact

Legend:

- Pre-Proj MIT = Mitigation measure improves intersection conditions to pre-project conditions or better.
- WCT MIT = Mitigation measure improves intersection conditions to LOS D conditions or better.

: Indicates changes between the "pre-mitigation" scenarios

: Illustrates proposed changes to mitigate indentified impacts

Proposed Year 2026 Mitigation Measures for the Waikapu Country Town (WCT) Project

Intersection #
13

N-S : Honoapi'ilani Highway

E-W : Waiale Road

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
Intersection Does Not Exist	NB: Perm; SB: Perm; WB: Perm FF	NB: Perm; SB: Perm; EB: Pm+Prot; WB: Pm+Prot FF	No Impact	No Impact

Intersection #
14

N-S : Honoapi'ilani Highway

E-W : Kuihelani Highway

Existing_2013	Buildout No Project_2026	Buildout WCT_2026	Buildout WCT Pre-Proj MIT_2026	Buildout WCT MIT_2026
FF NB: Prot; SB: Prot; EB: Split; WB: Split FF	FF NB: Prot; SB: Prot; EB: Split; WB: Split FF	FF NB: Prot; SB: Prot; EB: Split; WB: Split FF	No Impact	No Impact

Legend:

- Pre-Proj MIT = Mitigation measure improves intersection conditions to pre-project conditions or better.
- WCT MIT = Mitigation measure improves intersection conditions to LOS D conditions or better.

: Indicates changes between the "pre-mitigation" scenarios

: Illustrates proposed changes to mitigate indentified impacts

APPENDIX M

Fehr & Peers Prepared "No Waiale Bypass Analysis" Memorandum

FEHR PEERS

MEMORANDUM

Date: October 17, 2016

To: Mike Summers, Planning Consultants Hawaii, LLC

From: Netai Basu & Christine Mercado, Fehr & Peers

Subject: Waikapu Country Town Project – Analysis of 2026 Conditions without the Waiale Bypass

SD13-0085.01

Coordination with local and state agencies, such as the County of Maui, and the project team during the early preparation stages of the Transportation Impact Analysis Report (TIAR) for the Waikapu Country Town Project led to the decision to assume the completion of the planned Waiale Bypass in the study's future analysis scenarios. The Waiale Bypass is a planned southward extension of Waiale Road from its existing terminus at Waiko Road to intersect with Honoapi'ilani Highway approximately one mile south of Honoapi'ilani Highway/Waiko Road. The roadway extension would provide additional access to the project land uses on the makai side via a roundabout intersection with the future east-west roadway within the project ("Main Street") and via a 3-legged intersection with the major North-South Residential Street. This bypass is not identified in the County's FY 2017 CIP, and the precise schedule for construction of this roadway is now uncertain. As planned, Waiale Road would be extended southward from Waiko Road to a new connection with Honoapiilani Highway. It would create a new north-south roadway connection in this area with multiple connections to Kuihelani Highway through the County's planned Base Yard and Regional Park.

During the DEIS public circulation period, some comments have questioned this baseline street improvement assumption, especially given the significance of the bypass road for project circulation, and have asked about impacts on project design and the study area's transportation facilities if the roadway improvement is not funded and built in time for the project. In response, Fehr & Peers has developed and analyzed forecast traffic volumes in Year 2026 without the Waiale Bypass in place, both before and after the addition of project traffic. These traffic volumes

were then used to conduct a full quantitative impact analysis of future no-bypass scenarios. The results of the analysis are summarized in this memorandum.

FUTURE TRAFFIC PROJECTIONS

Estimates of the future traffic conditions without the proposed project in place were derived using the Maui Travel Demand Forecasting Model. Particularly, the same 2026 model developed for the TIAR was used; however, the Waiale Bypass (north of the intersection with the planned north-south residential street that would be constructed as part of the project [Study Intersection #12]) was excluded from the roadway network. The resulting post-processed cumulative base traffic volumes and the anticipated lane configurations, representing future conditions without the project and the bypass for year 2026, is presented in **Figure 1**.

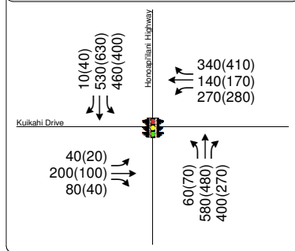
2026 NO PROJECT VOLUME COMPARISON

A comparison of the 2026 No Project peak hour volumes with and without the Waiale Bypass showed that the traffic projected to use the roadway extension would shift to use Honoapi'ilani Highway and Kuihelani Highway. Details of the shift in traffic volumes in the study area between Waiko Road and the intersection of Honoapi'ilani Highway & Kuihelani Highway under the 2026 No Project, No Bypass Condition are summarized below:

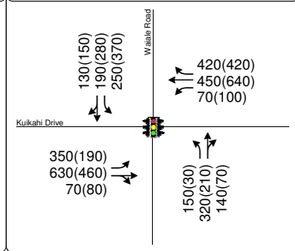
- During the AM peak hour, 210 additional northbound trips and 70 additional southbound trips would traverse Honoapi'ilani Highway.
- Along Kuihelani Highway, it is projected that there would be 110 additional northbound trips and 130 additional southbound trips traversing this portion of the study area in the AM peak hour.
- During the PM peak hour, 50 additional northbound trips and 210 additional southbound trips would traverse Honoapi'ilani Highway.
- Along Kuihelani Highway, it is projected that there would be 130 additional northbound trips and 80 additional southbound trips traversing this portion of the study area in the PM peak hour.

Study Intersection
Turn Lane
AM (PM) Peak Hour Traffic Volume
Traffic Signal
Stop Sign
Waiale Bypass

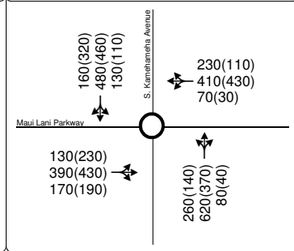
1. Honoapi'ilani Highway/Kuikahi Drive



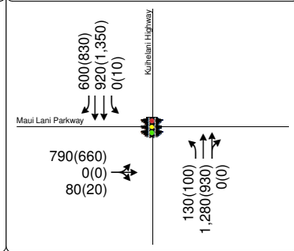
2. Waiale Road/Kuikahi Drive



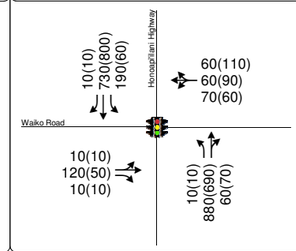
3. S. Kamehameha Avenue/Maui Lani Parkway



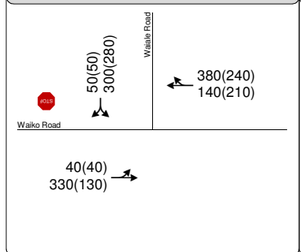
4. Kuihelani Highway/Maui Lani Parkway



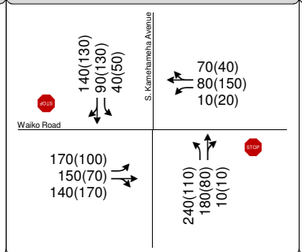
5. Honoapi'ilani Highway/Waiko Road



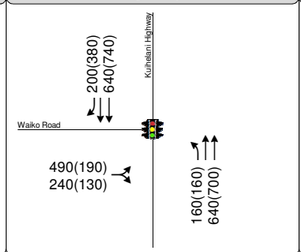
6. Waiale Road/Waiko Road



7. S. Kamehameha Avenue/Waiko Road



8. Kuihelani Highway/Waiko Road



9. Honoapi'ilani Highway/Main Street

Intersection does not exist under No Project Conditions

10. Waiale Road/Main Street

Intersection does not exist without the Waiale Bypass

11. Honoapi'ilani Hwy/E-W Residential Street

Intersection does not exist under No Project Conditions

12. N-S Residential Street/Waiale Road

Intersection does not exist under No Project Conditions

13. Honoapi'ilani Highway/Waiale Road

Intersection does not exist under No Project Conditions

14. Honoapi'ilani Highway/Kuihelani Highway

Figure 1
Peak Hour Traffic Volumes and Lane Configurations
Year 2026 No Project Conditions

PROJECT TRAFFIC PROJECTIONS

Using the same trip generation and overall trip distribution pattern presented in the TIAR, the project trips were assigned to the 2026 roadway network without the bypass. The trip assignment differs from the TIAR as trips to/from land uses on the makai side that were originally using Waiale Road were re-routed to use the site's internal roadways (i.e., Main Street, E-W Residential Road, and N-S Residential Road) and Honoapi'ilani Highway. **Figure 2** illustrates the net new 2026 project generated traffic volumes at full buildout for the AM and PM peak hours at each study intersection.

The project generated traffic volumes **(Figure 2)** were then added to the 2026 base traffic projection **(Figure 1)** to develop 2026 with Project traffic forecasts for the no-bypass scenario shown in **Figure 3**.

KEY STREET SYSTEM CHANGES

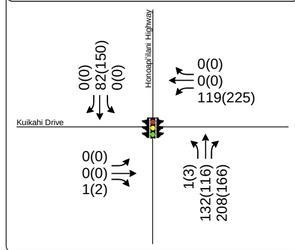
In addition to using the revised traffic projections in the 2026 intersection operations analysis presented in this memorandum, there have been changes to the baseline street system assumptions since the completion of the TIAR, as well as changes to the project street system assumptions due to not constructing that Waiale Bypass that have been applied. Described below are the key changes in study intersection configuration used in this analysis:

- Intersection 1: Honoapi'ilani Highway & Kuikahi Drive – Based on the May 2016 field observations, the eastbound and westbound approaches have been re-striped from one shared through/left-turn lane and one right-turn lane to one left-turn lane, one through lane, and one right-turn lane. Additionally, the eastbound and westbound left-turn phasing has been modified to protected/permitted. These modifications were used in the revised 2026 intersection operations analysis with and without the project in place.
- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway – A roundabout will be replacing the all-way stop-controlled intersection and construction is likely to begin operation sometime in Summer 2017. This intersection control modification was used in the revised 2026 intersection operations analysis with and without the project in place.
- Intersection 6: Waiko Road & Waiale Road – Signalization and construction of the fourth leg of this intersection are associated with the Waiale Bypass. Since this analysis evaluates

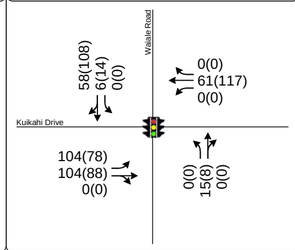
no-bypass scenarios, the existing control and configuration were maintained in the revised 2026 intersection operations analysis with and without the project in place.

- Intersection 9: Honoapi'ilani Highway & Main Street – This future intersection will be constructed as part of the project. Due to the increase in volumes at this location without the Waiale Bypass in place, the intersection configuration has been revised from what was assumed in the TIAR in order to yield acceptable operating conditions (i.e., minimum level of service [LOS] D or better). Thus, this analysis assumes that the intersection is configured with one left-turn lane, one through lane, and one right-turn lane across all approaches. Signal phasing is assumed to be protected/permitted across all approaches, and there would be an overlap phase for the westbound right-turn. These modifications were used in the revised 2026 with project intersection operations analysis.
- Intersection 10: Waiale Bypass & Main Street – This future intersection will not exist without the Waiale Bypass in place.
- Intersection 12: North-South Street Residential & Waiale Bypass– This future intersection will be constructed as part of the project. Without the Waiale Bypass in place this intersection would be a 2-legged, side-street stop-controlled intersection. These modifications were used in the revised 2026 with project intersection operations analysis.
- Intersection 13: Honoapi'ilani Highway & Waiale Bypass – This future intersection will be constructed as part of the project. Without the Waiale Bypass in place, this intersection would be a 4-legged, side-street intersection with stop-control on the minor approach.

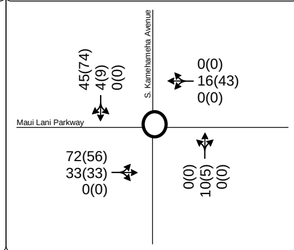
1. Honoapi'ilani Highway/Kuikahi Drive



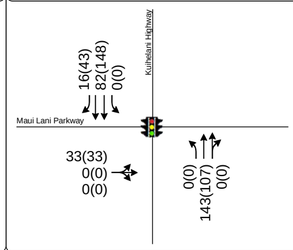
2. Waiale Road/Kuikahi Drive



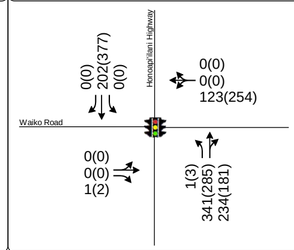
3. S. Kamehameha Avenue/Maui Lani Parkway



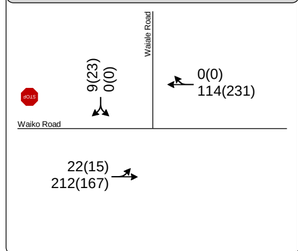
4. Kuihelani Highway/Maui Lani Parkway



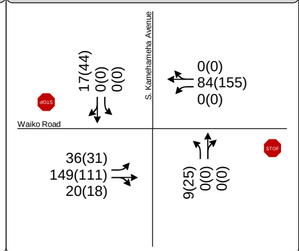
5. Honoapi'ilani Highway/Waiko Road



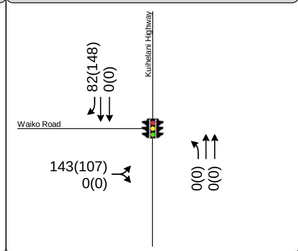
6. Waiale Road/Waiko Road



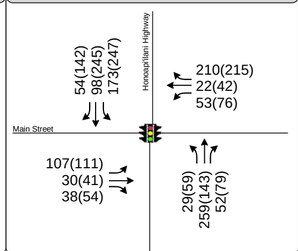
7. S. Kamehameha Avenue/Waiko Road



8. Kuihelani Highway/Waiko Road



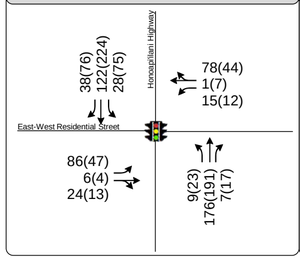
9. Honoapi'ilani Highway/Main Street



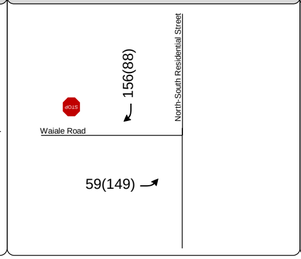
10. Waiale Road/Main Street

Intersection does not exist without the Waiale Bypass

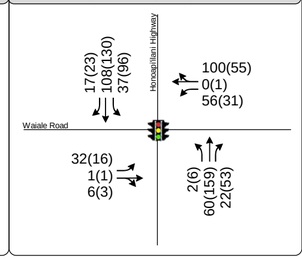
11. Honoapi'ilani Hwy/E-W Residential Street



12. N-S Residential Street/Waiale Road



13. Honoapi'ilani Highway/Waiale Road



14. Honoapi'ilani Highway/Kuihelani Highway

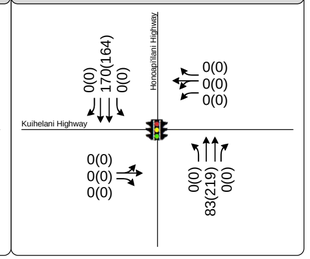
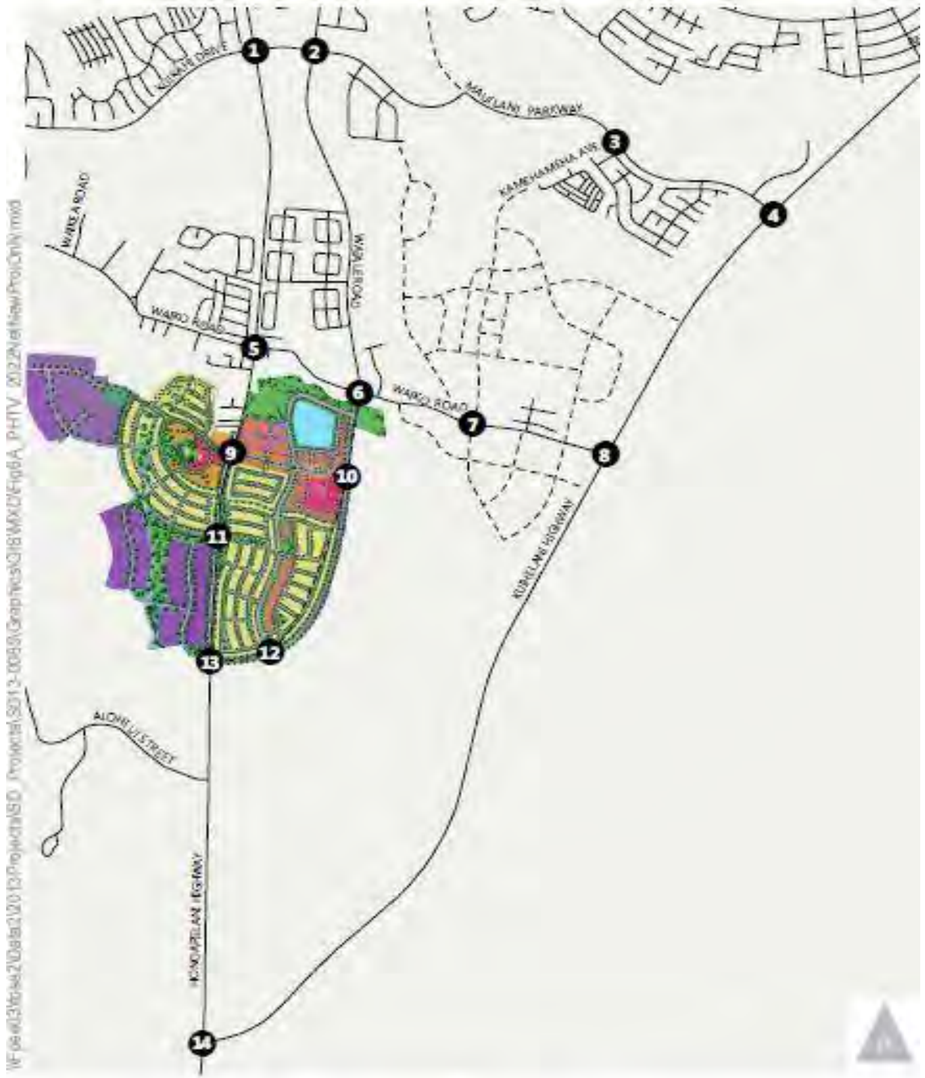
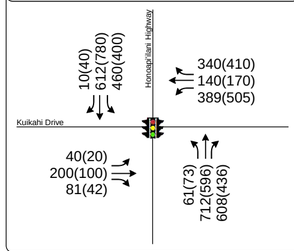


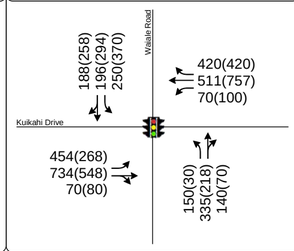
Figure 2
Peak Hour Traffic Volumes and Lane Configurations
Net New Project Only, Phase 1 & 2 (2026)



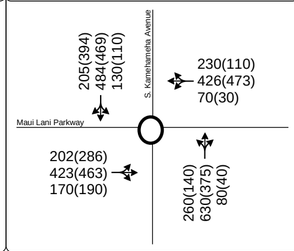
1. Honoapi'ilani Highway/Kuikahi Drive



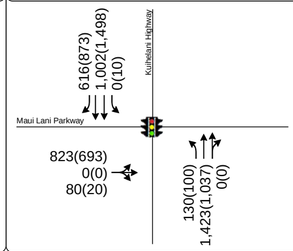
2. Waiale Road/Kuikahi Drive



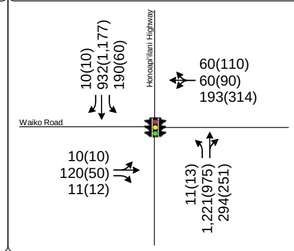
3. S. Kamehameha Avenue/Maui Lani Parkway



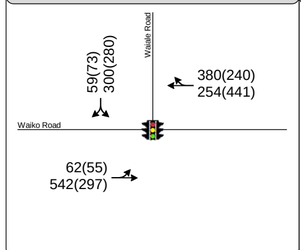
4. Kuihelani Highway/Maui Lani Parkway



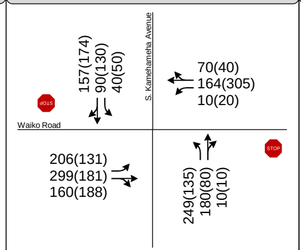
5. Honoapi'ilani Highway/Waiko Road



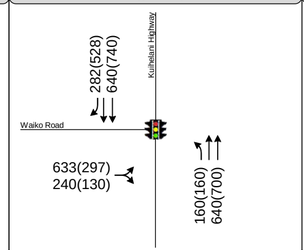
6. Waiale Road/Waiko Road



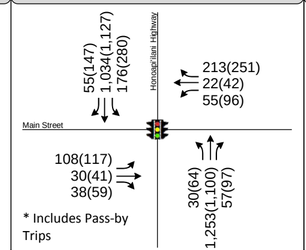
7. S. Kamehameha Avenue/Waiko Road



8. Kuihelani Highway/Waiko Road



9. Honoapi'ilani Highway/Main Street*

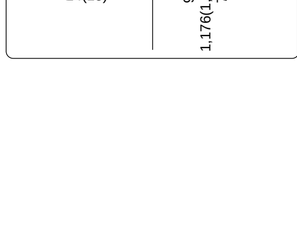


* Includes Pass-by Trips

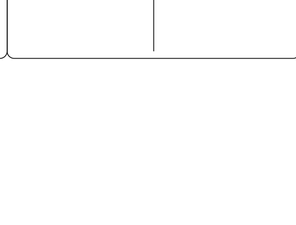
10. Waiale Road/Main Street

Intersection does not exist without the Waiale Bypass

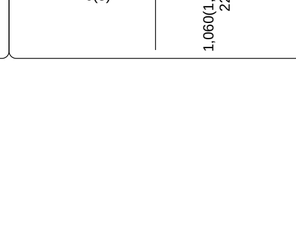
11. Honoapi'ilani Hwy/E-W Residential Street



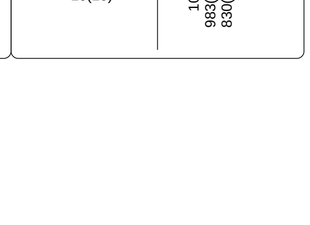
12. N-S Residential Street/Waiale Road



13. Honoapi'ilani Highway/Waiale Road



14. Honoapi'ilani Highway/Kuihelani Highway



#	Study Intersection		Traffic Signal
	Turn Lane		Stop Sign
AM (PM)	Peak Hour Traffic Volume	---	Waiale Bypass
*	Includes Pass-by Trips		

Figure 3
Peak Hour Traffic Volumes and Lane Configurations
2026 with Project (Phase 1 & 2) without Bypass Conditions

INTERSECTION ANALYSIS

The intersection operations analysis compares the projected levels of service at each study intersection under cumulative conditions for 2026 with and without the proposed project and without the Waiale Bypass to determine the potential impacts. Results of this analysis are presented in **Table 1**.

2026 NO PROJECT TRAFFIC CONDITIONS

The results of the LOS calculations indicate that all of the future study intersections operate at an overall desirable LOS (LOS D or better) under 2026 No Project Conditions, with the exception of the following locations:

- Intersection 1: Honoapi'ilani Highway & Kuikahi Drive (LOS F – AM peak hour)
- Intersection 2: Waiale Road & Kuikahi Drive (LOS E – AM peak hour hour)
- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway (LOS F – AM and PM peak hours)
- Intersection 4: Kuihelani Highway & Maui Lani Parkway (LOS F – AM and PM peak hours)
- Intersection 6: Waiale Road & Waiko Road (LOS F – AM Peak hour and LOS E – PM peak hour)
- Intersection 7: S. Kamehameha Avenue & Waiko Road (LOS F – AM and PM peak hours)
- Intersection 8: Kuihelani Highway & Waiko Road (LOS E – AM peak hour)
- Intersection 13: Honoapi'ilani Highway & Waiale Road (LOS F – AM and PM peak hours)

When compared to the 2026 No Project results presented in the TIAR, Intersection 6: Waiale Road & Waiko Road and Intersection 8: Kuihelani Highway & Waiko Road are new locations that would operate at undesirable LOS if the Waiale Bypass is not in place.

2026 WITH PROJECT TRAFFIC CONDITIONS

The proposed project would contribute to cumulative impacts (LOS E or LOS F conditions) during one or both of the peak hours at the seven study intersection listed in the previous section. In addition, project-specific impacts have been identified at intersections where the addition of

project-generated traffic would cause their overall intersection operations to degrade below LOS D in one or both peak hours. The project-related impacts identified are:

- Intersection 1: Honoapi'ilani Highway & Kuikahi Drive (cumulative and project-specific impact)
- Intersection 2: Waiale Road & Kuikahi Drive (cumulative and project-specific impact)
- Intersection 5: Honoapi'ilani Highway & Waiko Road (LOS F in the AM and PM peak hour)

The results of this no-bypass analysis shows that Intersection 5: Honoapi'ilani Highway & Waiko Road and Intersection 6: Waiale Road & Waiko Road are new impacts not identified in the TIAR. Additionally, when comparing these results to the 2026 intersection operations analysis results presented in the TIAR, the impact type at the following locations change:

- Intersection 2: Waiale Road & Kuikahi Drive would also have a project-specific impact in the PM peak hour.
- Intersection 8: Kuihelani Highway & Waiko Road would be identified as a cumulative impact instead of a project-specific impact under the 2026 with Project without Bypass Condition.
- Intersection 13: Honoapi'ilani Highway & Waiale Road would have a project-specific impact in the AM and PM peak hours.

TABLE 1 – YEAR 2026 LEVELS OF SERVICE - WAIKAPU COUNTRY TOWN FULL DEVELOPMENT (PHASE 1 & 2)

Intersection	Traffic Control	Peak Hour	Year 2026 No Project, No Bypass Conditions		Year 2026 with Project Without Bypass Conditions		Delay Change	Mitigation Required?	Impacted in the DEIS?	Mitigated to: Pre-Project or Better Conditions (≤ LOS D)		Mitigated to: LOS D or Better Conditions	
			Del/Veh[1]	LOS[2,3]	Del/Veh[1]	LOS[2,3]				Del/Veh[1]	LOS[2,3]	Del/Veh[1]	LOS[2,3]
1. Honoapi'ilani Highway & Kuikahi Drive	Signal	AM	85.5	**F**	116.5	**F**	31.0	**YES**	**YES**	51.2	D	Same as Pre-Project Mitigation	
		PM	35.1	D	86.2	**F**	51.1	**YES**	**YES**	37.7	D		
2. Waiale Road & Kuikahi Drive	Signal	AM	62.1	**E**	86.7	**F**	24.6	**YES**	**YES**	46.7	D	Same as Pre-Project Mitigation	
		PM	51.0	D	85.4	**F**	34.4	**YES**	**YES**	36.4	D		
3. S. Kamehameha Avenue & Maui Lani Parkway	Roundabout	AM	> 180	**F**	> 180	**F**	**	**YES**	**YES**	167.4[4]	**F**[4]	23.8	C
		PM	> 180	**F**	> 180	**F**	**	**YES**	**YES**	163.4[4]	**F**[4]	15.7	B
4. Kuihelani Highway & Maui Lani Parkway	Signal	AM	112.0	**F**	125.5	**F**	13.5	**YES**	**YES**	25.8	C	Same as Pre-Project Mitigation	
		PM	86.4	**F**	92.8	**F**	6.4	**YES**	**YES**	33.4	C		
5. Honoapi'ilani Highway & Waiko Road	Signal	AM	40.6	D	> 180	**F**	**	**YES**	NO	33.3	C	Same as Pre-Project Mitigation	
		PM	22.8	C	156.0	**F**	133.2	**YES**	NO	51.3	D		
6. Waiale Road & Waiko Road	SSSC	AM	> 180	**F**	>180	**F**	**	**YES**	NO	23.9	C	Same as Pre-Project Mitigation	
		PM	48.5	**E**	>180	**F**	**	**YES**	NO	16.3	B		
7. S. Kamehameha Avenue & Waiko Road	SSSC	AM	> 180	**F**	**	**F**	**	**YES**	**YES**	10.9	B	Same as Pre-Project Mitigation	
		PM	80.1	**F**	**	**F**	**	**YES**	**YES**	8.3	A		
8. Kuihelani Highway & Waiko Road	Signal	AM	70.5	**E**	113.1	**F**	42.6	**YES**	**YES**	32.3	C	Same as Pre-Project Mitigation	
		PM	21.0	C	26.6	C	5.6	NO	NO	18.6	B		
9. Honoapi'ilani Highway & Main Street	Signal	AM	Only built with project		46.3	D	46.3	NO	NO	No Mitigation Required			
		AM			44.9	D	44.9	NO	NO				
10. Waiale Road & Main Street	Roundabout	AM	Does not exist without the Waiale Bypass										
		PM											
11. Honoapi'ilani Highway & East-West Residential Street	Signal	AM	Only built with project		13.1	B	13.1	NO	NO	No Mitigation Required			
		PM			9.2	A	9.2	NO	NO				
12. North-South Residential Street & Waiale Road	SSSC	AM	Only built with project		8.9	A	8.9	NO	NO	No Mitigation Required			
		PM			8.6	A	8.6	NO	NO				
13. Honoapi'ilani Highway & Waiale Road	SSSC	AM	Only built with project		>180	F	>180	**YES**	NO	14.9	B	Same as Pre-Project Mitigation	
		PM			>180	F	>180	**YES**	NO	9.7	A		
14. Honoapi'ilani Highway & Kuihelani Highway	Signal	AM	21.3	C	22.8	C	1.5	NO	NO	No Mitigation Required			
		PM	23.4	C	26.7	C	3.3	NO	NO				

Source: Fehr & Peers, 2016

Notes:

** Indicated oversaturated conditions. Delay cannot be calculated. AWSC = All-way stop-controlled intersection; SSSC = Side-street stop-controlled intersection.

[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized and all-way stop control intersections. The vehicular delay for the worst movement is reported for side street stop-controlled intersections.

[2] LOS calculations performed using the 2000 Highway Capacity Manual (HCM) method.

[3] Unacceptable LOS highlighted in **bold.**

[4] The mitigation needed to have the intersection operate better than pre-project conditions is installing signal control and having the existing intersection configuration (i.e., a shared left/through/right lane on the eastbound and westbound approaches and a left-turn lane and a shared through/right-turn lane on the northbound and southbound approaches) in place.

POTENTIAL TRAFFIC IMPROVEMENTS

Physical mitigation measures developed in the TIAR were first applied to the impacted locations and others were investigated as necessary. The emphasis was to identify physical and/or operational improvements that could be implemented within the existing or planned roadway rights-of-way. **Table 1** summarizes the projected LOS in 2026 at the impacted locations with these proposed measures in place.

The full range of improvements that address both project-related and/or cumulative traffic impacts are discussed in detail below.

Intersection 1: Honoapi`ilani Highway & Kuikahi Drive – The mitigation presented in the TIAR is not sufficient to mitigate the impact under the no-bypass scenario. Thus, the impact at this intersection could be reduced by widening the northbound approach from a left-turn lane, a through lane, and a right-turn to a left-turn lane, a through lane, and two right-turn lanes, widening the southbound approach from a left-turn lane, a through lane, and a right-turn lane to two left-turn lanes, a through lane, and a right-turn lane, and widening the westbound approach from a left-turn lane, a through lane, and a right-turn lane to two left-turn lanes, a through lane, and two right-turn lanes. Additionally, to complement the addition of a second southbound left-turn lane and a second westbound left-turn lane, the east and south legs of the intersection would each need to be widened to provide a second departure lane. Signal modifications at this intersection would include protected phasing on all approaches and right-turn overlap phasing on the westbound and northbound approaches. Additional right-of-way would be needed on both Honoapiilani Highway and on Kuikahi Drive to fully implement this improvement, which would result in LOS D operations at an overall intersection level.

Intersection 2: Waiale Road & Kuikahi Drive – The impact at this intersection could be mitigated using a reduced version of the improvements proposed in the TIAR for this location. The improvements needed to mitigate the impacts identified under the no-bypass scenario include widening the eastbound and westbound approaches to provide a left-turn lane, two through lanes, and a right-turn lane. To complement the widening of the eastbound and westbound approaches, both the eastbound and westbound departures would also need to be widened to each provide a second receiving lane. This improvement would result in LOS D operations at an overall intersection level.

Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway – The impact at this intersection could be mitigated by implementing the improvements presented in the TIAR, which is signalization of the intersection and maintaining the existing lane configuration (i.e., a shared left/through/right lane on the eastbound and westbound approaches and a left-turn lane and a shared through/right-turn lane on the northbound and southbound approaches). It should be noted, however, that the updated 2026 No Project Condition now assumes that the intersection would be configured as a single-lane roundabout.

As discussed in the TIAR, the pre-project improvement is install a traffic control signal with permitted phasing at all approaches. For LOS D or better operations at an overall intersection level, not only would a traffic signal need to be installed, but the eastbound and northbound approaches would need to provide a left-turn lane and a shared through/right-turn lane and the westbound and southbound approaches to provide a left-turn lane, a through lane, and a right-turn lane.

Intersection 4: Kuihelani Highway & Maui Lani Parkway – The impact at this intersection could be mitigated by implementing the improvements presented in the TIAR, which is to widen the eastbound approach to provide a left-turn lane, a shared through/left-turn lane, and a right-turn lane. In addition to the change in configuration, the eastbound and westbound left-turn phasing would need to be modified to split phasing. This improvement would result in LOS D operations at an overall intersection level.

Intersection 5: Honoapi`ilani Highway & Waiko Road – This intersection is a new impact not previously identified in the TIAR. Thus, the impact at this intersection could be reduced by widening the northbound approach from a left-turn lane and a shared through/right-turn lane to provide a left-turn lane, a through lane, and a shared through/right-turn lane, and widening the eastbound and westbound approaches to provide a left-turn lane and a shared through/right-turn lane. The northbound departure of the highway would require widening for a minimum of approximately 250 feet to provide a second receiving lane, which would transition back into the existing single northbound lane. Additional right-of-way may be needed on both Honoapiilani Drive and Waiko Road to fully implement this improvement, which would result in LOS D operations at an overall intersection level.

Intersection 6: Waiale Road & Waiko Road – The impact at this intersection is a new impact not previously identified in the TIAR. It could be mitigated with the installation of a traffic signal,

which was assumed to be in place in the Cumulative, pre-project condition in the TIAR due to its key location on the planned Waiale Bypass. This improvement would result in LOS D operations at an overall intersection level and the turning movement level.

Intersection 7: S. Kamehameha Avenue & Waiko Road – The impact at this intersection could be mitigated using the improvement presented in the TIAR, which is installing a traffic signal with permitted phasing at all approaches. This improvement would result in LOS D or better operations at both the overall intersection level and the turning movement level.

Intersection 8: Kuihelani Highway & Waiko Road – The impact at this intersection could be mitigated using the improvement presented in the TIAR, which is widening and restriping the eastbound approach to provide a left-turn lane and a right-turn lane. This improvement would result in LOS D or better operations at an overall intersection level.

Intersection 13: Honoapi'ilani Highway & Waiale Road – The impact at this intersection is a new impact not previously identified in the TIAR. It could be mitigated with the installation of a traffic signal, which was assumed to be in place in the Cumulative, pre-project condition in the TIAR due to its key location on the planned Waiale Bypass. This improvement would result in LOS D or better operations at an overall intersection level and the turning movement level.

CONCLUSIONS

This memorandum documents analysis conducted to assess project-related and cumulative impacts upon full build-out of the proposed Waikapu Country Town project if the planned Waiale Bypass were not constructed by 2026. While three more study intersections would be significantly impacted under this scenario than in the "with Bypass" scenario analyzed in the TIAR, LOS D can be achieved at the impacted locations with an expanded program of roadway improvements as mitigation.

APPENDIX N

A History Report of Waikapū

A History of Waikapū

Waikapū is shown here in the 1890's, some 30 yeas after sugar growers William Cornwell and Jamees Louzada formed Waikapū Plantation, which was acquired by Wailuku Sugar Company in 1894. The road shown is West Waiko Road, and the church building at right is now a private residence. Waikapu is now home to more that 1,000 Mauians and is the site of the Maui Tropical Plantation, a visitor attraction built around a tropical agricultural theme. Maui Historical Society Photo

By

Jill Engledow

For

Mike Atherton

August 2009

A History of Waikapū

by

Jill Engledow

Ka makani kokoloio o Waikapū
"The gusty wind of Waikapū"
An *ʻōlelo noʻeau,* or traditional saying, referred to in the song "Inikinikimālie" by James Kahale

Famed for its gusty winds and pleasant living, the land division called Waikapū originates in one of four valleys created by streams known as *Nā Wai Eha*--The Four Waters. One of those famous streams carved the steep ridges and gullies of Waikapū Valley through the West Maui volcano, transporting the mountain's core material and depositing it in an alluvial fan at the mouth of the canyon. This fan joined with those of the other three valleys -- ʻĪao, Waiehu and Waiheʻe -- to create an alluvial plain 13 km long. (Kyselka: 28, 36) The soil of this plain accumulated thickly near the mountain, spreading more thinly across the Isthmus formed when lava from Haleakalā pooled against West Maui. Over thousands of years, as glaciers grew in other parts of the world and sea levels dropped, broad stretches of coral reef were exposed and broken down to sand. Trade winds blew the sand onto the isthmus and formed it into ridges, which became lithified, or turned into stone, by carbonic acid released from the roots of plants growing in the sand.

By the time human beings arrived, the land of *Nā Wai Eha,* with its deep, rich alluvial soil and flowing streams, was ripe for cultivation. The new residents looked down over the sand dunes of the Isthmus, a shifting plain where inhabitants of the land believed that ghosts wandered. (Pukui: 81) Many years later, a writer would remark that "at times, the wind sweeps across this plain with great force, and clouds of sand, five hundred to one thousand feet high, move over it, presenting to the spectator on the mountains a most beautiful sight." (*Pacific Commercial Advertiser*, April 9, 1864)

Ambitious ancient farmers took advantage of the optimal growing conditions close to the streams. "Spreading north and south from the base of Waikapu to a considerable distance below the valley are the vestiges of extensive wet plantations, now almost obliterated by sugarcane cultivation," wrote E. S.C. Handy in 1934. "Far on the north side, just above the main road and at least half a mile below the entrance to the canyon, an extensive truck garden on old terrace ground showed the large area and the distance below and away from the valley that was anciently developed in terraced taro culture. On the south side there are likewise several sizable *kuleana* where, in 1934, old terraces were used for truck gardening. . . There were probably once a few small terraces on the narrow level strips of valley bottom in the lower canyon." (Handy: 497)

S.W. Nailiili, writing in 1865, offered this poetic description: "Waikapu, a district known for its majesty and splendid living, whose native songs gather flowers in the dew and weave wreaths of *ohelo* berries."

(Sterling: 91)

Though some maintain that "Waikapū" means "sacred water," others say "Waikapū" refers to a conch shell, or *pū*, once secreted in a cave "away up the stream, about a mile or more from the village," wrote W.K. Kaualililehua in 1872.

> On the left side of the stream is a cave and in the cave was the conch. It sounded all the time, unseen by the public, but a prophet on Kauai listened for it and came to seek with the idea of finding it.
>
> On the northeast side of that stream on the opposite side of the conch that sounded, on the cliff, was a dog named Puapualenalena. Because he heard it, he sought diligently to find it but he did not succeed. Those who guarded the conch were very watchful. The dog kept studying ways of obtaining it.

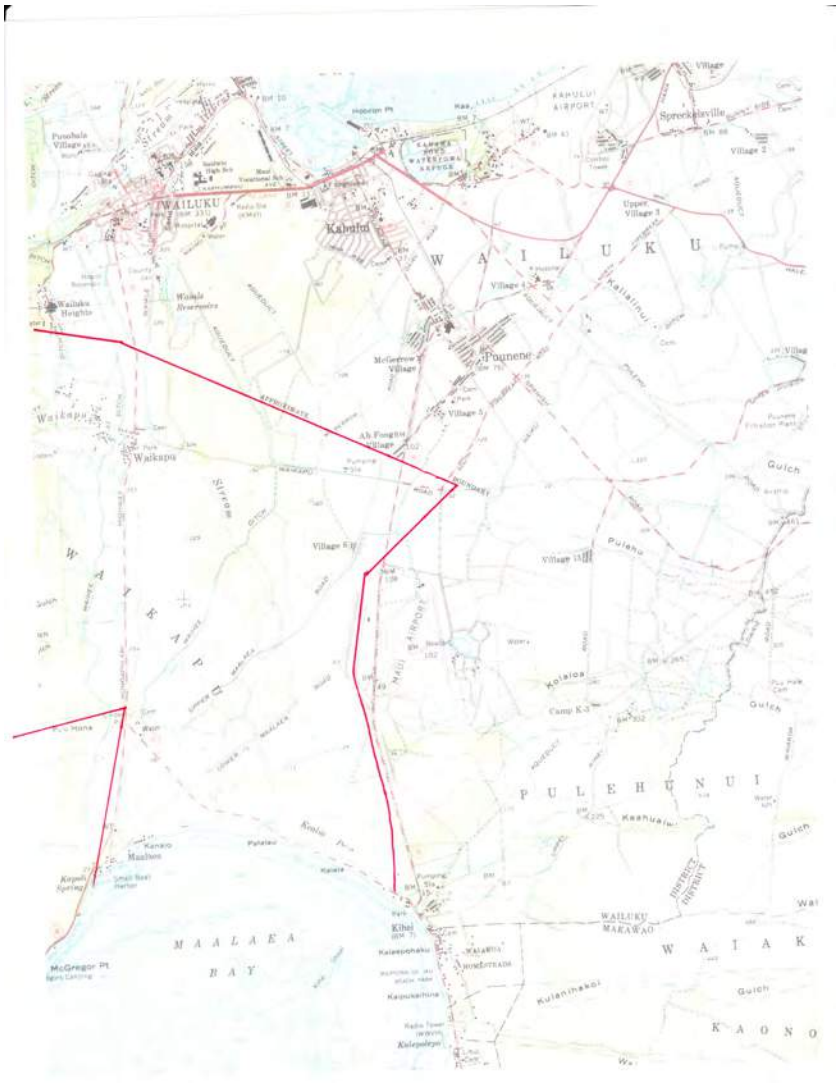
One day, when the owners of the conch had been "utterly careless," Puapualenalena stole the conch. "After he took it, it sounded no more to this day. It used to be heard everywhere in the islands and was annoying to some people. From this conch, the whole of the place was named Waikapū (Water of the conch). This is the legend of how it received its name. . . ." (Sterling: 93)

Others say the name refers to Kamehameha assembling his forces for battle by sounding a conch sshell at Waikapū. (Sterling: 93) It's not clear which battle this story refers to.

The great chief Kihapi‘ilani and his wife passed through Waikapū on their travels around the island, finding a crowd near a huge rock above the stream of Waikapū, an adz rock said to be the boundary between Wailuku and Waikapū. "And it remains there until this day," writer Moses Manu said in 1884. (Sterling: 94)

Kiha also visited Waikapū on the advice of two old men in Ha‘ikū, who told him their sister Pao could help him:

> Kihapi‘ilani started for Waikapu where the prophetess by the name of Pao was living. While Kihapi‘ilani was yet on the road, on his way to meet her, she predicted to those around her, saying: “There is a chief on the way here in search for some one to help him in his revenge.”
>
> When Kihapiilani arrived in the presence of Pao, a rainbow appeared at the same time. Pao then said: “My lord is swift of foot.” She then greeted Kihapiilani. Kihapiilani returned the greeting. After the greetings had been exchanged, Pao invited Kihapiilani to come in, and then she asked him: “What brings my lord here on this hot day?” The chief replied: “I have come in search of someone who will cause the death of my brother Piilani, for he has treated me shamefully.” Pao then replied: “There in the lowlands of Kalepolepo lives the one who will assist you in killing your enemy. You go down till you reach Kalepolepo and look for a man whose face is covered over with filth. He is the one.” At the close of the directions of Pao, Kihapiilani proceeded on his way to Kalepolepo, where in time he found the man described to him and he went up to meet him. (Fornander, Vol. IV)



1954 USGS map, with approximate Waikapū boundaries marked in red

Waikapū the District

Traditionally, Waikapū is more than just the fertile valley at the base of the mountain. The district covers approximately half of the Isthmus known as Kamaʻomaʻo, reaching the south shore and including the shoreline from near Maʻalaea to Kīhei Pūkoʻa. According to approximate boundary lines on a 1954 USGS map, the northern mauka boundary passes near the south end of Wailuku Heights and follows a line slanting down to a point near the bottom of modern-day Waiko Road. From there it turns sharply east, descending in a somewhat curved line to Kīhei. The eastern boundary line of the district meets the ocean at Kīhei Pūkoʻa, at the eastern end of the great wetlands known as Kealia Pond. Unlike the other three streams of Nā Wai Eha, Waikapū Stream did not reach the sea. Blocked by sand dunes, it drained instead into Kealia Pond. On this makai edge of the district is a surf spot still famous today and once there were salt pans "where they make most excellent salt," according to a voyager in 1817.

(Sterling: 95)

Between the shore and the valley was Puʻu Hele, a cinder cone formed late in the history of the West Maui Volcano. According to legend, Puʻu Hele was one of a pair of *moʻo* (lizards), the husband of nearby Puʻu-o-kali. Their child, Puʻu-o-inaina, was placed on Kahoʻolawe and later was a lover of Pele's sweetheart, Lohiau, according to *Place Names of Hawaii*. (Pukui: 203) Once 20 meters in height, Puʻu Hele was considered an essential stop on a trip around the island, according to Theodore Kelsey. "You cannot claim a circuit of Maui unless after you have been all around, you circle the hill above Puu-hele, then climb to the top and proclaim, 'Uapuni o Maui iaʻu'." (Sterling: 94)

Puʻu Hele now is a hole in the ground, deeper than it once was tall. Its cinders were mined to make road beds, beginning in World War II, when the Navy built Naval Air Station Puʻunēnē. (Kyselka:38 and Ashdown: 59) Today, what appears to be the remnants of the cinder cone's edges may be seen along Honoapiʻilani Highway just mauka of the South Kīhei Road intersection.

A Famous Battle

In the days when Puʻu Hele stood tall, before cultivation and sand mining had flattened the dunes of Kamaʻomaʻo, those dunes provided cover for Maui warriors in a famous battle. Around 1776, near the end of a century of warfare that frequently brought the chiefs of Maui and Hawaiʻi Island into conflict, the Big Island chief Kalaniopuʻu made what turned out to be a disastrous decision. Having successfully retaken Hana (a territory long disputed by chiefs of the two islands), he landed his fleet of war canoes along the south shore at Keoneʻōʻio, Honuaʻula and Kīhei. From here, he planned to attack Maui's ruling chief, Kahekili, who happened to be his brother-in-law. Kahekili's sister, Kalola, was with her husband, along with Kīwalaʻō, the son of Kalaniopuʻu and Kalola.

Though he had arrived with close to 3,000 men, Kalaniopuʻu at first gathered only 800, his most skilled warriors, the ʻĀlapa and the Piʻipiʻi. These young chiefs were "of equal height and were garbed in feather cloaks of various colors. They were those of whom King Kalaniopuu thought a great deal, for they were skilled in the martial arts of those days," Stephen L. Desha wrote. "I am sending you inland to Wailuku to fight the warriors of Kahekili and my word of hope to you is you will have great strength and drink the water of Iao," Kalaniopuʻu said to these warriors as he sent them into battle at dawn. The warriors' shouted response in the quiet morning betrayed their battle preparation to spies who raced back toward Wailuku to inform Kahekili that the Hawaiʻi Island army was ready to march.

Alas for those young warriors, their leader had failed to heed the advice of his own kahuna, who had warned him that he should wait until the next day at high noon, and have his nephew Kamehameha lead the army. On the other side of the isthmus, Kahekili had been given a more positive prophecy: "O heavenly one, the fish has entered the sluice-gate and is surrounded by the small-meshed net." A great strategist, Kahekili had planned carefully and also enjoyed the support of additional warriors provided by his ally and nephew, Kahahana of Oʻahu. "Kahekili's warriors were roused up, joined by the Oahu warriors under Kahahana, the young Oahu chief, and these numerous warriors were stationed at the sand dunes of Waikapu and also at a place close to those sand dunes seaward of Wailuku. Kahekili's warriors hid like sand crabs in their holes awaiting the onslaught of Kalaniopuu's relatively few warriors who would move inland to Wailuku without realizing that their death was awaiting them." (Desha: 35-43)

Historian Samuel Kamakau's description of the battle is evocative:

> Across the plains of Pu‘u‘ainako (Cane-trash-hill) and Kamaomao shone the feather cloaks of the soldiers, woven in ancient pattern and covered like the hues of the rainbow in red, yellow, and green, with helmets on their heads whose arcs shone like a night in summer when the crescent lies within the moon. . . . Like a dark cloud hovering over the Alapa rose the destroying host of Kahekili seaward of the sandhills of Kahulu`u. . . They slew the Alapa on the sand hills at the southeast of Kalua. There the dead lay in heaps strewn like kukui branches; the corpses lay heaped in death; they were slain like fish enclosed in a net. This great slaughter was called Ahulau ka Piipii i Kakanilua (Slaughter of the Piipii at Kakanilua). (Kamakau: 85)

Kahekili's forces, hidden in the sandhills on either side of the plain, allowed the warriors to advance across the plain of Kama‘oma‘o until they reached the southeastern side of a place called Kalua, close to the village of Wailuku. (Sterling: 88) The Maui warriors then attacked, slaughtering all but two of the crack warriors in Kalaniopu‘u's army. These two managed to get back to Kīhei Puko‘a, where Kalaniopu‘u was confidently boasting that his warriors had perhaps already drunk of the waters of Wailuku. Grief stricken and furious, Kalaniopu‘u and his chiefs determined to try again. In response, Kahekili's men rose at dawn once more and occupied the sand hills, and again their divided forces sent down a rain of spears, javelins and other missiles on the Hawaii warriors. "The terrified soldiers were surrounded and took to flight; they were driven by Kahekili's men like leaves before a whirlwind. The plains of Kamaomao became like a fishpond through whose sluice gate the sea flooded, Kalaniopuu's men like the mullet driven by the sound of beating into the sluice gate. . ." (Kamakau: 85-88)

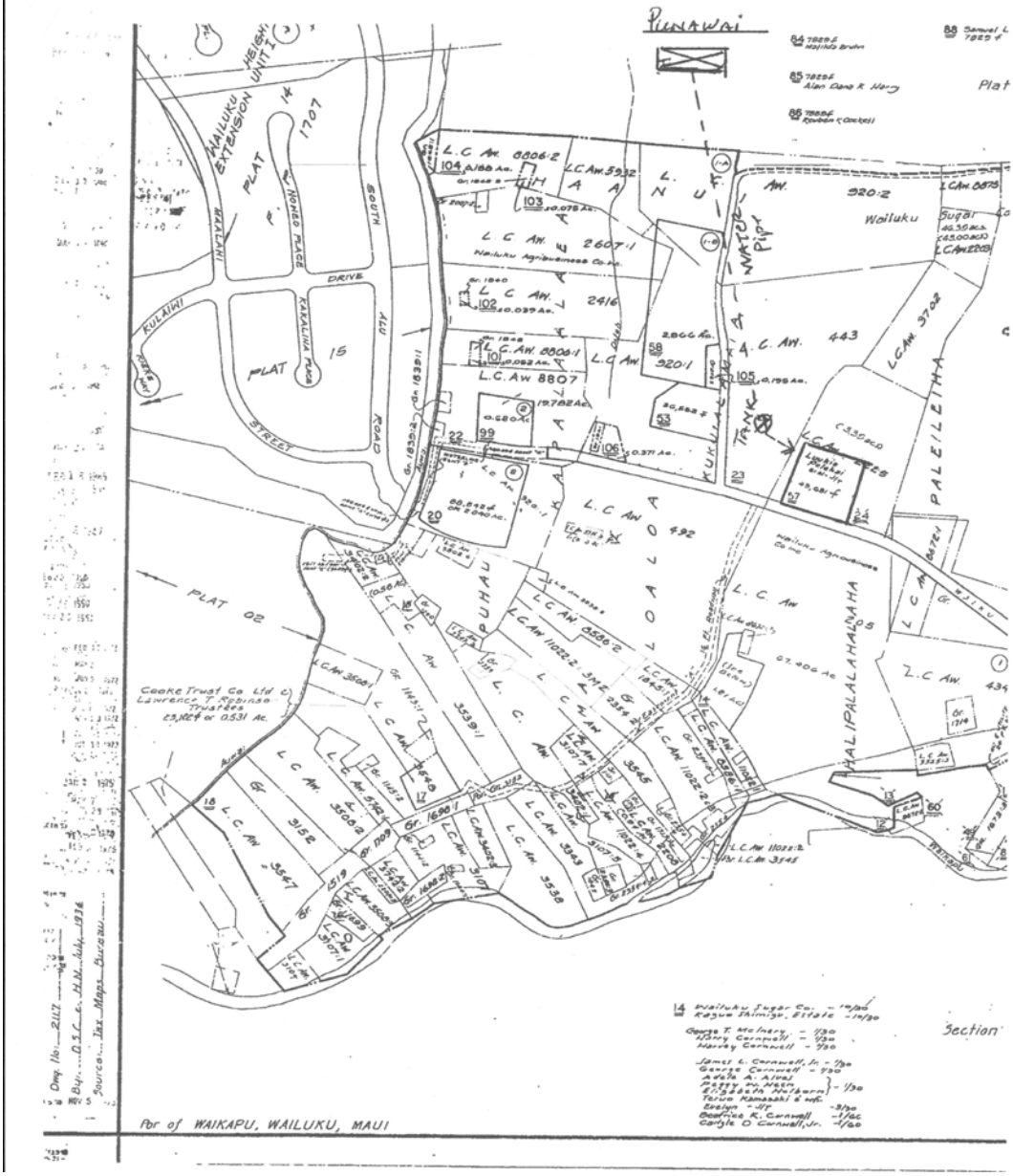
At last accepting that his men were surrounded and the battle lost, Kalaniopu‘u first asked his wife to go to her brother and sue for peace. Kalola refused, saying that she would be killed "for we came to deal death. If we had come offering love we should have been received with affection. I can do nothing." Instead, she told her husband to send her son, a chief of divine rank, along with the twin half-brothers of Kahekili. Kiwalao's rank was such that even the Maui warriors had to bow before him and allow him passage to Wailuku, where Kahekili magnanimously accepted their surrender. "Then Kahekili said to his followers, 'Take the fish of Kanaha and Mau‘oni and the vegetable food of Nawaieha down to Kiheipukoa.' So the two chiefs became reconciled, but Kalaniopuu's was a feigned friendship." (Kamakau: 88-89)

The next great battle in Na Wai Eha would be the decisive battle of Kepaniwai, in which Kalaniopu‘u's nephew and heir Kamehameha would defeat Kahekili's son in the valley above Wailuku in his campaign to conquer and rule all the islands. As part of the spoils of war, the conqueror parceled out land to his supporters. Waikapū was among the ‘āina given to Ke‘eaumoku, one of the four "Kona Uncles," powerful chiefs whose support had helped Kamehameha rise. (Kame‘eleihiwa: 106)

The Outside World Arrives

By this time, Western voyagers were beginning to appear regularly in the Islands as word spread of the visit by Captain James Cook in 1778.

Foreigners arrived early in Waikapū. Kamakau, describing the chief Kuakini (also known as John Adams), who "was fond of the foreigners and entertained them at meals," says "there were foreigners



Contemporary TMK map shows density of *kuleana* in Upper Waikapu.
Map source: online application for Surface Water Use Permit

living at Hana, Waikapu, Honokowai, Waialua and on all the lands of Kahekili on Maui and Oahu; and when that chief died they came under Kuakini." (Kamakau: 389) The Kahekili referred to here it is not the chief who won the battle of Kakanilua, but Kahekili Keʻeaumoku, heir of the "Kona Uncle" Keʻeaumoku. Kahekili Keʻeaumoku, who had been *kiaʻāina* (governor) of Maui since the time of Kamehameha I, died in 1824, leaving his lands to his younger brother Kuakini. The lands then passed to Leleiohoku after the death of Kuakini in 1844. (Kameʻeleihiwa, 106)

Soon after the death of Kamehameha I in 1819, missionaries arrived to share the Gospel and the Western skills of reading and writing. Small schools and churches spring up everywhere around the islands. Though missionaries did conduct two censuses (one in 1832 and one in 1836, with 733 persons in Waikapū in 1832 and 709 in 1836), it is often school and church records that give us an idea of population levels at a time when few records were kept.

A report from 1834 counts individuals attending two schools in Waikapū, one with 170 *kane* and 155 *wahine* and another with 84 *kane* and 54 *wahine*. The report, printed in the mission-sponsored newspaper *Ka Lama*, laments that few children are represented in these numbers. In a report on the Wailuku Station from June 1, 1837 to June 1, 1838, missionary Richard Armstrong wrote: "From Waikapu to Waihee, there are now 5 good doby [adobe] schoolhouses." (Ms. in HMCS). In April 1841, school commissioner David Malo reported to the Legislative Council of the Chiefs held at Kaluaokiha in Lahaina that there were four schools and four teachers in Waikapū, with a total of 159 students. In his 1842 tour of schools, Malo found a total of 146 students in Waikapū. Teachers at this time were paid between 12.5 cents and 25 cents a day. (General Reports 1821-1842, HMCS) In 1852, the school agent's report found three schools, with a total of 84 students. Very likely these schools were scattered throughout the district, rather than clustered at the village we now call Waikapū.

Waikapū village was clearly well populated at the time of the Māhele, when land was divided between the king, chiefs and commoners. A map of Waikapū Plantation in the State Survey Office shows the area to be filled with the small landholdings known as *kuleana*. Though the map is not dated, it probably would have been drawn sometime between 1862, when Waikapū Plantation was founded, and 1894, when the plantation was purchased by Wailuku Sugar Company. One contemporary landowner, Avery Chumbley, says there are 32 *kuleana* within the 67 acres he owns in upper Waikapū. The old map shows that land use was similarly concentrated throughout the village area, with *kuleana* extending along the streambed far up the mountain.

The *Indices of Awards*, listing those who acquired land during the Mahele, shows some of the largest in plots in Waikapū going to *haole.* Michael J. Nowlien received 303.5 acres, William Humphries 131.3 acres and James Lozada 26.1 acres. Others with relatively large pieces include Haa (35 acres), Copp (16.94 acres), Catalina (13.61 acres), Manu (11.01 acres), John Richardson & Co. (two pieces, 8 and 6.10 acres), William Shaw (two pieces 13.6 and 6.3 acres), Anthony Silva (8.2 acres), Kepaa (9.69 acres), Kuihelani (9.4 acres), William McLane (5 acres). Maps of the time show Richardson with what looks like considerably more land than is indicated in the *Indices.* David Malo, the well-known scholar and author, also received a lot with a house and *kalo* and pasture land.

In addition to *kalo*, there was some early growing of sugar at Waikapū, perhaps by Anthony (Antonio) Sylva or by Antonio (or Antone) Catalina. One 1823 report says that Catalina made "an excellent syrup." (Girvin: 195) There was an early attempt at coffee growing around 1847, (Kuykendall: 316) and residents apparently raised cattle, whose "depredations" as they wandered the plain destroyed acres of young sugar cane. "Some of the natives have lost nearly all they had planted," J. S. Green wrote in 1846. (*The Polynesian,* October 3, 1846) Some indication of the area's agricultural nature comes also from this *Pacific Commercial Advertiser* report of a destructive storm in 1858, when:

> . . . A waterspout was formed and carried to the summit of the mountains between Waikapū and Ukumehame and there discharged. The torrent rolled down on each side, bearing all before it; the branch of waterspout that came down to Waikapū uprooted huge trees and strewed them out

> over the plain, dug up and removed large fields of kalo, and carried away considerable portions of arable land, leaving deep fissures and piles of stone instead. Many families, who before the catastrophe, sent food to market, were left destitute. The water came down in a body like a mighty wall fifteen or twenty feet high, with such majesty that it would not follow the windings of the brook, but rushed over whatever lay in its way, cutting its own path. Several horses and cattle were caught in its track and drowned. One dwelling house was carried off with all its contents, the inmates barely escaping with their lives. It is very remarkable that the house of Mr. Devauchelle escaped destruction. The torrent passed like a high wall on both sides of it, leaving it unhurt and strewing large boulders and trunks of trees all around it. After crossing the road in front of Mr. Antonio Sylva's house, the torrent parted and one branch rushed on to Kealia and the other hastened down to Kahului, both depositing all along their track large trunks of trees brought down from the mountain, and kalo and sugar cane from the Waikapu gardens. . . (*P.C. Advertiser,* 3/11/1858)

Waikapū Plantation

Waikapū Plantation was founded several years later. It was formed by a series of purchases that began when James Louzada acquired the estate of the late Circuit Court Judge John "Iaone" Richardson. Members of the Richardson family had lived in Waikapū for many years. Apparently the first resident of that name was George Richardson, who was born in Ireland and died in Waikapū in 1835, leaving a widow named Kaneole. Their son or grandson, John Richardson, is named in several places on the Waikapū Plantation map. His land became available for sale through tragic circumstances, when Richardson committed suicide at age 35 by hanging himself from a tree on his cattle range in Kula. "He had been laboring for some time under a mental aberration, caused, it is said, by domestic troubles," said the *Pacific Commercial Advertiser* in January 1860. Perhaps this was depression resulting from the death of his wife, Dorcas (Doreka Ilai) in 1857 and their four-year-old daughter Fanny in 1859. The newspaper said Richardson had been a member of the House of Representatives, recently promoted by the king to a seat in the House of Nobles, and was considered "one of the most promising and intelligent of his race." (*P.C. Advertiser*, 1/12/1860)

Louzada, a native of New York, had arrived in the Islands in 1834. (*The Friend,* December 1869: 104) His acquisition of Richardson's estate was not his first stake in Waikapū land. A copy of a March 15, 1844, deed from Charles Kanaina to Louzada, translated from Native Register, Volume I, page 175, reads as follows:

> I hereby give two ilis of mine at Waikapu, Aoaokamanu and Puahinakao, to James Louzada to live on under me, as the natives of Hawaii do. If he does wrong under the law, his occupation thereof shall end. Furthermore I shall have the Thursdays and the Fridays [tax days] of the land, and he shall be responsible to me. Furthermore he shall give the tribute to the tax

> collector, as formerly paid by these lands. Furthermore, *e like no me ka la me ai kahiko* [the ancient ways of the land shall be followed?] Furthermore if it comes to us that he petitions as a foreigner [does not follow Hawaiian custom] then his occupation of the land shall cease. Furthermore if the *lunas* object to this grant of land, then it shall cease and the land be returned to me.

Several years later, Louzada wrote to William Richards, president of the Board of Commissioners to Quiet Land Titles, regarding his application for Land Commission Award 225, for land at Waikapū totaling 26.10 acres:

> Enclosed I take the liberty to transmit to Your Excellency a verified copy of a deed for the land, which I cultivate at present, given me by Ch. Kanaina Esqr. with the consent of Her Highness the late Premier. The stipulations of the deed are of such a nature, that as a new order of things is impending, I cannot feel satisfied or safe, until I ensure that the land cannot be taken from me. I have the more reasons to be anxious, as I have expended all I had, to put the land in order, and it would be very distressing to me, if I had to leave it. I have always strictly adhered to the conditions of the writing, and shall certainly still in future endeavor to show, that I am not unworthy of the favor which I respectfully beg . . .

Copies of these two documents are in the possession of a contemporary Cornwell descendant, Mark R. Walker.

In a column by Mrs. D.P. Penhallow titled "Waikapu, Maui: a Sketch" in the February 3, 1926, *Maui News* is more detail.

> As with much of early Hawaiian history, so it is with Waikapu. Definite dates of events are hard to fix and the sequence of them not always clear, but as Waikapu was first in this section of Maui in war so, evidently, was it the first to produce sugar and cattle. A Spaniard named Antone Catalina made cane syrup at Waikapu in 1823, which was apparently the beginning of the sugar industry in the Wailuku District. James Louzada came over from Waimea, Hawaii, a number of years later, established a cattle business, opened a store and began cultivating cane on a large scale. The date is not definite but he erected a stone mill with oxen for motive power on the premises known as Hale-pa-laha-laha at the interest in Waikapu Valley, located on its northern slope. It is reputed that Louzada's Hawaiian wife, Kapu, lost an arm while tending the mill.
>
> Following this mill a stream driven one was erected in 1862 near the present road to Lahaina, just north of the stream crossing. . . the store referred to was the first in the district, people going from Wailuku to make purchases there. The store building was located on the lower corner of the Pia Cockett premises and remained as a landmark until a few years ago. The cattle industry flourished and also, many fine horses were produced, horseracing being a feature of Waikapu for years. . . . Aside

> from its commercial aspect, there was much of romantic interest attached to Waikapu. Kalalaua spent some of his leisure time with the Cornwells, who kept open house, and it has been featured in song and story. Its romance was of the past, which belonged to its day and age. Of this there are but slight reminders evident only to those who can picture it as it was.

Louzada's acquisition of additional land in 1862 apparently was unplanned, simply a response to a promising opportunity. According to an article in the April 9, 1864, *Pacific Commercial Advertiser*:

> Mr. James Louzada, happening to be in the vicinity, heard that there was to be an auction sale of the estate of the late John Richardson, and attracted by curiosity attended it. A good frame house and lot was put up for sale, but nobody wanted it. Seven hundred dollars only were bid, and Mr. L. thinking it a safe investment, took it at a few dollars over that sum, and for a few hundreds also purchased the taro lands belonging to the estate. Thus, without any intention of buying when he went to the sale, he found himself possessed, for the paltry sum of $1,200, of a good dwelling house and some of the finest cane land on the island. He was not long in finding out that he had located over a mine destined to be as productive as a gold mine, nor in making his plans for the future. Associating himself with his brother-in-law, Henry Cornwell, Esq. [married to Louzada's sister Adelia], formerly of this city [Honolulu], he set to work to erect a mill and commence the manufacture of sugar, the natives and foreigners in the village promising to plant cane on their own lands. Two years have passed since the lucky purchase of this property occurred, and already he has sent to market some 400,000 pounds of sugar, worth perhaps $25,000, though his mill has been in operation only about eight months.

The writer said there had been a remarkable change in the village of Waikapū since "we last rode past it" four years ago, when "there was nothing here to attract a stranger--a few thatch houses with one or two frame buildings, scattered among taro patches were all that one would notice in passing. Now a tall chimney attracts for miles the eye of the traveler and the dark smoke, growing up in clouds from its top, tells plainly of the industry, capital and enterprise that center here."

The writer told of visiting the mill to meet:

> "Mr. Cornwell and his son William, who were hard at work turning cane juice into gold. The mill consists of a large building in the form of an L, on a hill slope, which facilitates the work very much. The machine is driven by a 36 horse engine, built by Mr. Henry Hughes of this city, who also constructed all the machinery used on this plantation. Everything about the mill is of Hawaiian manufacture, which can be said of but a few sugar manufacturers on the islands. The capacity of the mill is about four thousand pounds of sugar per day, though, by working nights, which is sometimes done, five thousand pounds can be got off. To obtain this product, Messrs. Louzada and Cornwell employ about seventy field and mill laborers, of whom forty are females, who are engaged on account of

the scarcity of men. . . .The land at Waikapu consisting of a gentle slope from the base of the mountain to the road, irrigated by the Waikapu river, is admirably adapted to sugar culture, producing, when well cared for, very heavy crops. The extent of land suitable for cane is limited only by the amount of water obtainable for irrigation. The proprietors of the mill have purchased land largely since they began operations and have now some 200 acres. They purchase cane from the natives, paying generally about one hundred dollars an acre for the standing crop, taking it off at their own expense. The sugar boiling department is under the charge of Wm. Cornwell, who possesses all the activity, industry and perseverance of his father and uncle. The high reputation of the sugar made at this mill is the best recommendation that a sugar-boiler can wish.

Old map of Waikapu Plantation shows mill site near Waiko Road intersection.
Map source: DLNR State Survey Office

> About a mile back from the mill, and on an elevation overlooking the whole country, stands the house of the late Mr. Richardson, the sale of which we have already referred to, now occupied by Mr. Cornwell and his family. It has been much improved, by additions, and forms one of the pleasantest residences we have ever seen. From its front verandah, a most beautiful scene is had--the village and mill buildings, the plain, Kahului Bay on the left, Kalepolepo Bay at the right, and the whole of Mt. Haleakala, with its villages on its side--are all in view. Were we to select a site for a country home, it would be this charming spot in Waikapu, and we congratulate Mr. and Mrs. C. and their family on possessing so healthy and delightful a home, where in and around the dwelling every comfort and luxury is provided. The traveler, who enjoys, as did we, the pleasure of a short sojourn here, and an acquaintance with those who show such refinement and taste, and who welcome visitors with such cordial hospitality, will leave their pleasant home with many regrets. Such residences and such homes we trust will spring up in every district.
>
> What a change has taken place in Waikapu within two years! Where were a few taro-patches, half cultivated by lazaroni, a village has sprung up, with its sugar mill and buildings, its waving cane fields and busy laborers, scattering industry, thrift and contentment everywhere. Here where a few hundred dollars worth of taro were formerly raised, forty thousand dollars' worth of sugar may now annually be made and sent to market.
>
> A planter's life, however, is no playspell. Messrs Louzada and Cornwell and every one else engaged on the estate work hard -- up early in the morning, and late at night, they earn every dollar they receive. Although the first outlay in commencing a plantation is heavy -- and few estates are set in operation with less than forty or fifty thousand, and from that to one hundred thousand dollars -- yet when once completed, the income promises to be large, and on most plantations will amount to at least twenty-five per cent on the investment, when well managed. This estate, thus far, has cost its proprietors nearly fifty thousand dollars and it is safe to say that it will produce annually at least forty thousand dollars, at present prices of sugar."

This account, in addition to providing a detailed glimpse of life at Waikapū in 1864, also offers insights into attitude and understanding at the time. Clearly, sugar plantations were welcomed as the economic future of the Islands. The use of the word "lazaroni" in relation to Waikapū taro farmers now seems insulting; *Webster's New World Dictionary* defines lazaroni as "any of the class of homeless beggars formerly common on the streets of Naples." The writer apparently has no understanding of the fact that "a few taro patches, half cultivated" may be the remnants of a highly productive farming community devastated by imported diseases in previous decades. Or perhaps the "few taro patches" were all that was left after the destructive 1858 waterspout described above. This 1864 writer's view is in contrast to that of Gorham D. Gilman, who wrote in 1843 of a tour of Maui: "The country around Waikapu and

approaching Wailuku is quite fertile and well cultivated, and formed a pleasing contrast to the arid plain below." Gilman reported being greeted by friendly natives who offered "a tumbler of fine cool water" and "a stick of Sugar Cane in our hands to eat on the way." (MHS ms. collection)

The new plantation established a mill at the Kīhei-mauka corner of West Waiko Road, which may be seen on the old Waikapū Plantation map. The map also shows another mill east of that site and on the other side of the stream; it seems unlikely that this is the earlier mill set up by Louzada, because a *Maui News* column from 1926 (quoted below) sites the first mill at Halepalahalaha, which is higher up the hill. The site of the Waikapū Plantation mill yard continued as stables until it was subdivided for housing starting about 1955. (Chumbley) The old smokestack "which marked the site of the original Waikapu sugar mill," toppled in a Kona gale in 1918. (Silva: 32)

Not all was rosy in the early years of the Waikapū Plantation. One problem arose from the establishment by Louzada and Cornwell of a road that is now known as Old Waikapū Road. Thomas W. Everett, a Waikapū resident who served as sheriff of Maui for many years, reported in an 1866 letter:

> I got Mr. Alexander to survey the Crownenburg Lot last week and likewise the Nowlien Lot Boundaries. He found that the disputed road was no part of it on the "Nowlien" land now owned by Cornwell but that after the road left the Crownenburg land it ran through Govt. land all the way into the main road leading from Wailuku to Lahaina. He found that Louzada and Cornwell had fenced in quite a piece of land into their pasture from the main road up to what I have marked on enclosed sketch Pohakoi. . . this stone "Pohakoi" was decided by the parties who settled the boundary question in 1847 or 8 to be the boundary between Wailuku and Waikapu. Consequently the Nowlien lot is in Wailuku. Cornwell has lately bought the Crownenburg lots, but Daniels has possesion for three years to come. . . . there is no doubt that the parties knew of this piece of land when it was fenced up but it was probably thought it would not be missed. . . (MHS files)

This road still remains, though it is little used today. According to Avery Chumbley, the road once continued more parallel with Honoapi‘ilani Highway, rather than turning down toward the highway around Kuikahi Drive. Chumbley thinks it was realigned some time around the 1930s. He is not sure why this happened, but says until that time the road was the main access to the hundreds of *kuleana* properties scattered throughout the valley.

A much bigger issue was the unclear boundary between Waikapū and Pulehunui. Much of the land of Waikapū was part of the one-twentieth of all unappropriated public lands set aside to produce income for school purposes by a law established in 1850. "During the next few years considerable acreage was sold to procure money for educational purposes." (Wist: 60) "In 1875, the Board of Education sold at auction the 'Land known as the Ahupuaa of Waikapu, saving grants hitherto made within the said ahupaa, or sales by the Board of Education,' to Henry Cornwell, from the Government issuing a royal patent in the above terms without survey or statement of area. Mr. Cornwell afterward sold to Claus Spreckels and others the part known as Waikapu Commons." (Sterling: 95) This 1878 sale was of an undivided half interest in 16,000 acres of the Waikapū Commons from Henry Cornwell to Spreckels, who was in the process of acquiring land and water rights in order to begin what would become Hawaiian Commercial & Sugar Company. (Adler: 36)

This land sale was to result in problems within the next few years, as the owners of the adjacent *ahupua'a.* The original sale to Cornwell had been based on a map, with no survey or notes and just an estimate of the acreage. For $15,050, Cornwell received "all that tract of Kula land commonly known as the Waikapu commons, extending on both sides of the Waikapu main road and embracing all the said commons land known to belong to the Hawaiian Board of Education." Subsequent to the sale, the owner of Pulehunui went to court to claim that the boundaries were incorrect. Based on testimony by "the oldest native residents" of the area, the claim was upheld, and Cornwell was "ejected." Having already sold it, he was obliged to repurchase it from the owner of Pulehunui at a cost of $7,500. Cornwell then went to court to claim that the Board of Education was responsible for this problem, and the court agreed. (Supreme Court of the Hawaiian Islands)

Meanwhile, the ownership of Waikapū Plantation had changed in 1877, with the original proprietor retaining an interest but selling the remainder to his son William H. Cornwell and William's brother-in-law, George W. McFarlane. At this point, Waikapū Plantation could produce 1,000 tons annually, and if water could be brought in, it would produce 2,000 tons of sugar. (Apparently this need would be met by the first artesian well on the outside islands, drilled in 1881 at Waikapū Plantation by the McCandless brothers.) Ownership changed yet again, with the partnership known as the Waikapū Sugar Plantation Company dissolved by mutual consent to be continued thereafter by William Cornwell and George McFarlane under the firm name of Cornwell & Company. (Silva: 17, 19) Louzada had died in 1869, and Henry Cornwell was getting on in years and would die in 1886 at the age of 70. (familysearch.org)

In 1889, the *Pacific Commercial Advertiser* reported the sale of W.H. Cornwell's half-interest in the Waikapū Plantation to Spreckels. "The remaining half is held by G. W. MacFarlane and Company and probably will be purchased by the same party. Major Cornwell will continue to be the manager. . . the purchase of this plantation by such a shrewd, farseeing capitalist as Colonel Spreckels, indicates that he has firm faith in Hawaiian sugar property, and that the proposed changes in the American tariff will not ruin our sugar planters, croakers to the contrary notwithstanding," the paper said. (Silva: 22) The next year, MacFarlane sold the other half interest to Spreckels. In 1894, Wailuku Sugar Company purchased Waikapū Sugar Company, with 2,500 shares at $42 per share. The first crop of the combined Wailuku, Waihee and Waikapū plantations in 1895 produced 4,939 tons of sugar. The survey for a railroad line to Waikapū had just been completed--this line would be 20,800 feet in length. (Silva: 24) Over the next 20 years or so, Wailuku Sugar Company would also buy up another operation, Waikapū Agricultural Company; it is not clear at this point who or what constituted this company. (Silva: 29-32)

Colonel Cornwell

Through the late 19th century, the Cornwell residence was a center of hospitality enjoyed by none other than King Kalākaua, as William Henry Cornwell's involvement in the affairs of the kingdom grew. Cornwell, born about 1842 in Brooklyn, New York, came to the Islands with his parents about 1857, according to his 1903 obituary in *Paradise of the Pacific*. Cornwell married Blanche MacFarlane, sister of G.W. MacFarlane, and the two had three children before her death at the age of 27. The obituary said that Cornwell:

> ". . .grew up in the cane fields and was made manager at an early age. Throughout his whole life he was one of the most successful planters in the group. He became quite intimate with Claus Spreckels when the latter launched his great plantations on Maui, and through business dealings

> with the gentleman afterwards, which involved the acquisition of water rights from the King, he got well acquainted with his Majesty, who made him a member of his staff. In 1890 he was elected noble and ever after that time was prominent in politics. On March 14, 1891, he [and others were] appointed by Queen Liliuokalani as members of her personal staff with the rank of Colonel. At the time of the overthrow of the Monarchy he was Minister of Finance in the Queen's Cabinet. After annexation Colonel Cornwell allied himself with the Democratic Party, being at the time of his death member of the National Democratic Committee. No one in the islands had a keener relish for honest racing sport than he. As an importer of superior breed of horses he was instrumental in improving much island stock for racing and general purposes." (*Paradise of the Pacific,* December 1903: 69)

Family stories shared by Cornwell's great-grandson, John Cornwell Walker of Honolulu, tell of the two-story house acquired in the original purchase of the Richardson state, its location still marked by two Norfolk pines that stood on either side of the walkway, with another pine a quarter-mile away at the site of the stables. Cornwell raised horses to race in Honolulu, and once took a winning steed to a downtown hotel and poured champagne over the horse. The king would come to visit, landing at McGregor Point, where he would be joined by other riders for a parade to Waikapū. He would stay for perhaps a week of parties and poker games, then depart, accompanied once again by an escort of horsemen. (Walker)

Two Norfolk pines mark the former site of the Cornwell home. Engledow photo 7/09

Some say that the character of "Uncle Bill Calhoun" in Armine von Tempski's *Born in Paradise* is based on that of William H. Cornwell. Though much of the story beginning on page 64 is obviously

fiction, it may be that some of the descriptions apply to the real Waikapū and the real Cornwell.

> "A short distance from the sheer walls of rock which made a sort of awesome portal [to the valley], a sprawling house sat on a low hill top surrounded by Norfolk Island Pines. Purple mango trees and dark pointing fingers of Italian cypresses flanked brick walks which leaped down through terraces of gay flowers in wide steps to meet the road. A feeling of excitement poured from the house though no people were visible . . ."

Inside the house, in "a spacious room filled with pictures of racehorses and women," Uncle Bill Calhoun lay, obviously ill. But "I sensed he was a great figure. His conversation was punctuated with damns, shouts, and 'Let's hoist another!' Opened-armed, open-hearted, he seemed to embrace life as it came toward him."

A photograph of Colonel Cornwell published in the Wailuku Sugar Company's Centennial history shows a man who might very well have been this hearty, lively character, though the real Cornwell did not die a lingering death tended by a lovely young *hapa-haole* woman, but died suddenly following an attack of angina pectoris at his home in Waikapū, having married Josephine Colvin a year earlier. William H. Cornwell was buried in Honolulu, but a Cornwell family graveyard remains on the property in upper Waikapū owned by Avery Chumbley, and Chumbley says other graves that were next to the Piltz house above Old Waikapū Road (near the site of the old Cornwell house) were exhumed. These may have included the grave of George E. Richardson, brother of Judge John Richardson, who was buried in Waikapu in the “family vault.”

Col. William H. Cornwell. Source: Wailuku Sugar Co. Centennial

Cornwells maintained their presence in Waikapū for at least a few years; William H. Cornwell Jr. opened a butcher shop called the Waiohuli Market in Waikapū in 1906. He left in 1907 to establish a business on the mainland. And at least one contemporary family, the Vidas, is of Cornwell ancestry.

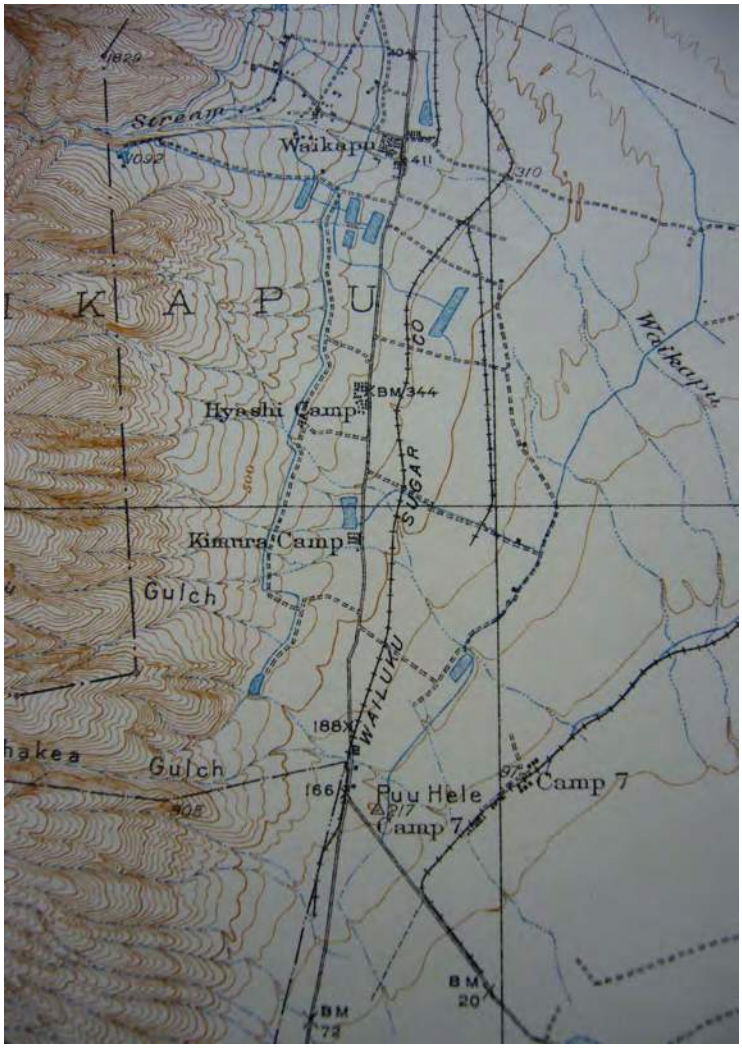
Wailuku Sugar

The sale of Waikapū Sugar Company to Wailuku Sugar Company brought it into a much larger operation and into the plantation lifestyle often remembered today, with workers of various ethnicities living in separate camps near their work sites. Apparently there was a camp at Waikapū village, which was enlarged in 1919 by bringing in six houses from Pu‘uhele Camp. That same year, a new dispensary was built at Waikapū. (Silva: 32) Old maps show two camps between Waikapū and Pu‘u Hele, one called Kimura Camp and one called Hayashi Camp. Graves in a small cemetery on East Waiko Road are almost all marked in Japanese, indicating that there may have been another ethnic Japanese camp nearby, but no such camp shows on maps consulted for this report. There are about 75 marked graves and more than 20 unmarked graves at this Waikapū Community Cemetery. (MHS)

Waikapu Community Cemetery. Engledow photo 7/09

The 1910 census enumerator noted specific areas as he filled in the names on each 25-line page for Census District 76, making it possible to estimate population at that time. Kimura Camp had about 60 residents; Hayashi about 100; Pu‘uhele Camp about 60; "Waikapu Plantation Camps" more than 200; "Waikapu Camp number one," 100; Waikapu Ranch Camp, 50; Waikapu Village about a dozen; "plantation camps," 50; and "Waikapu mauka camps," 50.

The 1920 count lists about 175 residents on Waikapū Road. The 1930 count lists 325 in Waikapū Village, 25 in Waikapū and an unclear number, at least 125, in Hayashi Camp.



1923 Ma‘alaea Quadrangle map showing Waikapu with camps and railroads. Hawai‘i State Archives

School and Church

Old maps show the parcel on the Wailuku side of the Waikapū Protestant church as a school. Whether this is the same location as the missionary schools reported in the mid-1800s if not clear, but a current Waikapū resident, Zelie Rogers Harders, says school continued to be in session there at least through the early 1940s. Mrs. Harders was attending Kaunoa School when Pearl Harbor was attacked, and her parents decided to keep her closer to home and enrolled her in the one-room Waikapū schoolhouse. A few records on file at the State Archives in the Department of Education “Reports on Numbers and Nationalities of Pupils” mention the school. In 1890, F.R. Woolsey was principal, with 29 boys and 14 girls (all “native”) plus two girls who were "half caste" in first through fourth grade. Most were aged six to 15; one was older than 15 years. (262-8-19) In 1911, Zelie Rogers (Mrs. Harders' grand-aunt) was a teacher. In the term ending March 31 of that year, there were 42 pupils but only 32 seats, all in first grade. The report said 16 were Hawaiian, five-part Hawaiian, 19 Japanese and one Chinese. Most were six or seven years old; two were 11 years old and beginning school for the first time. (262-9-39) Mrs. Harders says that when her grand-aunt was teacher, she was able to fool naughty boys who plotted mischief in Hawaiian, because she herself was part Hawaiian and fluent in the language. Miss Rogers later married Patrick “Pia” Cockett, who would become a member of the county Board of Supervisors.

Waikapu Church in 2009. Engledow photo 7/09

The Protestant church in Waikapū began in 1838. Its first building was erected in 1866. Records of church growth and change may be found in the Mission Houses Museum Library, which includes minutes of the Maui Presbytery and of the Hawaii Evangelical Association. Originally, this church was part of the Wailuku parish, which included Wailuku, Waikapū, Waihe‘e and Waiehu. In the minutes of the Maui Presbytery for 1869, translated by H. P. Judd, a request by members of the Waikapū congregation that it be separated as an independent church was approved. In 1870, church elder J. Kamakele reporting on the doings of the church, and the church called a new pastor, W. Kaho‘okaumaha (also spelled Ho‘okaumaha).

Archives of the Hawaiian Evangelical Association provide annual statistics as well as occasional insights into the life of the church and the village. In 1871, a report from the Rev. W. Ho‘okaumaha says "this is a small parish but rich (fertile). There are not many members of this church, for they are a small family." Religious meetings were held on Wednesdays, Saturdays and Sundays and not many attended during the week because they were working for the sugar planters, but "on Sundays the Hawaiians set apart that day, so they assemble in larger members in the church. There are some unbelievers in the parish. In the camps of the '*haole*' are the chief doubters." The pastor said these would hide in their office or lie down and pretend to be sick when church members came to visit. The church building was in poor condition, and the congregation was preparing to raise a fund of $2,000 to improve it. At this time, "there are two schools in the parish, the teachers of which are Protestant." There were a few Roman Catholics and Mormons. Apparently there was some sort of epidemic, because the pastor notes that "last March, 40 died." He was also concerned that hula teachers had come from Lahaina and unbelievers practiced the dance. "Some religious persons went to forbid that evil practice and it has ceased," and the teacher had gone back to Lahaina, he wrote.

In the Presbytery minutes of 1876, the minister reported "great activity of the church at Waikapu in rebuilding their edifice."

The statistical tables for 1870-71 shows 197 members in good standing. By 1887-88, there were only 56 members, with the Reverend S. Kaili in charge. The statistical report for 1889-90 shows that

Wailuku and Waikapū were under the leadership of the Reverend O. Nawahine, with a total of 94 on the membership rolls. Consolidation continued--in 1897-98, Wailuku, Waikapū and Honua‘ula were led by the Reverend S. Kapu, with a total of 187 congregants.

In 1909, the Maui News reported that the Reverend Lincoln Benjamin Kaumeheiwa had been invited to co-pastor with the Reverend R.B. Dodge of Kaahumanu and Waikapū churches; he had been in Hana and was "a good preacher and has a good voice for singing," the newspaper said. In 1918, he was installed as pastor of Waikapū and Pu‘unene churches. Church membership continue to dwindle, and by the 1940s a supply pastor preached to 27 members. In 1957, Waikapū, still listed as a "Hawaiian church," had an average attendance of 10 and was "yoked" with Kahului Union. By 1958, the church is no longer included in the annual statistical reports.

St. Joseph Mission, on Honopi‘ilani Highway, served the Catholic community of Waikapū from 1900 (*Pioneers of the Faith:* 327) until it burned down in February 1997. Today it is a well-kept shrine to St. Joseph, with some graves, only three of which are marked. They are the graves of Hanna Sylva, wife of Antone, who died October 13, 1885, and of Mary Ann and George Maxwell (died 1931 and 1930).

World War II

Like others around Hawaii, the people of Waikapū endured martial law and pitched in to prepare for possible enemy attack. There also was new construction in the village with the establishment of Waikapū Station Hospital. An article in the June 17, 1942, *Maui News* describes its formal opening at a banquet held in a hospital's mess hall.

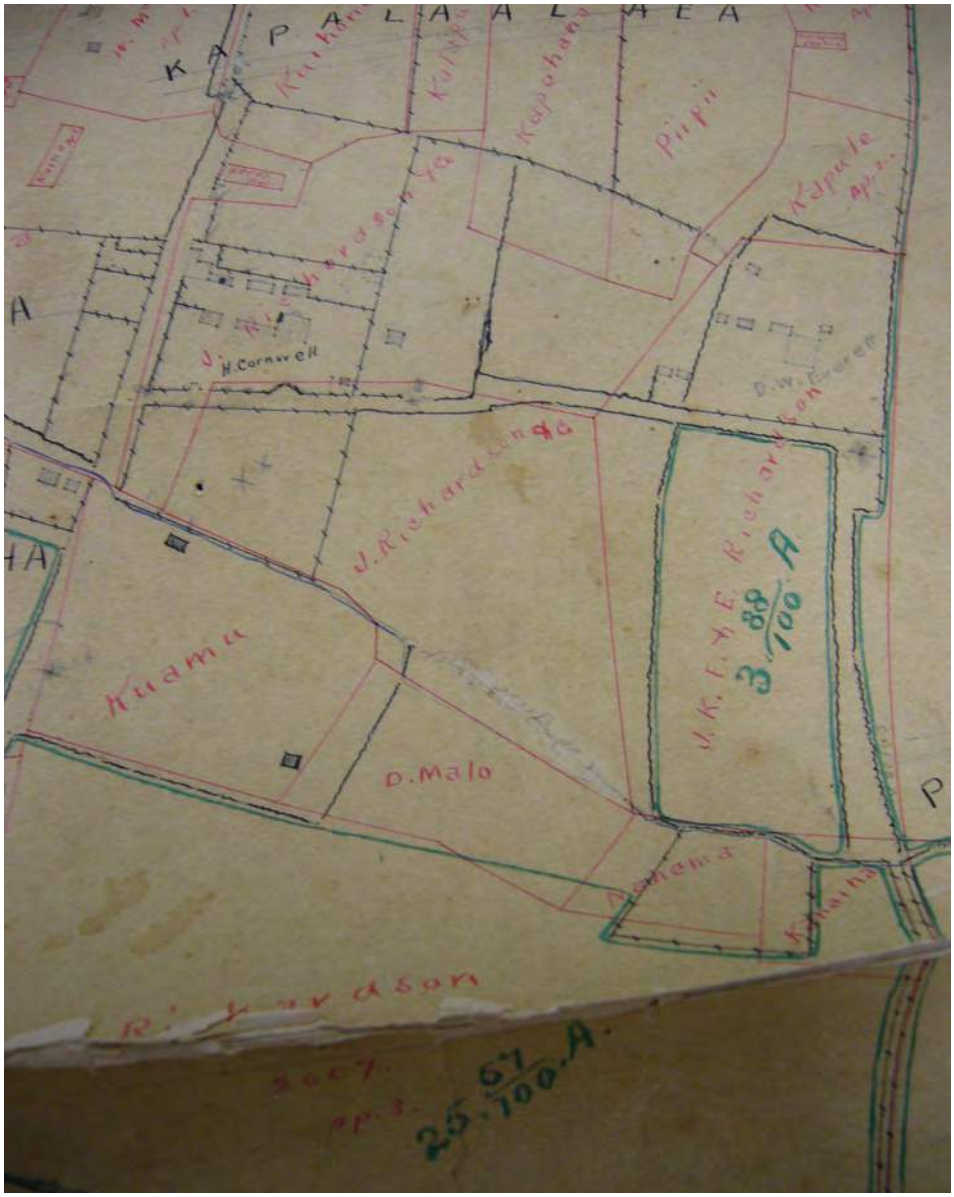
> The hospital is considered an example of the speed with which defense construction has been accomplished on the island, in as much as it was not completed until last January, and now includes almost complete facilities for operation of a general hospital. . . . Major J. Mulligan asserted that the hospital could not have been built without the combined efforts of individuals present at the banquet, and asserted that he appreciated the neighborliness and assistance that had been given on the project. Staff of the hospital consists of eight physicians, ten nurses and 21 enlisted men. Facilities installed include four wards, complete surgery, laboratory, dentistry office, X-ray machine and darkroom, beside large storerooms, mess hall and quarters for the officers, nurses and enlisted men. Wards at the new hospital are so constructed that emergency wards may be organized on the ground beneath them. The surgery is located in the old Waikapu church, from which the steeple has been removed to make it less conspicuous. Now serving as a nurses cottage is the old parsonage. {According to Avery Chumbley, this site was the triangular parcel at the junction of Waiko and Old Waiko roads.]

Steps at junction of Waiko and Old Waiko roads may have led to WWII nurses cottage. Engledow photo 7/09

An article in the August 18, 1923, *Maui News* tells of the formation of a volunteer company made up mostly of men from Waikapū.

> Proficiency in the use of the bolo knife, with which the majority of its members are armed, and skill with small arms and in hand-to-hand combat is the pride of Co. E. 2nd Bn., Maui Volunteers.
>
> The company, sponsored by the Wailuku Sugar Company, comes largely from Waikapu, where it has its headquarters, and consists largely of men working for the Wailuku Sugar Co. Most of its members are Filipino nationals.
>
> The company is commanded by Capt. Wayne Richardson, Jr., Wailuku Sugar Co. division overseer and a graduate of Stanford University, with 1st Lt. James A. Tokunaga, former Hawaiian National Guardsman and highway maintenance foreman for the Territorial department of public works here, as executive officer and second in command.
>
> Approximately 130 men answered the call on May 10, 1942, which deemed a volunteer company necessary at Waikapu. After considerable organizing and fundamental training, the company was under way to becoming a top-notch outfit.. . . Training primarily has been with small arms. Considerable effort and time also has been spent in training on hand-to-hand combat, bayonet defense and the use of bolo knives. Most members of the company are equipped with a bolo knife made by themselves and each man owns a hunting knife. . . . Weekly drills are

conducted from 8:30 to noon each Sunday at the Waikapu ball park. The public is invited to witness these drill periods and see the men who volunteer their time, in addition to fulfilling their civilian jobs, for the defense of Maui.



Section of Waikapu Plantation map showing Kuamu and David Malo kuleana, plus Richardson and Cornwell lands
DLNR State Survey Office

Waikapu Residents

Waikapū has over the years at home to many families whose names are familiar around Maui, including the Sylvas, Cocketts, Vidas and Maxwells, who are descendants, according to Charles K. Maxwell, of Kealiiwahineholololio, a high chiefess who once controlled all the lands from Waikapū to Ma‘alaea. (BWS 12/4/2002)

One of the oldest families in Waikapū is descended from Kuamu, whose *kuleana* was high on Waiko Road, which was bounded on one side by David Malo and on others by John Richardson. The great-great-great-great-grandson of Kuamo is Glenn McLean, who lived on the property for many years beginning in 1973. McLean is the family historian, having spent much time listening to the stories of his elders as he was growing up, and he has studied history formally in recent years, learning Hawaiian and digging into archival records. McLean's grandfather Kalã Pelekai grew up on the Kuamu kuleana. His grandmother Lu‘ukia Pelekai grew up on land mauka of the Maui Tropical Plantation belonging to her stepfather, Ka‘a‘a; there are several family graves on that parcel. Kalã and Lu‘ukia married in 1916 and moved to Hāna, where Glenn McLean now lives. McLean's mother also grew up in Waikapū, but now lives in Hāna as well.

McLean said Kuamu was awarded five *apana*--three for *kalo*, one for *wauke* and one in Keokea for sweet potatoes. The Waikapū property as it now exists has shrunk by about two-thirds from the original dimensions of about 3.5 acres shown on early maps. The property has limited access to water from the Waikapū stream, through a 1-inch pipe that waters fruit trees and the native plants grown by McLean's son Luke, who now lives on the property. McLean has applied for a Commission on Water Resource Management surface water use permit in order to a re-open old *lo‘i* on the property.

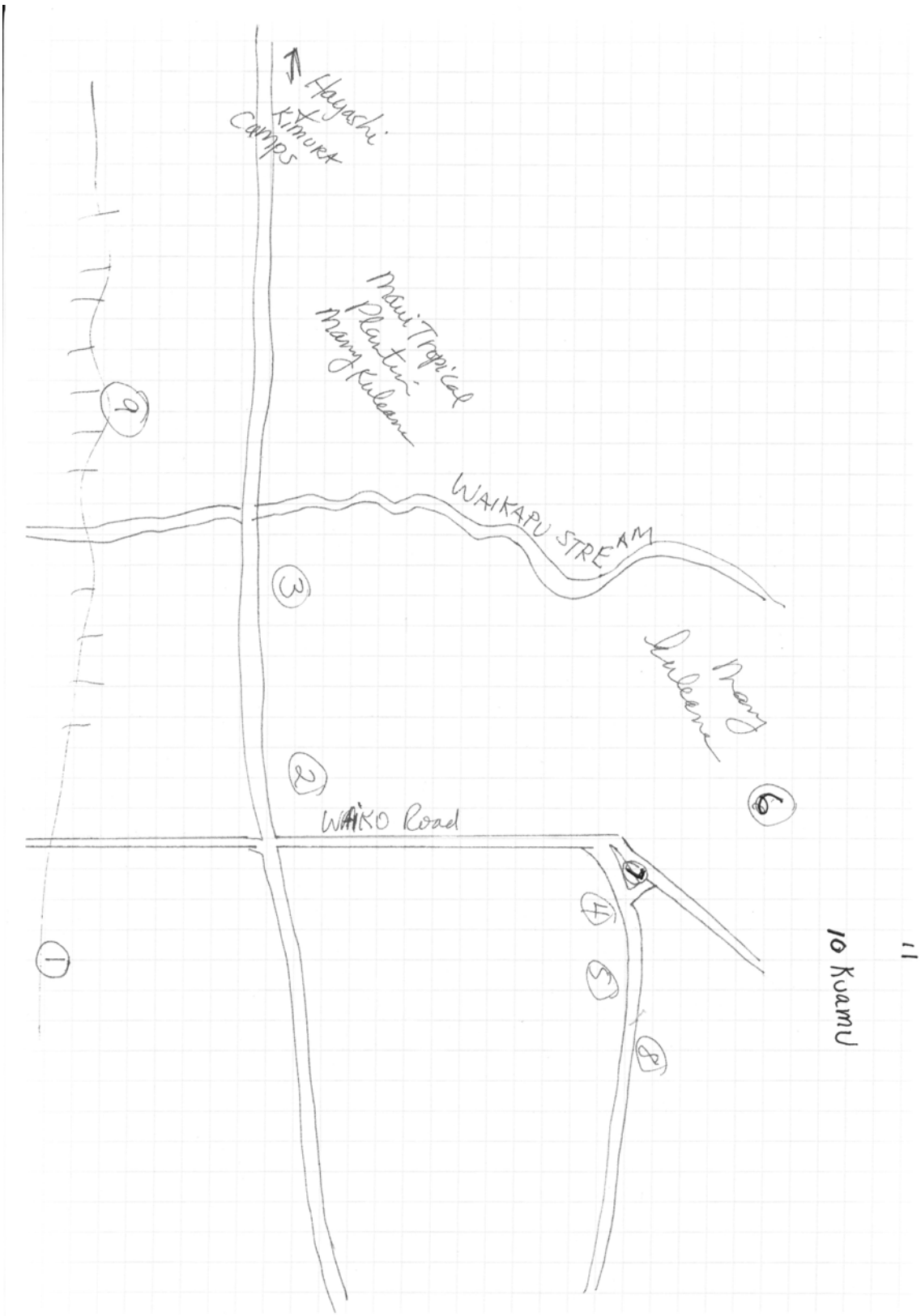
In a brief, informal conversation, McLean shared a few tidbits of Waikapū history. Some of his relatives were among many who left the village in the 1930s to move to Moloka‘i and take up homestead lands there. Eddie Rogers, whose family still lives in Waikapū, once leased 5,000 acres between Waikapū and Ma‘alaea for his cattle; as a young man, McLean worked for him fixing fences. Near the junction of Waiko and Old Waiko roads was a store run by Ah Fat Soong, where Rogers and other residents loved to go for bread and coffee in the morning. Another old family is the Vidas (descendants of Kate Louzada Cornwell and Daniel Rodrigues Vida, who came from Chile and married Kate in 1868). (familysearch.org) A grave on their property belongs to a Cockett, perhaps Charles, the first person of that well-known Maui name to come to the island.

Waikapu also has spawned some famous individuals, beginning with earliest recorded history. The early Hawaiian evangelist known as Blind Bartimeus was born in Waikapū about 1875 and was a noted hula performer and drummer for Hawaiian royalty. (Bingham)

More recently, it is the hometown of the late Shin’ichi Suzuki, a world-class teacher and practitioner of aikido. Suzuki was born in 1917 in Waikapū, the first in a family of ten children whose father immigrated from Japan to work in the cane fields. (Curtis)

* * * * *

Author's note: Waikapū clearly was a vital and important community in Maui's history, and its story as presented here could be greatly expanded. Due in part to time constraints, this report is based almost entirely on documentary resources, with few interviews of contemporary Waikapū residents (who are putting together their own oral history). Stories told by residents and descendants of former residents would fill in gaps and perhaps correct errors or mis perceptions found in this report. The author hopes that this report turns out to be the first draft of a comprehensive history of Waikapū.



Engledow map 7/09

Approximate locations of various sites mentioned in A History of Waikapū

1. Waikapū Community Cemetery.
2. Site of 1862 Waikapū Mill, later Wailuku Sugar stables area. This was subdivided starting 1955.
3. Old Catholic church that burned in 1997
4. Old Congregational church. Turned into a surgery during WWII; now a private residence.
5. Old school site, closed sometime after early 1940s.
6. Many kuleana on Avery Chumbley's land, and some Cornwell graves.
7. WWII nurses cottage
8. Old Waikapu Road, created in 1860s, was much-used access route between Wailuku and *kuleana* in the area.
9. Plantation railroad in this approximate area.
10. Kuamu *kuleana*
11. Cornwell home

Sources Cited for Waikapū Historical Documentary Research

Adler, Jacob. *Claus Spreckels: The Sugar King in Hawaii.* Honolulu: University of Hawai'i Press, 1966.

Ashdown, Inez MacPhee. *Ke Alaloa O Maui*. Wailuku: Kama'āina Historians, 1971.

Bartholomew, Gail. *The Index to the Maui News, 1900-1950*. Wailuku: Maui Historical Society, 1985.

Bingham, Hiram. *Bartimeus, the Blind Preacher of Maui.* Pamphlet at Maui Historical Society, AR44

Board of Education records at Hawai'i State Archives: General Reports 1841-1842, School Agents' Reports 1852, and Reports on Numbers and Nationalities of Pupils 1890, 1911. Series 262.

Board of Water Supply Special Meeting. Accessed 7/27/09 at http://www.co.maui.hi.us/archives/121/min021204sp.pdf

Chumbley, Avery. Personal communication, 6/30/09 and 7/02/09.

Curtis, Christopher. *Shin'ichie Suzuki Sensei.* Accessed 6/22/09 at http://www.aikidojournal.com/article?articleID=278

Department of Commerce and Labor--Bureau of the Census. *Census of the United States, 1900,*

1910, 1920. Accessed via Ancestry.com 6/24/09.

Desha, Rev. Stephen L. *Kamehameha and His Warrior Kekūhaupiʻo.* Honolulu: Kamehameha Schools Press, 2000.

Everett, T.W. Letter to F.W. Hutchison. On file at Maui Historical Society, AR66.

Familysearch.org, accessed 7/24/09 at
http://www.familysearch.org/Eng/Search/AF/individual_record.asp?recid=47268815&lds=0&frompage=99

Fornander, Abraham. *Collection of Hawaiian Antiquities and Folk-lore.* Accessed via Ulukau.org 7/1/09

Girvan, James W. *The Master Planter.* Honolulu: Press of the Hawaiian Gazette Co. Ltd., 1910.

Gorham, Gilman D. *A Journal of a Tour of Maui in the Year 1843*. Ms. copy in Maui Historical Society files, AR 67.

Handy, E. S. and E. G. with Mary Kawena Pukui. *Native Planters in Old Hawaiʻi; Their Life, Lore, & Environment*. Honolulu: Bishop Museum Press, 1972.

Harders, Zelie Rogers. Personal communication. 7/27/09 and 7/29/09

Hawaiian Mission Children's Society (HMCS). Mission Houses Museum includes Wailuku Station report excerpts, minutes of Maui Presbytery and church reports of Hawaii Evangelical Association.

Ka Lama Hawaii. Accessed via Ulukau.org 6/26/09.

Kamakau, Samuel Mānaiakalani. *Ruling Chiefs of Hawaii.* Revised Edition. Honolulu: Kamehameha Schools/Bishop Estate, 1992.

Kame`eleihiwa, Lilikalā. *Native Land and Foreign Desires: Pehea Lā E Pono Ai?* Honolulu: Bishop Museum Press. 1992.

Kuykendall, Ralph S. *The Hawaiian Kingdom, Vol. I.* Honolulu: University of Hawaiʻi Press, 1938.

Kyselka, Will and Ray Lanterman. *Maui: How It Came to Be*. Honolulu: University of Hawaiʻi Press, 1980.

Maly, Kepā and Onaona. *Wai O Ke Ola: He Wahi Moʻolelo No Maui Hikina.* Kumu Pono Associates, 2001. Includes excerpts from J.S. Green letters published in *The Polynesian.*

The Maui News. Wailuku: Maui Publishing Company, 1900-1950.

McLean, Glenn. Personal communication, 7/25/09.

Pacific Commercial Advertiser. Microfilm at Hawai'i State Archives, accessed 7/14/09.

Paradise of the Pacific. Microfilm at Kahului State Public Library, accessed 6/24/09.

Puku`i, Mary Kawena. *`Ōlelo Noe`au: Hawaiian Proverbs and Poetical Sayings*. Honolulu: Bishop Museum Press, 1983.

Pukui, Mary Kawena, Samuel H. Elbert and Esther T. Mookini. *Place Names of Hawaii*, 2nd ed. Honolulu: The University Press of Hawai'i, 1974.

Purnell, Nanette Napoleon. *Island of Maui Cemetery (Map & History) Directory*. Wailuku: Maui Historical Society, 1990

Schmitt, Robert C. *The Missionary Censuses of Hawaii*. Honolulu: Bishop Museum, 1973.

Schoofs, Robert, SS.CC. *Pioneers of the Faith*. Honolulu: Louis Boeynaems, SS.CC., 1978

Sterling, Elspeth P. *Sites of Maui*. Honolulu: Bishop Museum Press, 1998.

Silva, Alvin K. *Wailuku Sugar Company Centennial, November 1862-1962: A Century of Progress in Sugar Cane Cultivation*. Wailuku: Wailuku Sugar Co., 1962.

Supreme Court of the Hawaiian Islands. *Reports of Decisions, 1882*. Accessed 7/8/09 at http://books.google.com/books?id=9cgDAAAAYAAJ&pg=PA541&sig=-yMwsXmpTwPG2STV0tm1iUlVZx8

Von Tempski, Armine. *Born in Paradise*. Woodbridge, Conn.: Ox Bow Press, 1985 reprint.

Walker, John Cornwell. Personal communication, July 24, 2009.

Wist, Benjamin O. *A Century of Public Education in Hawaii*. Honolulu: The Hawaii Educational Review, 1940.

APPENDIX O

MCC, Chapter 2.96 “Workforce Housing Policy”

Chapter 2.96 - RESIDENTIAL WORKFORCE HOUSING POLICY

Sections:

2.96.010 - Purpose.

The purpose of this chapter is to enhance the public welfare by ensuring that the housing needs of the County are addressed. The council finds that there is a critical shortage of affordable housing, making home acquisition by the majority of County resident workers extremely difficult, and creating a shortage of affordable rental units. The resident workforce is leaving the County in search of affordable housing, and new employees are being deterred by the high cost of living. To maintain a sufficient resident workforce in all fields of employment, and to ensure the public safety and general welfare of the residents of the County, resident workforce housing needs must be addressed. It is the intent of this chapter to encourage the provision and maintenance of residential workforce housing units, for both purchase and rental, to meet the needs of income-qualified households for the workforce, students, and special housing target groups.

(Ord. 3418 § 1 (part), 2006)

2.96.020 - Definitions.

Whenever used in this chapter, unless a different meaning clearly appears from the context:

"Community land trust" means a nonprofit organization that acquires land that:

1. Is held in perpetuity;
2. Is primarily for conveyance under a long-term ground lease for the creation of dwelling units that shall be sold or rented to applicants within the income-qualified groups established by this chapter; and
3. Retains an option to purchase any dwelling unit at a price determined by formula that is designed to ensure that the dwelling unit remains affordable in perpetuity.

"Council" means the Maui County council.

"Department" means the department of housing and human concerns.

"Director" means the director of housing and human concerns, County of Maui.

"Disabled" means a person who is determined, by a medical doctor, to have a physical, mental, or emotional impairment that:

1. Is expected to be of long-continued and indefinite duration;
2. Substantially impedes his or her ability to live independently; and
3. Is of such a nature that the ability to live independently could be improved by more suitable housing conditions.

"Division" means the housing division of the department of housing and human concerns, County of Maui.

"Elderly" means a person who has attained the age of sixty-two years.

"Employed" means working for compensation in the County for any number of hours.

"Homeless" means:

1. An individual or family who lacks a fixed, regular, and adequate nighttime residence; or

2. An individual or family who has a primary nighttime residence that is:

    a. A supervised shelter designed to provide temporary living accommodations; or

    b. A place not designed for or ordinarily used as sleeping accommodations for human beings.

"HUD" means the United States Department of Housing and Urban Development.

"Improved land" means land that has necessary infrastructural improvements to support a public use project or a use density of at least a single-family or a two-family residential building per acre, in conformity with state and County zoning laws and building permit requirements.

"Lot" means any improved or unimproved land that has been subdivided.

"Median family income" means the middle income in a series of incomes ranked from smallest to largest as determined by HUD for the County, or as adjusted by the department, for Hana, Lanai, and Molokai.

"Prevailing interest rate" means the average interest rate of two mortgage lenders in the County, acceptable to the director, for a thirty year fixed loan with no discount points.

"Qualified housing provider" means a community land trust, nonprofit agency, or other private or public organization, agency, or entity authorized and designated by the department in accordance with section 2.96.150 to own, develop, construct, administer, operate or otherwise provide residential workforce housing required under this chapter.

"Resident" means a person who meets one of the following criteria:

1. Currently employed in the County;
2. Retired from employment in the County, having worked in the County immediately prior to retirement;
3. A full-time student residing in the County;
4. A disabled person residing in the County who was employed in the County prior to becoming disabled;
5. The parent or guardian of a disabled person residing in the County;
6. A spouse or dependent of any such employee, retired person, student, or disabled person residing in the County; or
7. In the event of the death of the employee, retired person, student, or disabled person, the spouse or dependent of any such person residing in the County.

"Residential workforce housing unit" means a unit or lot to be sold or rented to residents within one of the following income groups as established by the department:

1. "Very low income," which are those households whose gross annual family income is fifty percent or less of the area median income as established by HUD, or as adjusted by the department, for Hana, Lanai, and Molokai.
2. "Low income," which are those households whose gross annual family income is more than fifty percent, but not more than eighty percent of the area median income as established by HUD, or as adjusted by the department, for Hana, Lanai, and Molokai.
3. "Below-moderate income," which are those households whose gross annual family income is more than eighty percent, but not more than one hundred percent of the area median income as established by HUD, or as adjusted by the department, for Hana, Lanai, and Molokai.
4. "Moderate income," which are those households whose gross annual family income is more than one hundred percent, but not more than one hundred twenty percent of the area median income as established by HUD, or as adjusted by the department, for Hana, Lanai, and Molokai.

5. "Above-moderate income," which are those households whose gross annual family income is more than one hundred twenty percent, but not more than one hundred forty percent of the area median income as established by HUD, or as adjusted by the department, for Hana, Lanai, and Molokai.

"Special housing target group" means a group of residents that can be demographically defined as having a special or unique housing need, including but not limited to, the elderly, homeless, and disabled.

"Unimproved land" means land not classified as "improved land."

"Wait list area" means Hana, Lanai, Maui (excluding Hana), or Molokai.

(Ord. No. 4177, §§ 1—4, 2014; Ord. No. 3719, § 1, 2010; Ord. 3512 § 1, 2007; Ord. 3418 § 1 (part), 2006)

2.96.030 - Applicability.

A. Any development, including the subdivision of land and/or the construction of single-family dwelling units, two-family dwelling units, multi-family dwelling units, or hotels, as defined in section 19.04.040 of this code, whether constructed at one time or over several years, shall be subject to this chapter upon final subdivision or building permit approval, whichever is applicable and occurs first, if it will result in the creation of the following:

1. Ten or more lots, lodging units, time share units, or dwelling units, excluding farm labor dwellings or a second farm dwelling, as defined in section 19.04.040 of this code; provided that, such farm labor dwelling or farm dwelling is in full compliance with chapter 205, Hawaii Revised Statutes, and is not part of a condominium property regime, as set forth in chapter 514A, Hawaii Revised Statutes;

2. A conversion of ten or more hotel units to dwelling units or time share units; or

3. Any hotel redevelopment or renovation project that increases the number of lodging or dwelling units in a hotel by ten or more.

B. Exemptions. This chapter shall not apply to any development that falls into one or more of the following categories:

1. A development subject to an affordable housing requirement, evidenced by an executed affordable housing agreement with the County, currently in effect and approved prior to the effective date of this chapter;

2. A development subject to a change in zoning condition that requires affordable or residential workforce housing, unless the condition expressly allows for the application of the affordable housing or residential workforce housing policy set forth herein;

3. A subdivision granted preliminary subdivision approval prior to the effective date of this chapter;

4. A building permit application submitted prior to the effective date of this chapter;

5. A family subdivision, for immediate family members, as described in subsections 18.20.280.B.1 and B.2 of this code;

6. A development by a government entity or a community land trust, as approved by the director; or

7. A development within the boundaries of the Wailuku redevelopment area as defined by the Maui redevelopment agency pursuant to chapter 53, Hawaii Revised Statutes.

C. Adjustment by developer.

1. A developer of any development subject to this chapter may appeal to the council for a reduction, adjustment, or waiver of the requirements based upon the absence of any

reasonable relationship or nexus between the impact of the development and the number of residential workforce housing units or in-lieu fees/land required.

2. Any such appeal shall be made in writing and filed with the county clerk prior to final subdivision approval or issuance of a building permit for the development, whichever is applicable. Any such appeal shall administratively stay the processing of the development's subdivision or building permit, whichever is applicable, until a decision on the appeal is rendered. The appeal shall set forth in detail the factual and legal basis for the claim of reduction, adjustment, or waiver, and the developer shall bear the burden of presenting substantial evidence to support the appeal, including comparable and relevant technical information.

3. The council, or if the appeal is assigned to a council committee, the council committee shall convene a meeting within forty-five days of the county clerk's receipt of the appeal, to consider the appeal. The council shall approve or disapprove the appeal by resolution within forty-five days from the date the developer has concluded its presentation of evidence supporting the appeal in a council or committee meeting.

4. If the council or a council committee has not convened a meeting within forty-five days of the county clerk's receipt of the appeal, or if the council does not approve or disapprove the appeal by resolution within forty-five days from the date the developer has concluded its presentation of evidence at the council or council committee meeting, the appeal, as submitted by the developer, shall be deemed approved by the council.

5. If a reduction, adjustment, or waiver is granted by the council, any subsequent substantive change or modification in use within the development, as determined by the director, shall invalidate the reduction, adjustment, or waiver previously granted.

D. Adjustment by Director. The director may, subject to council approval by resolution, authorize a reduction, adjustment, or waiver of any provision of this chapter.

E. Projects pursuant to chapter 201H, Hawaii Revised Statutes, shall be subject to the requirements of this chapter, provided that where the terms of this chapter and chapter 201H are in conflict, the terms contained in chapter 201H shall control.

(Ord. No. 4236, § 1, 2015; Ord. No. 4177, § 5, 2014; Ord. 3546 § 1, 2008; Ord. 3418 § 1 (part), 2006)

2.96.040 - Residential workforce housing requirements.

A. Developers shall be required to provide a number of residential workforce housing units equivalent to at least twenty-five percent, rounding up to the nearest whole number, of the total number of market rate lots, lodging units, time share units, or dwelling units, excluding farm labor dwellings or a second farm dwelling, as defined in section 19.04.040 of this code, created. If a developer satisfies the requirements of this chapter through subsection (B)(3) and the units shall remain available only to income-qualified groups in perpetuity, the developer shall provide at least twenty percent, rounding up to the nearest whole number, of the total number of market rate lots, lodging units, time share units, or dwelling units, excluding farm labor dwellings or a second farm dwelling, as defined in section 19.04.040 of this code, created.

B. Prior to final subdivision approval or issuance of a building permit for a development subject to this chapter, the department shall require the developer to enter into a residential workforce housing agreement. The agreement shall set forth the method by which the developer satisfies the requirements of this chapter. The requirements may be satisfied by one or a combination of the following, which shall be determined by the director and stated in the agreement:

1. Offer for sale, single-family dwelling units, two-family dwelling units, or multi-family dwelling units as residential workforce housing within the community plan area;

2. Offer for rent, multi-family dwelling units as residential workforce housing units within the community plan area;

3. In lieu of directly selling or renting units pursuant to subsections (B)(1) or (B)(2) the developer may convey such units to a qualified housing provider subject to department approval pursuant to section 2.96.150; or

4. In lieu of providing residential workforce housing units, the residential workforce housing requirement may be satisfied by payment of a fee, by providing improved land, or by providing unimproved land in accordance with the following:

   a. The in-lieu fee per residential workforce housing unit required by this chapter shall be equal to the difference in unit costs for a three bedroom, single-family, dwelling unit, at one hundred percent and a three bedroom, single-family, dwelling unit at one hundred sixty percent of median income, for a family of four, pursuant to HUD affordable sales price guidelines, or as adjusted by the department for Hana, Lanai, and Molokai.

   b. Any dedication of improved or unimproved land in-lieu of residential workforce housing units shall be subject to the approval of the director and the council by resolution.

C. Income group distribution.

1. Unless an exemption is granted by the director, the percentage of ownership units within each income group shall be as follows:

   a. Thirty percent of the ownership units shall be for "below-moderate income" residents.

   b. Fifty percent of the ownership units shall be for "moderate income" residents.

   c. Twenty percent of the ownership units shall be for "above-moderate income" residents.

2. Unless an exemption is granted by the director, the percentage of rental units within each income group shall be as follows:

   a. One-third of the rental units shall be for "very low income" and "low income" residents.

   b. One-third of the rental units shall be for "below-moderate income" residents.

   c. One-third of the rental units shall be for "moderate income" residents.

(Ord. No. 4177, § 6, 2014; Ord. No. 3719, § 2, 2010; Ord. 3438 § 1, 2007: Ord. 3418 § 1 (part), 2006)

2.96.050 - Residential workforce housing credits.

A. Credits may be given under the following circumstances:

1. Upon developer's request, credits may be given for every single-family dwelling unit, two-family dwelling unit, or multi-family dwelling unit constructed and sold at affordable rates, in excess of the residential workforce housing units required by section 2.96.040, provided that developments comprised of one hundred percent residential workforce housing units shall be eligible for credits totalling no more than seventy-five percent of the total number of residential workforce housing units constructed.

2. Credits may be issued for a one hundred percent affordable project developed pursuant to section 201H-38, Hawaii Revised Statutes, provided that, one residential workforce housing credit shall be given, upon request by the developer, for every single-family dwelling unit, two-family dwelling unit, or multi-family dwelling unit constructed and sold at affordable rates, in excess of fifty percent of the total number of units constructed and sold at affordable rates in the project. Credits shall not be issued for projects developed pursuant to section 201H-38, Hawaii Revised Statutes, that are not one hundred percent affordable.

B. The credit may be used in any community plan area.

C. The credit may satisfy the requirement for any type of unit constructed.

D. The credit may satisfy the requirement for a unit in any income group.

E. The credit may be used for a future development, but may not be used for an affordable housing or residential workforce housing unit owed at the time the credit is given.

F. The number of credits issued shall be set forth in the residential workforce housing agreement.

(Ord. No. 4235, § 1, 2015; Ord. No. 4177, § 7, 2014; Ord. 3418 § 1 (part), 2006)

2.96.060 - Residential workforce housing restrictions-ownership units.

A. Timing of completion.

1. Residential workforce housing units shall be made available for occupancy either before or concurrently with market rate units at the same ratio required of the development.

2. Certificates of occupancy shall not be issued and/or final inspections shall not be passed for the market rate units unless certificates of occupancy are issued and/or final inspections are passed for the residential workforce housing units concurrently or sooner.

B. Deed restrictions.

1. The ownership units within each income group shall be subject to the deed restrictions contained in this section for the following periods:

a. "Below-moderate income," ten years.

b. "Moderate income," eight years.

c. "Above-moderate income," five years.

2. For the deed-restricted period, the following shall apply:

a. The unit must be owner-occupied.

b. The owner must notify the department upon a decision to sell.

c. Upon the owner's decision to sell, the County shall have the first option to purchase the unit from the owner; said option shall be available to the County for a period of one hundred and twenty days from receipt of written notice from the owner.

d. Upon sale of the unit, the deed restrictions shall remain in full force and effect for the remainder of the deed restriction period that commenced at the time of the initial sale.

e. Under special circumstances an owner of a residential workforce housing unit may appeal to the department for a waiver of the owner-occupancy deed restriction; these circumstances would include, but are not limited to, assignment to active duty military or short-term contracts for off-island employment.

f. Resale. The maximum resale price shall be established by the department using the following guidelines:

i. An appraisal of the property shall be required before occupancy ("the owner's purchase price").

ii. A second appraisal shall be required upon a decision to sell the unit.

iii. Twenty-five percent of the difference between the two appraisals shall be added to the owner's purchase price.

g. The restrictions contained in subparagraphs 2a through 2f above shall not apply in situations of foreclosure.

C. Sales price - dwelling units. The sales price of a new dwelling unit shall be established by the department based on current HUD price guidelines.

(Ord. No. 4235, § 2, 2015; Ord. No. 4177, § 8, 2014; Ord. 3418 § 1 (part), 2006)

2.96.070 - Residential workforce housing restrictions - rental units.

A. Timing of completion. Residential workforce housing units shall be made available for occupancy either prior to or concurrently with market rate units at the same ratio required of the development. Certificates of occupancy shall not be issued and/or final inspections shall not be passed for the market rate units unless certificates of occupancy are issued and/or final inspections are passed for the residential workforce housing units concurrently or sooner.

B. Vacancies. Any rental unit vacancy must be filled by an applicant in the appropriate income group to better maintain an equal distribution of rentals across the "very low income" and "low income," "below-moderate income," and "moderate income" groups.

C. Deed restrictions.

1. The rental unit must remain affordable for thirty years from the initial occupancy.

2. For the thirty-year affordability period, the following shall apply:

a. The owner must notify the department upon a decision to sell the rental development and the County shall have the first option to purchase the rental development from the owner; said option shall be available to the County for a period of one hundred and twenty days from receipt of written notice from the owner and shall not apply to sales by reason of foreclosure.

b Any new owner must comply with the deed restrictions.

3. Within 90 days of the expiration of the thirty-year affordability period, the owner shall offer the County the right to purchase the property at market value as determined by the owner.

D. Rental rates. The monthly rental rates shall be set by the department based on HUD income limits.

(Ord. No. 4177, § 9, 2014; Ord. 3418 § 1 (part), 2006)

2.96.080 - Residential workforce housing agreement.

A. Before final subdivision approval or issuance of a building permit, the developer shall enter into a residential workforce housing agreement that sets forth the detailed terms and conditions of compliance with the residential workforce housing policy, including but not limited to:

1. Sales or rental periods for the residential workforce housing units, which specify procedures for the release of units from the residential workforce housing requirements should units not be sold or rented following the expiration of the sales or rental periods;

2. Identification of the number, type, and location of units;

3. Designation of units for specific income and/or special housing target groups;

4. Marketing process for the residential workforce housing units;

5. Eligibility of income-qualified households;

6. Provision for residential workforce housing credits, as applicable;

7. Payment of in-lieu fees or provision of in-lieu land; and

8. Resale restrictions, which may include buy-back provisions, shared equity, and encumbrances.

B. The residential workforce housing agreement shall be recorded with the bureau of conveyances of the State of Hawaii or the land court of the State as the case may be, so that the terms and conditions of the agreement run with the land and bind and constitute notice to all subsequent grantees, assignees, mortgagees, lienors, and any other persons who claim an interest in such property. The agreement shall be enforceable by the County by appropriate action at law or suit in equity, against the developer, its successors, and assignees.

(Ord. 3418 § 1 (part), 2006)

2.96.090 - Applicant selection process - ownership units.

A. Wait List Procedure.

1. The developer, its partner, or its management company shall establish wait lists of interested applicants by development.

2. Prior to initiating the wait list, the developer, its partner, or its management company shall publish in at least five issues of a newspaper of general circulation within the County, a public notice that shall contain all information that is relevant to the establishment of the wait list. The public shall also be informed in a like manner, of any decision that would substantially affect the maintenance and use of the wait list.

3. Selection for purchase shall be made by a lottery administered by the developer, its partner, or its management company and overseen by the department, subject to the applicant meeting the eligibility criteria established in subsection (B).

B. Eligibility criteria. In order to be eligible for a residential workforce housing unit, an applicant must meet the following criteria:

1. Be a citizen of the United States or a permanent resident alien who is a resident of the County.

2. Be eighteen years of age or older.

3. Have a gross annual family income (not to include the income of minors) which does not exceed one hundred forty percent of the County's area median income as established by HUD, or as adjusted by the department, for Hana, Lanai, and Molokai. Initial determination for compliance with the maximum gross annual family income provision shall be made by the developer, its partner, or its management company for the initial sale of residential workforce housing units, on the basis of the information provided on the ownership application. The ownership application will be completed when a specific unit is being considered. Final determination for compliance with the maximum gross annual family income provision shall be made by the prospective lender at the time the applicant's income verification data is received.

4. Have assets that do not exceed one hundred forty percent of the County's area median income as established by HUD, or as adjusted by the department, for Hana, Lanai, and Molokai. Assets shall include all cash, securities, stocks, bonds and real property. Real property shall be valued at fair market value less liabilities on such real property.

5. For a period of three years before the submittal of the ownership application, have not had an interest of fifty percent or more in real property in fee or leasehold in the United States, where the unit or land is deemed suitable for dwelling purposes, unless the applicant is selling an affordable unit and purchasing a different affordable unit that is more appropriate for the applicant's family size.

6. Pre-qualify for a loan with the applicant's choice of lender.

C. Notification of Change. Each applicant shall be responsible for notifying the developer, its partner, or its management company in writing of any changes in mailing address, telephone number, fax number, and/or e-mail address. If an applicant fails to properly notify the developer, its partner, or its management company of such changes and the developer, its partner, or its management company is unable to contact the applicant, the developer, its partner, or its management company shall remove the applicant's name from the wait list.

D. Selection priority.

1. Residents on the wait list shall receive first priority for the available units. Nonresidents on the wait list may purchase a residential workforce housing unit once the wait list has been exhausted of all residents.

2. The developer, its partner, or its management company may do a mass mailing of housing applications to applicants on the wait list.

3. The residential workforce housing units must be offered to residents in the order in which their names were drawn in the lottery, provided that there is a unit available in the income group for which they qualify. Nonresidents will be offered residential workforce housing units in the order in which their names were drawn in the lottery.

4. In the event that units are not sold within the first ninety days after they are offered for sale, and the developer has made a good faith effort, as determined by the director, to contact and qualify applicants on the wait list, the sale of remaining units shall be conducted as follows:

    a. For the next ninety-day period, units shall be offered for sale to the next-higher income preference group, at the original sales price. For example, units targeted for families earning up to one hundred twenty percent of the median income may be sold to families earning up to one hundred forty percent of the median income. All other eligibility criteria shall apply.

    b. Units shall be offered to the next higher income group every ninety days until the units are sold or there are no more income groups available.

    c. Units shall then be offered to nonresidents on the wait list in the order in which their names were drawn in the lottery, for the next ninety-day period, provided that the applicant's income is within the residential workforce housing income groups.

    d. Any units that remain unsold may be offered at market rate without deed restrictions. Upon the sale of the unit, the County shall receive fifty percent of the difference between the original sales price of the unit and the actual market rate sales price, for deposit into the affordable housing fund. In this event, the developer shall still be deemed to have satisfied the requirement for producing a residential workforce housing unit.

5. The developer shall submit copies of the following information to the department to verify the sale of residential workforce housing units to eligible buyers:

    a. Applicant's completed ownership application.

    b. Executed sales contract.

    c. Pre-qualification notice from lender.

    d. All signed federal and state tax returns used to determine eligibility, or any other documents used to determine eligibility by the lender.

    e. Escrow company's settlement statement.

6. An owner of a residential workforce housing unit that is being resold must sell the unit to an income-qualified household and notify the department of the sale. The department shall verify the sales price.

(Ord. No. 4177, § 10, 2014; Ord. 3418 § 1 (part), 2006)

2.96.100 - Applicant selection process—rental units.

A. Wait List Procedure.

1. The developer, its partner, or its management company shall establish wait lists of interested applicants by rental development;

2. Prior to initiating the wait list, the developer, its partner, or its management company shall initiate the wait list process by publishing in at least five issues of a newspaper of general circulation within the County, a public notice that shall contain all information that is relevant to the establishment of the wait list. The public shall also be informed in a like manner, of any decision that would substantially affect the maintenance and use of the wait list; and

3. Selection for rental units shall be made by a lottery administered by the developer, its partner, or its management company and overseen by the department, subject to the applicant meeting the eligibility criteria established in subsection B of this section.

B. Eligibility Criteria. The eligibility criteria for rentals shall be established on a project-by-project basis by the director in the following manner:

1. If the project is receiving federal and/or state assistance, the applicable federal and/or state eligibility criteria shall apply; and

2. If the project is not receiving federal and/or state assistance, all eligibility criteria in section 2.96.090.B of this chapter shall apply, except for section 2.96.090.B.6 of this chapter.

C. Notification of Change. Each applicant shall be responsible for notifying the developer, its partner, or its management company in writing of any changes in mailing address, telephone number, fax number, and/or e-mail address. If an applicant fails to properly notify the developer, its partner, or its management company of such changes and the developer, its partner, or its management company is unable to contact the applicant, the applicant's name shall be removed from the applicable wait list.

D. Selection Priority.

1. Residents on the wait list shall receive first priority for the available units. Nonresidents on the wait list may rent a residential workforce housing unit once the wait list has been exhausted of all residents.

2. The developer, its partner, or its management company may do a mass mailing of housing applications to applicants on the wait list.

3. The residential workforce housing units shall be offered to residents in the order in which their names were drawn in the lottery, provided that there is a unit available in the income group for which they qualify. Nonresidents will then be offered residential workforce housing units in the order in which their names were drawn in the lottery, provided that there is a unit available in the income group for which they qualify.

4. The developer, its partner, or its management company shall submit copies of the following information to the department to verify the rental of residential workforce housing units to eligible renters:

a. Applicant's completed final rental application;

b. Executed rental lease; and

c. All signed federal and state tax returns used to determine eligibility, or any other documents used to determine eligibility by the developer, its partner, or its management company.

5. The developer, its partner, or its management company shall maintain a wait list for the development after all of the units are rented, which shall be used to fill any vacancy.

6. Any rental unit vacancy shall be filled by an applicant in the same income group as the original tenant to maintain an equal distribution of rentals across the "very low income" and "low income," "below-moderate income," and "moderate income" groups.

7. An owner of a residential workforce housing rental development intending to sell the development shall notify the department in writing prior to the closing of the sale, and shall provide documentation to the department that the prospective new owner acknowledges and is aware of the terms, conditions, and restrictions encumbering the development as set forth in section 2.96.070.

(Ord. 3546 § 2, 2008; Ord. 3418 § 1 (part), 2006)

2.96.110 - Review requirements.

A. The council shall review this chapter every two years.

B. The director shall provide an annual report to the council on the status of the housing policy that shall include the following:

1. The number of units built for sale and rent, categorized by number of bedrooms, income group, and sales price if for sale;

2. The number of purchasers who resold units, categorized by number of bedrooms, income group, and sales price; and

3. The number of developers, their partner(s), or their management companies maintaining a wait list, and the number of applicants on each wait list.

C. For rental developments, the developer, its partner, or its management company shall submit an annual report of rental units to the department that includes the following:

1. The tenant's move-in date; and

2. The income group of the tenant or family.

(Ord. 3418 § 1 (part), 2006)

2.96.120 - Rules.

The director shall adopt administrative rules to implement this chapter, pursuant to chapter 91, Hawaii Revised Statutes, within one hundred eighty days after the effective date of the ordinance codified in this chapter.

(Ord. 3418 § 1 (part), 2006)

2.96.130 - Property assessment value.

The annual tax assessed value, as determined by the County, will take into account the limited resale value of the residential workforce housing property.

(Ord. 3418 § 1 (part), 2006)

2.96.140 - Incentives.

A. For developments subject to this chapter, and under the jurisdiction of the development services administration of the department of public works, decisions on permits will be made by all

departments within sixty days of the date the permit application is deemed complete by the development services administration. Decisions on permits that require review by any outside agency will be made within thirty days of receipt by the development services administration of the last approval from an outside agency; provided that decisions on applications that require special management area permit review, or environmental review pursuant to chapter 343, Hawaii Revised Statutes, shall be issued within ninety days of completion of the applicable review.

B. For developments subject to this chapter, and if applicable, the council will schedule the initial meeting for such application within six months of the referral to the appropriate committee. The council will vote to approve or deny the application within one year of the referral to committee.

(Ord. No. 4177, § 11, 2014; Ord. 3418 § 1 (part), 2006)

2.96.150 - Qualified housing providers.

Where the department determines that such an agreement will further the purposes of this chapter, the department shall enter into an agreement, on a project-by-project basis, with a qualified housing provider. Such an agreement may provide, without limitation, that the qualified housing provider shall:

A. Receive, own, manage, rent, operate and sell residential workforce housing units provided by developers pursuant to section 2.96.040.

B. Receive land and in-lieu fees provided by developers pursuant to subsection 2.96.040(B)(4).

C. Receive disbursements from the affordable housing fund and other funds provided for the purposes of this chapter.

D. Administer the selection processes under sections 2.96.090 and 2.96.100 subject to the department's oversight.

1. Where a qualified housing provider receives, owns, develops, rents, operates or sells residential workforce housing units, such units shall be rented or sold to applicants qualified under this chapter, as set forth in the qualified housing provider's agreement with the department.

2. Selection of purchasers or renters for a qualified housing provider's units shall be made in accordance with sections 2.96.090 and 2.96.100 of this chapter or with other selection processes permitted under the qualified housing provider's agreement with the department.

3. All qualified housing provider rentals or sales shall be on terms, conditions, and restrictions set forth in the agreement, which shall be at least as restrictive as the terms, conditions and restrictions applicable to developer rentals or sales under this chapter, and may be more restrictive.

4. All qualified housing provider agreements shall require detailed reports to the department, on no less than an annual basis, of the qualified housing provider's implementation of, and compliance with, the agreement. This report shall include an annual financial audit.

(Ord. No. 4177, § 10[12], 2014; Ord. 3418 § 1 (part), 2006)

APPENDIX P

September 14, 2009 Community Survey Results

W a i k a p u

A Country Town Master Plan

Land Owner Presentation

September 14, 2009

Community Survey

Waikapu Properties, LLC's Owner's Representative Michael Atherton presented ***Waikapu – A Country Town Master Plan*** to about 158 Waikapu and Maui residents at the Maui Tropical Plantation Restaurant on Tuesday, September 14, 2009, at 7:00 PM. Notification of the event occurred through a mail-out of 1,000 invitations to Waikapu residents and notification of Waikapu Community members attending a September 2, 2009, Waikapu Community Association Meeting. Of the 158 persons attending the presentation, 101 signed a sign-in sheet and received a Community Survey to complete at the end of the presentation. The purpose of the survey is to receive stakeholder input and gauge community attitudes towards the project. A total of 45 surveys were returned following the presentation, of which 43 were sufficiently complete to summarize the data.

Survey Results

1. The proposed site is an appropriate location for a new country town community. Please indicate by circling "**A"** for strongly agree through **"E"** for strongly disagree.

A	**B**	**C**	**D**	**E**
16	11	7	4	5
37%	26%	16%	9%	12%

Comments:
1. Great – can you get a great chef to open the restaurant again and make it a special destination spot for a unique dining experience?
2. Would be a nice expansion of Old Waikapu Town and yet maintain separation from other communities both north and south of the proposed new town.
3. If development must occur it seems that evolving Waikapu has great potential for success. However, I do not like the idea of developing so far up the valley or building condominiums just across the street from Old Waikapu.
4. We need to show the rest of the County what a Country Town can be.
5. Too bad the "Town Center" is separated from the Store by the highway. Please consider either an elevated walkway over the highway or a "people culvert" under the highway.
6. It is very centrally located and has great access from many directions.
7. Buffers separating communities are a great idea and goal. Protects against community blending.
8. Waikapu is very important to me and any future plans for development will naturally cause me anxiety and concern.
9. Great plan.
10. Please maintain as much true agricultural land as possible.
11. I still have concerns in regard to traffic from Wailuku and Maalaea.

12. It's hard to change. Growth is difficult to accept. I'm worried about the condos – how high are they going to go? Also, the valley is a sacred place that needs to be preserved.
13. What about Kuikahi between Honoapiilani Highway and Waiale as a connector?
14. Not enough detailed info
15. It will bring too much traffic. How affordable are the homes? How much of us makes $65,000 a year? Unless you're a nurse, policeman, own your own business and making money, has 10 families living with you to help meet your mortgage [sic].
16. First, the community park and recreation field should surround the public "community center." Second, the landscape buffer and dedicated agricultural lands should also surround the center as opposed to homes.
17. We don't need another 1,500 homes or 5,000 homes in the next 20 years. Where are we going to get the water from? We are already running out.
18. Why have to add more?
19. Leave Waikapu just the way it is!
20. Preserve the natural beauty of the existing open spaces. The view of the valley and hillside of Waikapu should not change. Seeing houses there is not the same.
21. Has possibilities.

2. I support the vision for the community as presented in the Master Plan? Please indicate by circling "**A"** for strongly agree through **"E"** for strongly disagree.

A	**B**	**C**	**D**	**E**
11	14	11	1	5
26%	33%	26%	2%	12%

Comments:
1. Even more extensive bike paths, both mauka and makai, 20 miles or more. Make this a destination cycling course.
2. Need integration of Old Waikapu and New Waikapu. Pathway over highway, sidewalks, etc.
3. I hope more developers will follow your lead.
4. Good project in great location
5. The vision seems to respect the inherent way of life here in Waikapu, wanting to embrace our community and nature-based values. However, maybe too much too fast?
6. Great idea for Waikapu. Don't give in to the Planning Department and what they think we should be.
7. Good balance, and specific use areas are well defined and contained.
8. Sounds plausible, but this information is too new to me.
9. You have outlined a nice project. If we <u>have</u> to accept new large development, your plan, if actually done as described, is a good one.
10. I'm still on the fence but appreciate the communication.
11. Waikapu has character (aside from the new housing). We need to keep that. But we shouldn't be overwhelmed by new ideas taking over the old ones.
12. Might work.
13. 99% Affordable homes!
14. Good elements, just wrong location.
15. Can you define what is urban, rural and country town?
16. Don't need more homes!
17. I strongly do not agree.
18. Project has too many homes for this community, even with the widening of Waiale and changes in infrastructure improvements. 1,200 homes calculates to another 2,500 automobiles, which is way too many. Even 400 homes means approximately 650 cars, way too many.

19. Neutral for now. We've been promised so many things and promises have been broken. Trust needs to be earned.

3. What are your feelings about the various elements of the plan? Please indicate by writing "**A**" for strongly like through "**E**" for strongly dislike.

Affordably Priced Housing (70%)					Main Street; Business Country Town Commercial					Rural Lots				
A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
27	5	2	2	6	16	6	10	4	6	16	7	8	4	5
64%	12%	5%	5%	14%	38%	14%	24%	10%	14%	40%	18%	20%	10%	13%

Community Town Center					River Park					Open space, hiking, and biking trails				
A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
25	5	6	1	6	20	10	5	0	5	28	7	3	0	4
58%	12%	14%	2%	14%	50%	25%	13%	0%	13%	67%	17%	7%	0%	10%

Protected Agricultural Lands					Public Facilities (Schools, Parks, Police and Fire stations, etc.)					Market Price Lots				
A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
31	2	2	3	4	21	11	5	2	3	11	6	10	6	5
74%	5%	5%	7%	10%	50%	26%	12%	5%	7%	29%	16%	26%	16%	13%

Comments:
1. Love it all!
2. We want a horse trail.
3. This is a lovely plan. Thank you for considering such a wonderful concept with your land. It would be a very unique opportunity to live in close proximity to this area, and some of the proposed features are exactly what we are looking for and unable to find in the islands. We love Waikapu and your project would add to this special place and give it identity and character that would benefit the whole community.
4. We want a horse trail. Thank you for the bike paths.
5. Good – may have proposed <u>too</u> many options or opportunities.
6. What kind of school will be built? Elementary? Middle School? High School?
7. Making this place accessible to more people is going to mean a rigorous effort from the Waikapu community to maintain its natural beauty, safety and easy-going way of life.
8. Where's the Church?
9. You have included many thoughtful and creative aspects into your project plan. If you build-out is completed and approved and the nice features actually come to be included, you will have a better development than is typical. No matter what you do, you will be creating a separate community rather than an extension of Waikapu Town.
10. At this time all that you are planning to accomplish seems to be a great opportunity for many.
11. I appreciate the idea of a commuity ag farm, parks are always great, and keeping the stream preserved is very important.
12. No condos and no time shares.
13. Please no condos in Waikapu. No time shares or rentals.
14. Why must you need to develop Waikapu?
15. I understand that you people are in this for business, and I just think that the project has too many homes for this area. I think your project has many good points, but please consider making it smaller.
16. How to guarantee in perpetuity? Where's the water now? Timeline? No gated communities!

4. Do you have specific concerns about the project presented tonight?

Comments:
1. Pedestrian safety. I like the bridge allowing Old Waikapu residents to cross over the stream to the marketplace and the main highway.
2. Keep your word!
3. Length of time before project starts. Ultimate cost of "affordable home." Will water be available to complete the project?
4. Traffic through to Wailuku and the safety of main street pedestrians to walk to general store.
5. Wastewater treatment substation.
6. Condos proposed to be placed across the street from Olioli, Lehuapueo streets – please give us a pretty view and buffer from such development! Increased crime rate, destruction of natural environment, water diversion, traffic increase and congestion.
7. You should show the police and fire station during presentation.
8. Traffic. One solution for speeding traffic through a subdivision is to have traffic circles at intersections.
9. Too many residential units on too small lots.
10. What are the phases and how long will it take to see the plan mature?
11. I hope the actual creation of this project will be as proposed tonight.
12. Will there be multiple builders, or just one development contractor?
13. Will this be a shotgun development, or a protracted project that spans many years? A protracted plan will seriously diminish the goals.
14. Wastewater treatment. Sewer system for the entire area? What about existing residences that are on cesspool or septic tank systems? Any plans for upgrading sanitation in these areas? Any traffic mitigation plans? Honoapiilani Hwy. will remain a busy thoroughfare. Too many speedsters right now!
15. Good plan. Great architect. Extraordinary!
16. I don't see a Church.
17. Effects of traffic on Waiko Road and Waiale Road. Transitioning of New Town into older side of Waikapu Town and developments. Stop lights on Waiale to regulate traffic with consideration to Waikapu Gardens population.
18. Any large development will have significant impacts on the adjacent community. We who are long-time residents of the Waikapu community enjoy a community we are happy with. The impacts we will experience as a result of this project will not necessarily be of much benefit to us personally. I would to alert you that no matter how well you execute your project, it will probably have, on balance, more negative effects on existing residents than positive ones.
19. Traffic and water.
20. Perpetuity of affordable housing. Question was conveniently sidestepped. Make housing available only to established residents to prevent price speculation.
21. Water. According to some people who have received information from those who monitor our water, the wells (Waikapu, Iao and Waihe'e) come from the same source underground.
22. All this is actually very new to me and I probably need to be more acquainted with everything that's about to happen in my community.
23. I worry about roads being expanded and that Waikapu loses its small town feel. I also worry about the properties being developed in the valley and overwhelming the mountain's valley.
24. Who will buy? Is the County going to change its tourism philosophy? We need budget and mid-priced hotels to get middle-income tourists.
25. Will you eventually sell off parcels of this property to other developers? What other developers have adjacent properties and what are their housing #s?
26. More traffic lights on Honoapiilani Highway. No condos or time shares.
27. Don't want to see condominiums or townhomes. Opportunities should be given to local residents only, to not provide outside influence. A lot of questions asked tonight were not answered directly.
28. What locals can afford lots for farm?

29. Traffic and water
30. This project is not necessary or wanted by the now existing Waikapu community. What will happen to the "country life" of Waikapu?
31. It all sounds nice, but where does it end? If you develop next to Wailuku, it will continue until the ocean, until you run out of land. Who and where are the Native beneficiaries. Ultimately the question of true title is there, and only land that had Royal patents has true land title.
32. Traffic congestion at peak hours and inadequate infrastructure in this area. As you have heard, we here in Waikapu have heard promises from past developers in this area, and how do we know that you will keep your promises?
33. Water. Promises. Keep it authentic.

5. Do you have specific suggestions to improve this project?

Comments:
1. Please try to have organic foods, local growers and non-processed foods; coffee tastings. Open up the Community Center for fundraising events.
2. A dog park!
3. Landscape buffers along the highway will really make a difference in creating a sense of this residential development. It looks like the plan has this. I want to encourage it to remain. I think residents are used to speeding along Hwy 30 and a strong visual barrier alerting drivers to the town will be helpful.
4. Love the trails, country store and walkability.
5. Try to get away from pesticides.
6. Talk out <u>all</u> the different alternatives with the community leaders and homeowners as early as possible.
7. Use local contractors and union members to build this project. Don't bring in construction workers from the mainland. Put our local families back to work.
8. Strong Waikapu committee, recycling and green waste center, community garden, priority housing for kama'aina, teachers, etc., art gallery, skate park.
9. Should have shown the connectability between Old & New neighbohoods, walkability, bikeability. Slow down main traffic through Waiale Road.
10. Among the Senior housing, a few group-type homes.
11. Keep Waikapu rural. Add a dog park.
12. A good, realistic, manageable time table.
13. Waiale Bypass should be a four-lane road.
14. Seems quite ambitious and carefully planned, but how much will come to fruition after going through regulatory channels?
15. Elderly housing.
16. Chris – get Elmer Cravalho to support this project. How about a Christian Church? Pastor Eddie Asato of Grace Bible Church is interested in having a Church with a pre-school.
17. Lessen the number of homes. It seems to be congested, traffic will be a problem.
18. I hope you consider a phased build-out. I would like to see a significant amount of affordable housing, not as currently done, but more in the theme of the old-style plantation style. That would truly benefit the community as a whole. I would prefer that the high-end housing does not dominate so that another exclusive, un-Waikapu-like, community unfriendly area isn't created.
19. Ensure perpetuity of affordable housing.
20. Appreciate the meetings and the information given, and the receptiveness of taking suggestions.
21. No condos!
22. I would like to be involved with the extension of Waiale Road, as it will have a direct impact on our subdivision.
23. 99% affordable housing! Using ag land for paintball-skate-BMX extreme park. Nothing for keiki to do between ages of 12-18 years old.
24. 1100-1350 homes brings 1100-1350 more traffic on Highway, 3100-3500 more people using water [sic]. Define for me what is Country Town, and what is the difference between urban and rural growth. Make homes available only to established residents and require live in resident to prevent

price speculation on homes.
25. Make it so that whoever buys has to live in it, not buy then resale for profits.
26. No project
27. Stop the project!
28. Development is not necessary, as war is not necessary for peace. Don't change it. Keep it the same. Waikapu is one of na wai eha and sacred in Hawaiian culture and history. New Waikapu will not be Old Waikapu. Give or sell the land to Department of Hawaiian Homelands. The Natives need more homes.
29. Please, if you can reduce the number of houses in this project. I do not condone any more growth in this area, but I know that you need to make a profit from this development, but you need to consider making this a smaller amount of your project.
30. Let us write our own history. We know it best.

Summary and Conclusions

Generally, the survey results suggest support for the project among a majority of Waikapu community members. Strongly negative comments were confined to six (6) individual survey respondents. Three (3) out of these six respondents expressed universal opposition to any development in Waikapu, answering E, "Strongly Disagree," or "Strongly Dislike," to each survey question.

In response to Question #1, "the proposed site is an appropriate location for a new country town community," 27 of 43 respondents (63%) answered either A, "Strongly Agree," or B, "Agree." Nine (9) of 43 respondents (21%) answered either D, "Disagree," or E, "Strongly Disagree."

In response to Question #2, "I support the vision for the community as presented in the Master Plan," 25 of 42 respondents (59%) answered either A, "Strongly Agree," or B, "Agree." Six (6) of 42 respondents (14%) answered either D, "Disagree," or E, "Strongly Disagree."

When asked their opinion of specific elements of the proposed Project Master Plan, respondents showed higher levels of support. Survey participants responding either A, "Strongly Like," or B, "Like," indicating a favorable view of various elements of the plan, were heavily in the majority for eight of the nine elements discussed, as follows.

Element	"Like" (A or B)	"Dislike" (D or E)
1. Open Space, Hiking and Biking Trails:	84%	10%
2. Protected Agricultural Lands:	79%	17%
3. Affordably Priced Housing:	76%	19%
4. Public Facilities (Schools, Parks, etc.):	76%	12%
5. River Park:	75%	13%
6. Community Town Center:	70%	16%
7. Rural Lots:	58%	23%
8. Main Street; Business Country Commercial:	52%	24%
9. Market Price Lots:	45%	29%

When asked to provide additional written comments and concerns, survey participants provided a wide range of answers. Recurring themes emerging from the survey results that may bear further consideration include the following, in order of prevalence:

- Traffic – Traffic was by far the most prevalent concern stated in the surveys. Fifteen (15) surveys included comments related to traffic, including concerns about incorporating features into the project to mitigate existing traffic on Honoapiilani Highway; concerns about mitigation for additional traffic generated by the project; and concerns about traffic impacts on pedestrian safety, given the pedestrian-oriented nature of the proposed project.

- Maintaining Separation and Uniqueness of Community – Seven (7) surveys included comments and concerns surrounding this theme, which fell into two categories. Three (3) surveys expressed support for maintaining physical separation of Waikapu Town from adjoining urban areas, and praise for elements such as landscape buffers, protection of agricultural land, and protection of open space. Four (4) surveys expressed concern regarding integration of the new Waikapu Country Town development with existing Waikapu Town and related impacts on preservation of Waikapu's unique country town character.

- Scale Back the Scope Of Development – Seven (7) surveys did not oppose the project, but expressed reservations about the proposed scope of development. Three (3) of the seven advocated reducing the number of homes proposed. Three (3) of the seven opposed the construction of condominiums. One (1) out of the seven opposed both the number of homes currently proposed and the construction of condominiums.

- Water – Five (5) individual survey respondents cited concerns regarding water availability and infrastructure.

- Keep Promises to Develop the Project as Represented – Five (5) surveys indicated support for the project as presented at the meeting, provided that, at build-out, the finished project shows reasonable follow-through on promises and representations being made at the current time.

- Maintaining Affordability of Homes in Perpetuity – Three (3) surveys expressed concern about ensuring that the affordable housing component of the project remains affordable to local residents in perpetuity.

- Wastewater – Three (3) surveys inquired about how treatment of wastewater generated by the project would be handled. One (1) of the three inquired whether existing homes and neighborhoods in Waikapu would be able to tie in to any new wastewater treatment infrastructure associated with the proposed project.

APPENDIX Q

EISPN Agency Comment and Response Letters

EISPN AGENCY COMMENT AND RESPONSE LETTERS

The EISPN was sent to agencies, organizations, and individuals as described in Chapter IX of the DEIS. The public comment period on the EISPN was from May 23, 2015 through June 22, 2015. The EISPN agency comment and response letters are included in Appendix L in the order listed below.

EISPN Agency Comment and Response Letters	Comment Date
1. State of Hawai'i, Department of Agriculture	June 22, 2015
2. State of Hawai 'i, Department of Accounting and General Services	May 28, 2015
3. State of Hawai'i, Department of Business. Economic Development and Tourism. Office of Planning	June 24, 2015
4. State of Hawai'i, Department of Defense	June 25, 2015
5. State of Hawai'i, Department of Education	June 5, 2015
6. State of Hawai'i, Office of Hawaiian Affairs	June 22, 2015
7. State of Hawai'i. Department of Health, Environmental Health Administration	June 19, 2015
8. State of Hawai'i. Department of Health, Safe Drinking Water Branch	June 1, 2015
9. State of Hawai'i. Department of Health, Clean Air Branch	June 3, 2015
10. State of Hawai'i. Department of Health, Clean Water Branch	June 9, 2015
11. State of Hawai'i. Department of Health, Maui District Office	June 23, 2015
12. State of Hawai'i. Department of Health, Wastewater Branch	June 25, 2015
13. State of Hawai'i, Department of Transportation	June 17, 2015
14. County of Maui, Department of Environmental Management	June 17, 2015
15. County of Maui, Department of Housing and Human Concerns	June 1, 2015
16. County of Maui, Department of Parks and Recreation	May 27, 2015
17. County of Maui, Department of Planning	June 9, 2015
18. County of Maui, Police Department	June 2, 2015
19. Department of the Interior, Fish and Wildlife Service	June 18, 2015
20. Department of Agriculture, National Resources Conservation Service	June 2, 2015

1. State of Hawai'i, Department of Agriculture

DAVID Y. IGE
Governor

SHAN S. TSUTSUI
Lt. Governor

SCOTT E. ENRIGHT
Chairperson, Board of Agriculture

PHYLLIS SHIMABUKURO-GEISER
Deputy to the Chairperson

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 South King Street
Honolulu, Hawaii 96814-2512
Phone: (808) 973-9600 FAX: (808) 973-9613

June 22, 2015

Mr. Michael Summers, President
Planning Consultants Hawaii, LLC
2331 W. Main Street
Wailuku, HI 96793

Dear Mr. Summers:

Subj: Environmental Impact Statement Preparation Notice (EISPN)
for Waikapu Country Town
Waikapu Properties
TMK: (2) 3-6-002:001; (2) 3-6-002:003; (2) 3-6-004:003;
(2) 3-6-004-006; (2) 3-6-005:007; (2) 3-6-006:036
Area: 1,576 acres

This is in response to your May 15, 2015 letter informing us of Waikapu Properties' (the Applicant) EISPN for Waikapu Country Town (Project), a master planned residential community in Central Maui.

Background:
The 1,576-acre project site is located on both sides of Honoapi'ilani Highway, two miles south of Wailuku. 1,562 acres is in the State Agricultural District and 14 acres in the Urban District. Of the lands in the State Agricultural District, approximately 92% (1,437 acres) are rated "A" or "B" with irrigation by the Land Study Bureau. Approximately 499 acres is planned for residential and commercial development in two phases, of which 485 acres is currently in the State Agricultural District. The Project includes a significant agricultural component, where approximately 1,077 acres is intended to remain in agriculture, with 800 acres to be dedicated in perpetuity by easement to agricultural use. Several hundred acres within the 800-acre agricultural easement is proposed to be developed as an agricultural park. The proposed agricultural park is intended to be "anchored" by "highly qualified farmers" who will grow crops ranging from fresh vegetables and fruits, taro, coconuts, coffee, sugarcane, bio-fuels and cattle.

The Applicant purchased the bulk of the Project property from the Wailuku Agribusiness Company from 2004-2006. Currently, the entire project site is used for sugarcane cultivation by Hawaiian Commercial & Sugar Company (HC&S) (1,230 acres), cattle grazing by Michael Atherton, and diversified agriculture including Kumu Farms (75 acres) and Hawaii Taro LLC (68 acres). The EISPN states that Kumu Farms and Hawaii Taro will relocate their operations to the proposed agricultural park and other lands within the Project area. HC&S may lose up to 405 acres from urbanization and the proposed agricultural park. The cattle herd will likely remain on the mauka agricultural lands even after urbanization occurs.

Surrounding uses of the Project site include agricultural lands to the south, owned by the Applicant and is leased by HC&S. To the west are agricultural lands that are in diversified agriculture and cattle grazing. To the east are agricultural lands owned by the County of Maui for a baseyard and regional park complex. The existing town of Waikapu abuts the northern boundary of the Project site.

We note that the Project appears to be consistent with the Maui Island Plan (MIP). Development of the Project will require: (1) State Land Use District Boundary Amendment from Agriculture to Urban and Rural for 485 acres; (2) Community Plan Amendment from Agriculture to Rural and Project District; and (3), Change In Zoning from Agricultural to Rural and Project District. A Community Plan Amendment is a trigger for an Environmental Impact Statement (EIS) under Chapter 343, Hawaii Revised Statutes (HRS).

Comments/Recommendations:

1. The EISPN states that 1,077 acres of land will remain in agriculture, with approximately 800 of those acres planned to be permanently dedicated to agricultural use through an agricultural easement. The EISPN states that the remaining 277 acres may be subdivided into as many as five large agricultural lots where farm dwellings may be permitted. The location of the easement area and the agricultural lands to be subdivided should be described in the EIS. The EIS should also include more information on the planned uses for the 1,077 acres that will remain in agriculture, including estimated irrigation demand, adequacy of supply, and the location and acreage of the agricultural park and how it will be managed.
2. Your cover letter mentions that the Applicant desires to establish "a limited amount of renewable energy production and other permissible uses on these lands." If photovoltaic systems (PV) are being considered on the project site, we would ask that they be located on lands not suited for agricultural cultivation.

3. The EISPN notes that land use conflicts, such as the impact of dust, noise, and smoke from cane burning, can be a problem if not carefully managed (Agricultural Impact Assessment, p. 70). The Department of Agriculture would appreciate a plan be developed in the EIS in order to notify all prospective residential and commercial owners/lessees from the Project that farming operations and practices that may include potential nuisances from noise, odors, vectors, dust, fumes, spray, smoke, or vibration on adjacent or contiguous land in the State Agricultural District are protected under HRS Chapter 165, the Hawaii Right-to-Farm Law.

Thank you for the opportunity to provide our comments. Should you have any questions, please contact Earl Yamamoto at 973-9466 or by email at earl.j.yamamoto@hawaii.gov.

Sincerely,

Phyllis Shimabukuro-Geiger

for Scott E. Enright, Chairperson
Board of Agriculture

c: Maui County Planning Department
Office of Planning

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. Scott E. Enright
Chairperson
Board of Agriculture
State of Hawaii
Department of Agriculture
1428 South King Street
Honolulu, Hawaii 96814-2512

Dear Mr. Enright:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 22, 2015 letter providing comments in response to the above-referenced project. In response to your comments, please find the following response:

- ***Agricultural Land Dedication.*** As described in the EISPN, and as further elaborated upon in the DEIS, the Project's agricultural component will include approximately 800 acres that will be dedicated in perpetuity to agricultural production and approximately 277 acres that will have subdivision potential for up to five agricultural lots. The DEIS identifies the lands to be dedicated and thoroughly describes the Project's agricultural component. As noted in the DEIS, the Applicant's agricultural lands are currently being farmed by well-established agricultural enterprises and it is expected that these operations will serve as anchor tenants for the agricultural preserve.

  The future demand for irrigation water by future diversified agricultural operations will be served by a combination of non-potable

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

well water and available ditch water. Through the use of agricultural reservoirs, the Applicant is confident that future agricultural operations will have a reliable source of competitively priced irrigation water to support their farming activities.

- ***Renewable Energy Generation***. The Applicant desires to incorporate a relatively small solar farm within the agricultural lands to generate additional revenues while off-setting the Project's demand for carbon based fossil fuels. Should such systems be economically and technologically feasible, the Applicant will seek to minimize the impact that these systems might have upon agricultural resources and ongoing agricultural endeavors.
- ***Agricultural Nuisance Impacts***. As described in the EISPN and DEIS, agricultural operations can produce nuisance impacts to neighboring residential communities. The Applicant is committed to identifying appropriate counter measures to reduce potential impacts to future homeowners while providing assurances to farmers that their operations will be protected from such complaints.

Some measures that can help to minimize these conflicts include:

- Advising prospective homeowners in advance of purchasing property that neighboring lands are in agricultural use, that nuisance impacts may occur, and that agricultural uses are protected under HRS Chapter 165, the Hawaii Right-to-Farm Law.
- Establishing appropriate buffers between actively used agricultural lands and homes.
- Planting windbreaks planting within the buffer areas to further mitigate agricultural impacts to homeowners.
- Locating residential communities upwind of agricultural operations.
- Where feasible, locating the least noxious agricultural activities in closer proximity to urban uses while locating the more noxious activities further away.
- Requiring farmers to implement agricultural best management practices to reduce the potential for overspray from the use of pesticides and to implement erosion control measures to reduce

dust and agricultural runoff from impacting neighboring properties.

The Applicant appreciates your interest in the project and we look forward to working with your Department through the development review and land use entitlement process. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

2. State of Hawai'i, Department of Accounting and General Services

DAVID Y. IGE
GOVERNOR

DOUGLAS MURDOCK
Comptroller

AUDREY HIDANO
Deputy Comptroller

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

MAY 28 2015

(P)1128.5

Mr. Michael J. Summers, President
Planning Consultants Hawaii, LLC
2331W. Main Street
Wailuku, Hawaii 96793

Dear Mr. Summers:

Subject: Environmental Impact Statement Preparation Notice
Waikapu Country Town, Wailuku, Maui
TMK: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003
(2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036

Thank you for the opportunity to provide comments for the subject project. The subject project does not affect any of the Department of Accounting and General Services' existing facilities and we have no comments to offer at this time.

If you have any qnestions, your staff may call Ms. Gayle Takasaki of the Planning Branch at (808) 586-0584.

Sincerely,

JAMES K. KURATA
Public Works Administrator

GT:lnn

PLANNING CONSULTANTS HAWAII, LLC

URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. James K. Kurata
Public Works Administrator
State Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawaii 96810-0119

Dear Mr. Kurata:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your May 28, 2015 letter, which states that the Project will not affect any of the Department's facilities and that you have no comments at this tinue.

Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

3. State of Hawai'i, Department of Business Economic Development and Tourism. Office of Planning

OFFICE OF PLANNING
STATE OF HAWAII

DAVID Y. IGE
GOVERNOR

LEO R. ASUNCION
ACTING DIRECTOR
OFFICE OF PLANNING

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: http://planning.hawaii.gov/

Ref. No. P-14789

June 24, 2015

Mr. Michael J. Summers, President
Planning Consultants Hawaii LLC
2331 W. Main Street
Wailuku, Hawaii 96793

2015 JUN 25 P 1:01
LAND USE COMMISSION
STATE OF HAWAII

Dear Mr. Summers:

Subject: Chapter 343, HRS Environmental Impact Statement Preparation Notice
LUC Docket No. A15-798
Waikapu Country Town
TMK: (2) 3-6-004: Portion of 003; (2) 3-6-005: Portion of 7; (2) 3-6-002: Portion of 3; (2) 3-6-004:006; and (2) 3-6-005:007
Wailuku, Maui, Hawaii

Thank you for the opportunity to review the subject Environmental Impact Statement Preparation Notice (EISPN) for Waikapu Country Town. The proposed project encompasses 1,576 acres, of which approximately 485 acres would be reclassified from the State Agricultural District to the State Urban District and State Rural District. Approximately 1,077 acres of the Petition Area would remain in the State Agricultural District, of which approximately 800 acres would be permanently protected by the Petitioner through a conservation easement or similar mechanism. The remaining 14 acres of the Petition Area are already classified in the State Land Use Urban District and are utilized by the Maui Tropical Plantation. The Urban and Rural components of the project will include 1,433 residential units, 146 Ohana units, neighborhood retail, commercial, a school, parks, and open space.

The Office of Planning (OP) offers the following comments.

1. The majority of the Petition Area lies within the State Agricultural District. The proposal will require that the subject property be reclassified to the State Urban District and State Rural District through the Land Use Commission (LUC). OP represents the State as a mandatory party in proceedings before the LUC. In developing its position, OP evaluates whether the project meets the LUC decision-making criteria in HRS § 205-17, as well as its conformance with Coastal Zone Management objectives and policies in HRS § 205-A-2.

Attached for your consideration is a document entitled "Issues of Concern in District Boundary Amendment Proceedings Based on LUC Decision-Making Criteria." The Draft Environmental Impact Statement (DEIS) should address these issues and criteria – particularly the areas of State concern in this document and best practices that could or will be incorporated in the proposed project to address State priority guidelines for sustainability. A short list of resources related to best practices can be found at the OP website at http://hawaii.gov/dbedt/op/land_use.htm.

We also strongly recommend that petitioners consult with affected State agencies early in the project formulation process; and that they continue to do so in the preparation of any environmental compliance documents required under HRS Chapter 343, so that potential impacts to resources, facilities, and services managed or provided by the State and appropriate mitigation measures are identified in petitions and their environmental compliance documents.

2. We understand that several significant studies, including the Archaeological Inventory Survey, the Cultural Impact Assessment, the Traffic Impact Analysis Report (TIAR), the Preliminary Drainage Report, and the Preliminary Engineering Report (for water and wastewater), are still being prepared for this project and thus OP is unable to comment on them at this time. These studies, or the results of these studies, should be included in the DEIS.

3. The proposed project would result in the urbanization of approximately 485 acres of land rated "Prime" by the Agricultural Lands of Importance to the State of Hawaii (ALISH) rating system. We recognize, however, the Petitioner's efforts to mitigate this loss by including approximately 1,100 acres of mostly "Prime" agricultural land within the Petition Area, of which 800 acres would be permanently protected through a conservation easement. The DEIS should identify the accepting agency or organization of the conservation easement and discuss how the conservation easement is to be implemented and managed.

4. We understand the DEIS will include a more thorough analysis of the impact of the proposed project on area schools. This discussion should include the following:
    a. Projected population increase for the Wailuku-Kahului region
    b. Whether the Petitioner will be required to establish an Education Contribution Agreement with the State Department of Education
    c. How the Petitioner intends to coordinate with the Waiale project for the development of the elementary or intermediate school as indicated in the EISPN.

5. The EISPN indicates that the proposed project will be implemented in two five year phases through 2026. In the DEIS, please provide a schedule of development for each phase of the total project and a map showing the location and timing of each phase of development. Regarding infrastructure (e.g., highway improvements), the Petitioner should discuss how improvements will be completed to ensure that mitigation coincides with the impact created by the proposed project.

6. In the DEIS, please include a map of existing uses within the Petition Area as well as on adjacent properties.

7. Several of the maps and figures in the EISPN were difficult to read and should be revised as follows:
    a. All maps should be consistently formatted to include a north arrow, scale, and legend.
    b. The resolution and clarity of some of the maps is poor and should be improved, specifically the Community Plan Map on page 52, the Petition Area Soils map on page 58, and the Character and Context map on page 74.
    c. The Petition Area boundaries on several of the maps are unclear or missing and should be made more prominent, specifically the Maui Island Plan Directed Growth map on page 30, the Wailuku-Kahului Planned Growth Areas map on page 31, and the Community Plan Map on page 52.

8. Chapter 3, Section A, of the EISPN states that the Project will require amendments to the conditions placed upon the 14 acres of currently urbanized lands (p. 98). Please clarify in the DEIS the permit approval being referred to, which conditions will require amendments, and how the conditions will be amended.

9. OP provides technical assistance to state and county agencies in administering the statewide planning system in Hawaii Revised Statutes (HRS) Chapter 226, the Hawaii State Plan. The Hawaii State Plan provides goals, objectives, priorities, and priority guidelines for growth, development, and the allocation of resources throughout the State. The Hawaii State Plan includes diverse policies and objectives of state interest including but not limited to the economy, agriculture, the visitor industry, federal expenditure, the physical environment, facility systems, socio-cultural advancement, climate change adaptation, and sustainability.

    We acknowledge that the EISPN document has identified the need to address the Hawaii State Plan. The Draft EIS should include an analysis that addresses whether the proposed project conforms or is in conflict with the objectives, policies, and priority guidelines listed in the Hawaii State Plan.

10. The coastal zone management area is defined as "all lands of the State and the area extending seaward from the shoreline to the limit of the State's police power and management authority, including the U.S. territorial sea" see HRS § 205A-1 (definition of "coastal zone management area").

    We acknowledge that the EISPN document has identified the need to address the enforceable policies of the Hawaii Coastal Zone Management Program. HRS Chapter 205A requires all State and county agencies to enforce the coastal zone management (CZM) objectives and policies. The Draft EIS should include an assessment as to how the proposed project conforms to the CZM objectives and its supporting policies set forth in HRS § 205A-2. The assessment on compliance with HRS Chapter 205A is an important component for satisfying the requirements of HRS Chapter 343. These objectives and policies include: recreational resources, historic resources, scenic and open space resources, coastal ecosystems, economic uses, coastal hazards, managing development, public participation, beach protection, and marine resources.

11. According to the EISPN, pg. 96, the Draft EIS will contain a Drainage Report that will analyze drainage patterns, existing development, runoff totals, and analyze anticipated changes to stormwater runoff. Additionally, according to the review material, this project will need a National Pollutant Discharge Elimination System permit for construction activity to safeguard against erosion and sediment loss. In order to ensure the coastal waters of Kahului Bay and the nearshore waters of West Maui remain protected, the negative effects of both natural processes such as stormwater runoff and a wide range of human activities should be considered and mitigated. The Draft EIS should summarize the area's classification in the State Land Use Districts, its relation to wetlands and perennial streams, the tsunami evacuation zone, and flood zone. These items, as well as the nearshore water quality classification, should be considered when developing mitigation measures to protect the coastal ecosystem.

    OP has a number of resources available to assist in the development of projects which ensure sediment and stormwater control on land, thus protecting the nearshore environment. OP recommends consulting these guidance documents and stormwater evaluative tools when developing strategies to address polluted runoff. They offer useful techniques to keep soil and sediment in place and prevent contaminating nearshore waters, while considering the practices best suited for each project. These three evaluative tools that should be used during the design process include:

    - Hawaii Watershed Guidance provides direction on site-appropriate methods to safeguard Hawaii's watersheds and implement watershed plans http://files.hawaii.gov/dbedt/op/czm/initiative/nonpoint/HI Watershed Guidance Final.pdf

- Stormwater Impact Assessments can be used to identify and evaluate information on hydrology, stressors, sensitivity of aquatic and riparian resources, and management measures to control runoff, as well as consider secondary and cumulative impacts to the area http://files.hawaii.gov/dbedt/op/czm/initiative/stormwater_imapct/final_stormwater_impact_assessments_guidance.pdf

- Low Impact Development (LID), A Practitioners Guide covers a range of structural best management practices (BMP's) for stormwater control management, roadway development, and urban layout that minimizes negative environmental impacts http://files.hawaii.gov/dbedt/op/czm/initiative/lid/lid_guide_2006.pdf

The responsiveness of the project and proposed petition to concerns identified in the environmental review process will strongly influence OP's evaluation and development of the State's position on the proposed petition to ensure conformance with Chapter 205, HRS.

Thank you for the opportunity to review this project. If you have any questions please call either Katie Mineo of our Land Use Division at (808) 587-2883 or Josh Hekekia of our Coastal Zone Management Program at 587-2845.

Sincerely,

Leo R. Asuncion
Acting Director

c: Land Use Commission

Enclosure

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. Leo R. Asuncion
Acting Director
State of Hawaii
Office of Planning
P.O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Asuncion:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 24, 2015 letter providing comments in response to the above-referenced project. In response to your comments, please find the following response:

- ***"Issues of Concern in District Boundary Amendment Proceedings Based on LUC Decision-Making Criteria"***. The Applicant is aware of and acknowledges the areas of State concern identified in the above-referenced document. Moreover, the Applicant has and will continue to coordinate with State agencies through the development review and land use entitlement processes.

- *Supporting Technical Studies.* The DEIS includes numerous specialized technical studies to help document project impacts and appropriate mitigation measures. These studies include the following:
  - Archaeological Inventory Survey;
  - Cultural Impact Assessment;

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

- Waikapu History Report;
- Preliminary Engineering and Drainage Report;
- Traffic Impact Analysis Report;
- Air Quality Study;
- Noise Assessment Report;
- Agricultural Impact Assessment;
- Botanical and Faunal Surveys, and
- Market, Economic and Fiscal Impact Assessment.

- ***Agricultural Conservation Easement.*** As documented in the EISPN, and further described in the DEIS, the Project's agricultural component includes approximately 1077 acres of which about 800 acres will be permanently protected through an agricultural conservation easement. The remaining 277 acres will remain within the State Agricultural District. The conservation easement will limit the 800 acre reserve to only those uses permitted within the State Land Use Agricultural District and the County Agricultural District; however; the easement will prohibit farm and/or residential dwellings from being constructed and will only allow agricultural subdivisions to serve agricultural enterprises. The specific details of the conservation easement are still being considered.

  The Applicant intends to maintain ownership of the agricultural preserve. However, it is possible that in the future the Applicant may decide to deed a portion and or all of the reserve to the State and or County for the purpose of establishing an Agricultural Park. Long-term ownership and management options are still being considered.

  The DEIS includes a description of the Project's agricultural components and the Applicant's long-term vision for these lands.

- ***Schools.*** The Applicant has been consulting with the Department of Education's Facilities Development Branch regarding the

appropriate location, size and type of school facility to be incorporated into the Project site. The Applicant is also aware that the Project will be subject to a school facility impact fee to help address construction costs. The DEIS documents the projected population increase for the area, the population impact to the immediate area caused by the Project, and the expected student population created by the Project.

- ***HRS Chapter 205A***. The DEIS addresses the Project's consistency with the objectives and policies of the Special Management Area.

- ***NPDES Permit Requirements and Drainage and Erosion Control Measures***. The Applicant is aware that an NPDES permit will be required prior to grading of the subject property. The DEIS describes construction and operation phase drainage and erosion control BMPs that will be implemented to mitigate potential downstream impacts to nearshore ecosystems and coastal waters. The Applicant appreciates receiving the links to the Hawaii Watershed Guidance, Stormwater Impact Assessments, and Low Impact Development Techniques websites. These links have also been forwarded to the Project's Landscape Architect and Civil Engineer.

Thank you very much for your interest in the Project, while we look forward to working with your office through the development review and land use entitlement processes. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

Issues of Concern in District Boundary Amendment Proceedings Based on LUC Decision-Making Criteria

The following issues are commonly discussed and analyzed for project proposals in petitions and their supporting environmental assessments (EAs) or environmental impact statements (EISs) prepared pursuant to Hawaii Revised Statutes (HRS) Chapter 343. This list reflects the range of issues the State Land Use Commission (LUC) must take into consideration in its decision-making under HRS Chapter 205, and Hawaii Administrative Rules (HAR) Chapter 15-15. This list is not exhaustive or complete.

1. **Water Resources.** Groundwater and surface water resource protection and water quality are critical State issues. A thorough evaluation of these resources includes identifying and discussing: (a) estimated water demand by types of land use; (b) proposed potable and non-potable water sources to be used for the project and measures to reduce water demand and promote water reuse in the project; (c) whether the proposed project is within a designated Water Management Area; (d) the impact of the project on the sustainable yield and water quality of affected aquifers and surface water sources; (e) permits or other approvals required for proposed water source use; and (f) the consistency of the project and impact of the project in terms of proposed water use and system improvements and priorities contained in the county water use and development plan, prepared pursuant to the State Water Code, HRS Chapter 174C.

2. **Agricultural Lands.** Article XI, Section 3, of the Hawaii State Constitution provides that "[t]he State shall conserve and protect agricultural lands, promote diversified agriculture, increase agricultural self-sufficiency, and assure the availability of agriculturally suitable lands." Protecting agriculture is a policy objective in the Hawaii State Plan, HRS Chapter 226, and in the State Administration's New Day Comprehensive Plan, which is available at http://hawaii.gov/gov/about/a-new-day. Agricultural activity in the vicinity of the proposed project should be identified, and the impact of urban use or conversion of project lands on existing and future agricultural use and the viability of agricultural use of adjoining agricultural lands needs to be examined. Please discuss how the proposed project meets policy objectives to promote and protect agriculture, particularly in cases where the lands have high agricultural value.

3. **Affordable Housing.** Increasing the supply of affordable housing is a critical State and county issue. Every county has an affordable housing policy and both the Hawaii State Plan, HRS Chapter 226, and the State Administration's New Day Comprehensive Plan identify affordable housing as a policy priority. If applicable, please discuss specifically how the proposed project will meet State and county affordable housing policy objectives, to include a discussion of how the project's proposed residential product types will be allocated among the market and various affordable housing target populations, and the expected price ranges for the different product types.

4. **Coastal Zone Management (CZM).** The Office of Planning is the lead agency for the Hawaii CZM Program, which is a Federal-State partnership for protecting, restoring, and responsibly developing coastal communities and resources. The coastal zone is defined as all lands of the State and the area extending seaward from the shoreline to the limit of the State's police power and management authority, including the United States territorial sea (HRS § 205A-1). EA/EISs should reference this definition of the coastal zone. State agency actions must be consistent with the CZM program objectives and policies under HRS § 205A-2. The EA/EIS needs to discuss the project in terms of its consistency with the following CZM objective areas.

    a. **Coastal and Ocean Resources.** The State has an interest in protecting coastal and marine ecosystems and resources, as well as coastal and marine water quality. The EA/EIS should identify any coastal and marine resources and ecosystems that may be impacted by the proposed project, and the potential for nonpoint sources of pollution from the project to adversely affect coastal and marine water quality. Project impacts on existing site and offsite hydrology and measures to manage stormwater and runoff need to be discussed. The Office of Planning recommends the use of low impact development (LID) techniques and other best

management practices (BMPs) that promote onsite infiltration and minimize runoff from storm events. More information on LID and stormwater BMPs can be found at http://hawaii.gov/dbedt/czm/initiative/lid.php.

b. **Coastal and Other Hazards.** The EA/EIS should describe any hazard risks that are relevant to the site and describe the measures that are proposed to mitigate any hazard impacts, such as from tsunami, hurricane, wind, storm wave, sea level rise, flood, erosion, volcanic activity, earthquake, landslide, subsidence, and point and nonpoint source pollution. This should include a discussion of any wildfire hazard and any mitigation measures that might be required to address potential threats from wildfires.

   The EA/EIS process also provides an opportunity to address the sustainability of proposed projects in terms of natural hazards and hazard mitigation, and the potential impact of climate change on the proposed project over time. To this end, OP recommends the final EA/EIS include a discussion of the proposed project with respect to the *State Multi-Hazard Mitigation Plan, 2010 Update*, adopted in September 2010, available at http://www.scd.hawaii.gov/documents/HawaiiMultiHazardMitigationPlan2010PUBLIC.pdf, as well as the respective County Hazard Mitigation Plan.

c. **Coastal-dependent Uses and Beach Protection**. If the project is located on or near the coast, the EA/EIS should discuss why the proposed development needs to be located on the coast, the economic uses that will be of benefit to the State, as well as potential impacts on beach access. The discussion should identify measures to protect beach systems and ensure short- and long-term public access to beaches.

d. **Coastal Recreational Resources.** If the project is located on the coast, the EA/EIS should include a description of recreational uses and facilities on or near the project site, and discuss how the impact of increasing users on coastal and ocean recreational resources and competing uses will be mitigated and managed during project development and buildout.

e. **Scenic Resources.** The EA/EIS should discuss the impact of the proposed project on scenic views to and from the coast and along the coast and coastal open space, and how any impacts on these scenic and open space resources will be avoided, minimized, or mitigated.

f. **Special Management Area (SMA) Permitting.** The SMA is defined by the counties and includes areas in the coastal zone that are particularly sensitive so that it requires special attention. Please identify whether the proposed project is within the SMA and how SMA permitting requirements pursuant to HRS Chapter 205A, will be satisfied.

For additional resources and information, visit http://hawaii.gov/dbedt/czm.

5. **Cultural, Archaeological, and Historic Resources.** Another CZM objective is to protect, preserve, and where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone that are significant in Hawaiian and American history and culture. If archaeological or historic properties or artifacts, including native Hawaiian burials, are identified in an archaeological inventory survey on the property, the EA/EIS should discuss how the petitioner has consulted with the State Historic Preservation Division (SHPD), what plans will be prepared to monitor or protect identified resources, and how the petitioner intends to comply with HRS Chapter 6E, related to historic preservation, and the CZM objective and policies for historic resources contained in HRS §§ 205A-2(b) and (c). SHPD has information and guidance available at http://hawaii.gov/dlnr/hpd/hpgrtg.htm.

   The EA/EIS document should identify any cultural resources and cultural practices associated with the property, including visual landmarks, if applicable, and discuss the impact of the proposed project on identified cultural resources and practices as well as proposed mitigation measures. The LUC is obligated under Article XII, Section 7 of the Hawaii State Constitution to protect the

reasonable exercise of customarily and traditionally exercised native Hawaiian rights. Thus, the LUC requires information as to the presence of cultural resources and cultural practices associated with the project site and vicinity for decision-making on petitions. The State Office of Environmental Quality Control (OEQC) provides guidance for preparing a cultural assessment at http://oeqc.doh.hawaii.gov, at "Environmental_Assessment_PrepKit." (http://oeqc.doh.hawaii.gov/Shared%20Documents/Preparation_of_Hawaii_Environmental_Policy_Act_Documents/Guidance_on_Cultural_Impact/1997%20Cultural%20Impacts%20Guidance.pdf)

6. **Biota.** The EA/EIS should include an inventory and assessment of flora and fauna, including invertebrates, found on or in proximity to the project site and in any lava tubes and caves on the property that are listed on the federal or State list of endangered or threatened species. Please also discuss species of concern and candidates for listing. The petitioner should consult with the Database Manager at the Hawaii Biodiversity and Mapping Program, Center for Conservation Research and Training, University of Hawaii, (808) 956-8094, as to the potential for the presence of rare species in the project area. The EA/EIS should discuss measures to be taken to protect rare, threatened, or endangered species or ecosystems of concern as required by law. The design of the biological survey should consider both wet and dry season observations to capture the fullest range of flora and fauna.

7. **Wastewater Treatment and Disposal.** The EA/EIS needs to identify the anticipated volume of wastewater to be generated by type of user, as well as the proposed means of wastewater treatment and disposal. A discussion of the availability of county wastewater collection and treatment capacity and its existing service levels, design capacity, and allocated capacity is also needed. The EA/EIS should also identify whether any facility improvements would be required to accommodate additional wastewater generated within the service area, including the proposed project. If a private wastewater treatment system is identified as the preferred option, the EA/EIS should discuss the type of plant to be used, permitting requirements, plans for reuse and/or disposal of treated effluent and waste solids, and how the private system will be operated and maintained.

8. **Energy Use and Impacts**. The State Hawai'i Clean Energy Initiative has adopted a goal of using efficiency and renewable energy resources to meet 70 percent of Hawaii's energy demand by 2030, with 30 percent from efficiency measures and 40 percent from locally-generated renewable sources. The EA/EIS should quantify the projected energy requirements of the project and discuss measures to be taken to reduce energy demand, promote energy efficiency, and to promote use of alternative, renewable energy sources. Please discuss how energy efficiency and energy demand reduction, including reduced transportation energy use will be incorporated in the design of the project and identify the kinds of green building and sustainable design practices that could be used to promote energy and resource conservation in the proposed project. Please also identify any generating or transmission capacity constraints that may arise as a result of the proposed project and other projects planned for the region.

9. **Impact on State Facilities and Resources.** The EA/EIS should quantify the impacts of the proposed project on State-funded facilities, including schools, highways, harbors, and airports, and discuss these impacts in terms of existing and planned capacity of the impacted facilities. The EA/EIS should cite the mitigation measures proposed to be used in the development of the project and describe efforts to address identified State agency concerns. Regarding transportation impacts, consider project design options that limit the need to drive, including mixed land uses, compact site design, walkable neighborhoods, and providing a variety of transportation choices (e.g., biking, public transit, etc.).

10. **Conservation District.** If the proposed project is within the State Conservation District, the EA/EIS should provide an inventory of conservation resources, and discuss how the loss of these resources (habitat, watershed area, etc.) will impact the public.

11. **Conformance with County Plan Designations and Urban Growth or Rural Community Boundaries.** Act 26, Session Laws of Hawaii (SLH) 2008, reaffirmed the Land Use Commission's duty to consider any proposed reclassification with respect to the counties' adopted general, community, or development plans. If the proposed project is not consistent with the county plans or lies outside a county urban growth or rural community boundary, the EA/EIS should provide an analysis and discussion of the following:

    a. **Alternative Sites Considered.** Describe and discuss alternative sites that were considered for the project, and discuss why the project could not be accommodated on lands within the urban growth or rural community boundary, if the county plan delineates such boundaries, or on land already designated by the county for similar uses.

    b. **Impact on Surrounding Lands.** Discuss what the impacts of changing the county plan designation or extending the urban growth or rural community boundary would have on the surrounding lands.

    c. **Significant Public Benefit.** Discuss what, if any, public benefits are provided by the proposed project above that already required under existing approval and permitting requirements.

    d. **Plan Amendment.** Provide a timeframe for application for and approval of any required plan amendment.

12. **Environmental Health Hazards.** The EA/EIS should discuss the potential for the project or project users to generate hazardous materials or release possible contaminants to the air, soil, or water, as well as measures to be taken to ensure that environmental and public health and safety will be protected during construction and after buildout. The EA/EIS should also identify and discuss any potential health and environmental threats that may be present due to site-specific contamination from past or current use. If contaminants of concern are identified for the project site, OP recommends that the petitioner consult with the State Department of Health's Hazard Evaluation and Emergency Response Office as to measures to be taken to address possible or actual contamination at the site.

13. **Solid Waste Management.** The EA/EIS should quantify the volume of solid waste likely to be generated by the project by types of users, and describe the impact the project will have on the county's existing and planned capacity for managing solid waste as represented in the county's solid waste management plan. The EA/EIS should discuss specific mitigation measures to be taken to reduce solid waste generation and ensure that recycling and reuse are incorporated within the project area by residential, commercial, and institutional users.

14. **Sustainability Analysis.** OP is implementing the sustainability elements of the State Administration's New Day Comprehensive Plan and Act 181, SLH 2011 (the new sustainability priority guideline of the Hawai'i State Planning Act) by requesting petitioners to prepare sustainability plans for their projects in district boundary amendment proceedings before the LUC. LUC Dockets A06-771, DR Horton-Schuler Homes (Hoopili) and A11-793, Castle & Cooke Homes (Koa Ridge Makai/Castle & Cooke Waiawa) provide a good point of reference for sustainability plans. The Koa Ridge Sustainability Plan and Hoopili Sustainability Plan can be found on the LUC's web site under each respective docket's exhibits.

    To address the principles and priority guidelines for sustainability, OP recommends that a sustainability plan or relevant elements thereof be incorporated as part of program and plan development. The sustainability plan should be included as part of the applicant's submission for development review and approval, including environmental assessments or in petitions for district boundary amendment to the State Land Use Commission submitted pursuant to HRS Chapter 205. See Technical Assistance Memorandum 2013-1 in Planner's Toolbox available online at http://planning.hawaii.gov.

The sustainability plan should address the following areas:

a. **Sustainable Development** - the development's contribution to creating a high quality of life and mutual supportive role among environmental, economic, and social equity concerns, as enumerated in HRS §226-108.

b. **Smart Growth and Livability Principles** - the principles that promote safety and options with transportation choices, the promotion of energy-efficient, equitable and affordable housing choices, the enhancement of economic competitiveness and support to the existing communities.

c. **Resource Conservation** – incorporation of energy and water efficiencies, including the implementation of solid or liquid waste management through methods of recycle and reuse, low impact development with respect to site design considerations and structural best management practices to increase on-site infiltration and reduce off-site flows and pollution from stormwater runoff, and climate change and hazard mitigation and adaptation strategies.

d. **Green Building Standards** - the planned use of green building and sustainable design practices.

15. **Development Timetable.** The LUC requires that projects seeking reclassification be substantially completed within ten years or seek incremental approvals, pursuant to HAR § 15-15-50. The EA/EIS and/or petitioner should provide a schedule of development for each phase of the total project and a map showing the location and timing of each phase or increment of development. Regarding infrastructure (e.g., highway improvements), the petitioner should discuss how improvements will be completed to ensure that mitigation coincides with the impact created by the proposed project.

4. State of Hawai'i, Department of Defense

DAVID Y. IGE
GOVERNOR

ARTHUR J. LOGAN
BRIGADIER GENERAL
ADJUTANT GENERAL

KENNETH S. HARA
COLONEL
DEPUTY ADJUTANT GENERAL

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

June 25, 2015

Mr. Michael Summers, President
Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Hawaii 96793

Attn: Mr. Summers

Subject: Environmental Impact Statement Preparation Notice for Waikapu County Town, Wailuku, Maui, Hawaii, TMK: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007, and (2) 3-6-006:036

Dear Mr. Summers,

Thank you for the opportunity to comment on the above project.

The State of Hawaii Department of Defense recommends the provision of three (e) Omni-directional 121-db(c) solar-powered sirens mounted on 45-foot H2 rated composite poles. The Hawaii Emergency Management Agency will work with Waikapu Properties, LLC on the location of these sirens.

If you have any questions or concerns, please have your staff contact Mr. Lloyd Maki, Assistant Chief Engineering Officer at (808) 733-4250.

Sincerely,

ARTHUR J. LOGAN
Brigadier General
Hawaii National Guard
Adjutant General

c: Ms. Havinne Okamura, Hawaii Emergency Management Agency

PLANNING CONSULTANTS HAWAII, LLC

URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. Arthur J. Logan
Brigadier General, State of Hawaii
Department of Defense
Office of the Adjunct General
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495

Dear Mr. Logan:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 25, 2015 letter, which states that you recommend that three (e) Omnidirectional 121-db(c) solar-powered sirens be mounted on 45-foot H2 rated composite poles within the subject property. The Applicant will contact the Hawaii Emergency Management Agency to coordinate on the location of these sires.

Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

5. State of Hawai'i, Department of Education

DAVID Y. IGE
GOVERNOR

KATHRYN S. MATAYOSHI
SUPERINTENDENT

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI'I 96804

OFFICE OF SCHOOL FACILITIES AND SUPPORT SERVICES

June 5, 2015

Mr. Michael J. Summers
Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Hawaii 96793

Re: Environmental Impact Statement Preparation Notice for Waikapu Country Town, Wailuku, Maui TMK Numbers: (2)3-6-002:001, (2)3-6-002:003, (2)3-6-004:003, (2)3-6-004:006, (2)3-6-005:007 and (2)3-6-006:036

Dear Mr. Summers:

The Department of Education (D0E) has reviewed the Environmental Impact Statement Preparation Notice for Waikapu Country Town.

The proposed project is located within the Central Maui School Impact District, which was adopted by the Board of Education on November 18, 2010, pursuant to Chapter 302A-1604, Hawaii Revised Statutes. The Waikapu County Town project will be required to pay school impact fees. Although there have been preliminary conversations about siting a public school site within the proposed project, Waikapu Properties, LLC is strongly encouraged to meet with the DOE, Facilities Development Branch to negotiate and execute an Educational Contribution Agreement before county entitlements are sought.

Thank you for the opportunity to comment. If you have any questions, please call Roy Ikeda of the Facilities Development Branch at (808) 377-8301.

Respectfully,

Kenneth G Masden II
Public Works Manager
Planning Section

c: Alvin Shima, Complex Area Superintendent, Baldwin/King Kekaulike/Maui High Complex Areas

PLANNING
CONSULTANTS
HAWAII, LLC

URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. Kenneth G. Masden II
Public Works Manager
State of Hawaii
Department of Education
P.O. Box 2360
Honolulu, HI 96804

Dear Ms. Masden:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 5, 2015 letter providing comments in response to the above-referenced project.

The Applicant understands that the subject property is within the Central Maui School Impact Fee District and is subject to Chapter 302A-1604, Hawaii Revised Statutes. The Applicant met with the Department's Facilities Development Branch in Honolulu on January 17, 2014 to discuss the appropriate location of a school site and the State's impact fee requirements. Ongoing consultation with the Facilities Development Branch has occurred since this initial meeting

The Applicant also understands that the DOE advises that the Applicant enter into an Educational Contribution Agreement early in the process.

Thank you for your interest in the project, while we look forward to working with your office as we proceed through the development review and

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

land use entitlement processes. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

6. State of Hawai'i, Office of Hawaiian Affairs

PHONE (808) 594-1888

FAX (808) 594-1938

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
560 N. NIMITZ HWY., SUITE 200
HONOLULU, HAWAI'I 96817

HRD15/7503

June 25, 2015

Michael J. Summers, President
Planning Consultants Hawai'i, LLC
2331 W. Main Street
Wailuku, HI 96793

Re: Request for Comments on an Environmental Impact Statement Preparation Notice for the Waikapū Country Town
Waikapū Ahupua'a, Pū'ali Komohana Moku, Maui Mokupuni
Tax map key (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007, and (2) 3-4-006:036

Aloha Mr. Summers:

The Office of Hawaiian Affairs (OHA) is in receipt of your June 8, 2015 letter requesting comments on an environmental impact statement preparation notice (EISPN) for the Waikapū Country Town (WCT). The applicant is Planning Consultants Hawai'i, LLC on behalf of Waikapū Properties, LLC (applicant).

The WCT is a mixed-use residential community project on approximately 1,576 acres, of which 502 acres will encompass the WCT project and the remaining 1,074 will remain agricultural. The project site will include commercial space, an elementary school, park and open space areas, agricultural lands, and 1,433 residential units plus 146 'Ohana units. The residential units are divided among 970 single-family, 256 multi-family/town-home, 80 rural, and 127 country town mixed-use.

The project site is currently designated as an agricultural district by the State of Hawai'i Land use Commission (LUC), zoned by the Maui County as agricultural, and designated as a planned growth area in the Maui Island Plan. In order to comply with state and county laws, the

applicant is requesting a (1) district boundary amendment,[1] (2) County of Maui change-in-zoning,[2] (3) community plan amendment,[3] (4) project district approval,[4] (5) subdivision approval,[5] (6) NPDES permit,[6] and (7) building permits.[7]

Agricultural Lands

The applicant is requesting a change in classification for 485 of the 499 acres that are in the State of Hawai'i agricultural district and the Maui County agricultural zoning. The remaining 14 acres is designated urban. The entire 499-acre area is designated as a planned growth area in the Maui Island Plan, published in December 2012.

The project site is categorized as Agricultural Lands Important to the State of Hawai'i, and designated as A or B by the University of Hawai'i Land Study Bureau. The WCT agricultural lands are very high quality and an important resource to the State of Hawai'i.

OHA understands that a few of the dwellings will be categorized as rural residential subdivision, allowing for small-scale agriculture, and that 485 acres of the 1,576 overall agricultural acres are proposed to be reclassified as urban. However, the EISPN states that due to the rural residential subdivision and the remaining portions of agricultural land within the WCT, no mitigation is needed because there will be no impact upon the agricultural production on Maui Island. We respectfully disagree, as the development of large tracts of agricultural land takes them out of current and future agricultural use, whether cultivation or pasture, and has an impact upon the overall agricultural potential of the island and the state. All agriculturally designated lands play an important role in supporting the State of Hawai'i's food self-sufficiency goals, including the Aloha+ Challenge target of doubling local food production by 2030. Therefore, we ask that WCT propose mitigation efforts towards its proposed conversion of agricultural land.

Walking Community

OHA appreciates the Plan's emphasis on supporting non-automotive travel such as pedestrian and bike use within the community, and transit use for trips both within and outside the community.

One of OHA's strategic priorities is Mauli Ola (Health), which represents our commitment to improve the conditions of Native Hawaiians and quality of life by reducing the onset of chronic diseases. In furtherance of this priority, and in line with Act 155 (Reg. Sess. 2014) and HRS § 226-20, we particularly support a public health approach that takes a holistic and systemic view in addressing obesity in Hawai'i's communities, *e.g.*, through the social

---

[1] Approval by State of Hawai'i Land Use Commission
[2] Approval by Maui County Planning Commission
[3] Approval by Maui County Planning Commission
[4] Approval by Maui County Planning Commission
[5] Approval by Maui County Planning Commission
[6] Approval by State of Hawai'i Department of Health, Clean Water Branch
[7] Approval by Maui County Planning Commission

determinants of health. Community design, including complete streets designed for pedestrians, bicyclists, transit users, motorists, and persons of all ages and abilities, is one of the social determinants of health. Conversely, improper community design is well-documented as a major contributing factor to disproportionate chronic and co-morbid disease rates of a community's residents. OHA notes that HRS §226-20 requires all state agencies to strive for the elimination of the health disparities of Native Hawaiians and other communities, by identifying and addressing social determinants of health. This includes prioritizing interventions, such as walkable communities, that address the social determinants of health.

Affordable Housing

OHA appreciates that WCT will include workforce affordable homes in the project, and we look forward to reviewing the specifics in the draft EIS. We understand the need for affordable housing, as one of OHA's strategic priorities focuses on improving Native Hawaiians' economic self-sufficiency, centering its efforts on two critical goals: increasing homeownership and increasing family income in Native Hawaiians.

Archaeological and Cultural Resources

An archaeological inventory survey of the proposed project site parcels is being completed by Archaeological Services Hawai'i, LLC, and a cultural impact assessment (CIA) is being prepared by Hana Pono, LLC. OHA looks forward to reviewing the AIS, CIA, and the Draft EIS.

OHA understands that previous use of the land was sugarcane cultivation which would have likely disturbed or destroyed surface cultural sites. Nevertheless, OHA does request assurances that should iwi kūpuna or Native Hawaiian cultural deposits be identified during any ground altering activities, all work in the area will immediately cease and the appropriate agencies, including OHA, will be contacted pursuant to applicable law.

Mahalo for the opportunity to consult. Should you have any questions, please contact Jeannin Jeremiah at 594-1790 or by email at jeanninj@oha.org.

'O wau iho nō me ka 'oia 'i'o,

Kamana'opono M. Crabbe, Ph.D.
Ka Pouhana, Chief Executive Officer

KC:jj

**Please address replies and similar, future correspondence to our agency:*
Dr. Kamana'opono Crabbe
Attn: OHA Compliance Enforcement
560 N. Nimitz Hwy, Ste. 200
Honolulu, HI 96817

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. Kamana'opono M. Crabbe, Ph.D.

Ka Pouhana, Chief Executive Officer
State of Hawai'i
Office of Hawaiian Affairs
560 N. Nimitz Hwy., Suite 200
Honolulu, Hawai'I 96817

Dear Mr. Crabbe:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 25, 2015 letter providing comments in response to the above-referenced project. Please find the following response to your comments:

- *Agricultural Lands.* The Applicant acknowledges that the subject project will result in the conversion of agricultural lands to urban use and that this will reduce the overall supply of agricultural land on Maui and in the State of Hawaii. However, as stated in the EISPN, and as further documented in the DEIS, there has been a significant transition of agricultural land out of sugar and pineapple on Maui and throughout the State over the last several decades. Much of this land remains fallow and could be used for diversified agricultural production.

  As noted in the EISPN, and as further described in the DEIS, the Applicant will be placing a conservation easement on approximately 800 acres of the Applicant's agricultural land holdings to create a

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

permanent agricultural production zone and open space separation between Waikapu Town and Maalaea to the south. The 800 aces will accommodate a public and/or private agricultural park, with its core tenants being the existing successful farmers that currently cultivate the Applicant's lands. Moreover, an additional 277 acres will be limited to just five agricultural lots, which will also make these lands very conducive to long-term agricultural production.

- ***Walking Community.*** The Applicant sincerely appreciates OHA's strong interest in the area of public health and its support for community design that promotes active transportation modes. As is documented in the DEIS, the Applicant is committed to designing a community that facilitates walking and bicycling and that lends itself to other forms of active and passive recreation and healthy lifestyles.

- ***Affordable Housing.*** The project will comply with the County's workforce housing ordinance, which currently requires that between 20- and 25 percent of the project's residential housing be sold at prices deemed affordable to homebuyers, or renters, earning between 80 and 140 percent of the County's median income. Workforce housing units are required to have deed restrictions that control resale prices for specified periods of time.

  In addition to developing workforce housing, the Applicant will be developing market priced housing. In consideration of the project's Central Maui location, which largely caters to the local housing market; together with the Applicant's planned lot size and unit configurations, it is expected that about 85 percent of the market priced housing will be affordable to residents earning less than 140 percent of the County's median income.

- ***Archaeological and Cultural Resources.*** The DEIS includes an Archaeological Inventory Survey and Cultural Impact Assessment that document existing archaeological and cultural resources on the property and potential impacts from development of the site. As noted in those reports, should any iwi kupuna or Native Hawaiian cultural deposits be identified during any ground altering activities, all

work will immediately cease and the appropriate agencies, including OHA, will be contacted pursuant to applicable law.

Thank you again for your interest in the project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

7. State of Hawai'i. Department of Health, Environmental Health Administration

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:

EPO 15-117

June 19, 2015

Mr. Michael Summers
President
Planning Consultants Hawaii, LLC
2331 W. Main Street
Wailuku, Hawaii 96793

Dear Mr. Summers:

SUBJECT: Comments on the Environmental Impact Statement Preparation Notice (EISPN) for the Proposed Waikapu Country Town Project, Waikapu, Island of Maui, Hawaii

The Department of Health (DOH), Environmental Planning Office (EPO), appreciates your letter that we received on May 19, 2015. EPO emailed the electronic link of the EISPN:
http://oeqc.doh.hawaii.gov/Shared%20Documents/EA_and_EIS_Online_Library/Maui/2010s/2015-05-23-MA-5E-Act-172-12-EISPN-Waikapu-Country-Town.pdf
to various branches and offices. EPO recognizes that the State of Hawaii, Department of Health, Safe Drinking Water Branch provided you with three pages of comments on June 1st, 2015 and that the Clean Water Branch provided you with three pages of comments on June 9th, 2015. EPO agrees with all of their comments and would like to provide additional information.

1. National Pollutant Discharge elimination System (NPDES) permit coverage may be required for this project. The Clean Water Branch should be contacted at (808) 586-4309 and relevant information should be reviewed at:
    a. http://health.hawaii.gov/cwb
    b. http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/standard-npdes-permit-conditions
    c. http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/forms
2. Should a subdivision exceed 50 lots, a Private Wastewater Treatment Plant is required or the project must connect to the County sewer system. The Wastewater Branch should be contacted at (808) 586-4294 and relevant information should be reviewed at: http://health.hawaii.gov/wastewater
3. The noise created during the construction phase of the project may exceed the maximum allowable levels as set forth in Hawaii Administrative Rules, Chapter 11-46, "Community Noise Control". A noise permit may be required and should be obtained before the commencement of work. Please call the Indoor and Radiological Health Branch at (808) 586-4700 and review relevant information online at:
    a. http://health.hawaii.gov/irhb
    b. http://health.hawaii.gov/irhb/noise

EPO further recommends that the Hazard Evaluation and Emergency Response (HEER) Office's Site Discovery and Response (SDAR) Section be contacted. The SDAR section protects human health and the environment by identifying, investigating, and remediating sites contaminated with hazardous substances (non-emergency site investigations and cleanup). The HEER Office's SDAR Section can be contacted at: (808) 586-4249 and relevant information can be reviewed at: http://eha-web.doh.hawaii.gov/eha-cma/Leaders/HEER/site-assessment-and-cleanup-programs

EPO also recommends that if a large amount of dust may be created during the construction phase of the project then the Clean Air Branch should be consulted at: Clean Air Branch Hawaii Department of Health 919 Ala Moana Blvd., Suite 203 Honolulu, Hawaii 96814 or via e-mail: cab@doh.hawaii.gov or via Phone: (808) 586-4200 between 7:45 a.m. and 4:15 p.m. or via Fax: (808) 586-4359. You may also wish to call toll-free from the neighbor islands. From Maui call 984-2400, then enter "64200".

EPO strongly recommends that you review the standard comments and available strategies to support sustainable and healthy design provided at: http://health.hawaii.gov/epo/home/landuse-planning-review-program/. Projects are required to adhere to all applicable standard comments.

EPO encourages you to examine and utilize the Hawaii Environmental Health Portal. The portal provides links to our e-Permitting Portal, Environmental Health Warehouse, Groundwater Contamination Viewer, Hawaii Emergency Response Exchange, Hawaii State and Local Emission Inventory System, Water Pollution Control Viewer, Water Quality Data, Warnings, Advisories and Postings. The Portal is continually updated. Please visit it regularly at: https://eha-cloud.doh.hawaii.gov

You may also wish to review the revised Water Quality Standards Maps that have been updated for all islands. The Water Quality Standards Maps can be found at: http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/water-quality-standards/.

We request that you utilize all of this information on your proposed project to increase sustainable, innovative, inspirational, transparent and healthy design.

Mahalo nui loa,

Laura Leialoha Phillips McIntyre, AICP
Program Manager, Environmental Planning Office

Attachments:
SDWB letter June 1, 2015
CWB letter June 9, 2015

c: Mr. Michael Summers via hard and soft copy (via email to msummers@planningconsultantshawaii.com)
Mr. Daniel Orodenker, Executive Officer, Land Use Commission – DBEDT (via email daniel.e.orodenker.dbedt.hawaii.gov only)
Mr. Daniel Orodenker, Executive Officer, Land Use Commission – DBEDT, P.O. Box 2359, Honolulu, HI 96804-2359
Mr. Michael Atherton, Member, Waikapu Properties, LLC, 1670 Honoapiilani Hwy., Wailuku, HI 96793
SDWB, CWB (06018PCTM.15), WWB, CAB, SHWB, IRHB, DHO Maui (via email only)

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Ms. Laura Leialoha Phillips McIntyre, AICP
Program Manager
Environmental Planning Office
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, HI 96801-3378

Dear Ms. McIntyre:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 19, 2015 letter providing comments in response to the above-referenced project. In response to your comments, please find the following responses:

- ***NPDES Permit.*** The Applicant will consult with the Clean Water Branch to confirm NPDES permit coverage requirements.
- ***Private Wastewater Treatment Plan.*** The Applicant will consult with the Wastewater Branch to confirm State requirements for the planning and development of a Private Wastewater Treatment Plant.
- ***Community Noise Control.*** The Applicant conducted a Noise Assessment Report to document construction and operation phase noise impacts that might be generated by the project. The report is included in the DEIS. Should a noise permit be required during construction, your office will be contacted and the proper permits obtained prior to initiation of construction.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

- ***HEER SDAR Office.*** The Applicant appreciates the contact information provided for the SDAR office and will make contact with this office should issues related to hazardous substances arise.
- ***Air Quality Impacts.*** The Applicant conducted an Air Quality Study to document construction and operation phase project generated impacts to air quality. During the construction phase, it is anticipated that dust from construction activities could cause air quality impacts. As such, construction phase BMPs will be implemented. These measures are described in the DEIS.

The Applicant appreciates your sharing of the links to the Department's Hawaii Environmental Health Portal and Water Quality Standards Maps. Thank you again for your interest in the project, while we look forward to working with your office through the development review process.

Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

8. State of Hawai'i. Department of Health, Safe Drinking Water Branch

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
SAFE DRINKING WATER BRANCH
919 ALA MOANA BLVD., ROOM 308
HONOLULU, HI 96814-4920

In reply, please refer to:
File: SDWB
WaikapuCountryTown1.docx

June 1, 2015

Mr. Michael Summers
Planning Consultants Hawai'i LLC
2331 W. Main Street
Wailuku, Hawaii 96793

Dear Mr. Summers:

SUBJECT: WAIKAPU COUNTRY TOWN
5(E) ACT 172-12 EISPN
WAIKAPU, MAUI, HAWAII
TMK: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007 AND (2) 3-6-006:036

The Safe Drinking Water Branch (SDWB) Engineering Section has reviewed the subject document and has the following comments:

1. The description of the project does not clearly identify the source of drinking water for the project. Please clearly identify the source of drinking water.

2. This project may qualify as a public water system. Federal and state regulations define a public water system as a system that serves 25 or more individuals at least 60 days per year or has at least 15 service connections. All public water system owners and operators are required to comply with Hawaii Administrative Rules (HAR), Chapter 11-20, "Rules Relating to Public Water Systems."

3. All new public water systems are required to demonstrate and meet minimum capacity requirements prior to their establishment. This requirement involves demonstration that the system will have satisfactory technical, managerial and financial capacity to enable the system to comply with safe drinking water standards and requirements in accordance with HAR Section 11-20-29.5, "Capacity demonstration and evaluation."

4. Projects that propose development of new sources of drinking water serving or proposed to serve a public water system must comply with the terms of HAR Section 11-20-29, "Use of new sources of raw water for public water systems." This section requires that all new public water system sources be approved by the Director of Health (Director) prior to its use. Such approval is based primarily upon the submission of a satisfactory engineering report which addresses the requirements set in HAR Section 11-20-29.

5. The engineering report must identify all potential sources of contamination and evaluate alternative control measures which could be implemented to reduce or eliminate the potential for contamination, including treatment of the water source. In addition, water quality analyses for all regulated contaminants, performed by a laboratory certified by

the State Laboratories Division of the State of Hawaii, must be submitted as part of the report to demonstrate compliance with all drinking water standards. Additional parameters may be required by the Director for this submittal or additional tests required upon his or her review of the information submitted.

6. All sources of public water systems must undergo a source water assessment which will delineate a source water protection area. This process is preliminary to the creation of a source water protection plan for that source and activities which will take place to protect the source of drinking water.

7. Projects proposing to develop new public water systems or proposing substantial modifications to existing public water systems must receive approval by the Director prior to construction of the proposed system or modification in accordance with HAR Section 11-20-30, "New and modified public water systems." These projects include treatment, storage and distribution systems of public water systems. The approval authority for projects owned and operated by a County Board or Department of Water or Water Supply has been delegated to them.

8. All public water systems must be operated by certified distribution system and water treatment plant operators as defined by Hawaii Administrative Rules, Chapter 11-25, "Rules Relating to Certification of Public Water System Operators."

9. All projects which propose the use of dual water systems or the use of a non-potable water system in proximity to an existing drinking water system to meet irrigation or other needs must be carefully designed and operated to prevent the cross-connection of these systems and prevent the possibility of backflow of water from the non-potable system to the drinking water system. The two systems must be clearly labeled and physically separated by air gaps or reduced pressure principle backflow prevention devices to avoid contaminating the drinking water supply. In addition backflow devices must be tested periodically to assure their proper operation. Further, all non-potable spigots and irrigated areas should be clearly labeled with warning signs to prevent the inadvertent consumption on non-potable water. Compliance with Hawaii Administrative Rules, Chapter 11-21, "Cross-Connection and Backflow Control" is also required.

10. All projects which propose the establishment of a potentially contaminating activity (as identified in the Hawai'i Source Water Assessment Plan) within the source water protection area of an existing source of water for a public water supply should address this potential and activities that will be implemented to prevent or reduce the potential for contamination of the drinking water source.

11. For further information concerning the application of capacity, new source approval, operator certification, source water assessment, backflow/cross-connection prevention or other public water system programs, please contact the Safe Drinking Water Branch at (808) 586-4258 or call from Maui the direct toll free number 984-2400, ext. 64258.

The SDWB Underground Injection Control (UIC) program provides the following comments:

1. The project is bisected by the UIC line. There are no known drinking water wells located within ¼ mile of the project site. Land areas above the UIC line are considered to overlie underground sources of drinking water; and

2. The UIC program regulates the construction and operation of wastewater disposal injection wells to prevent the contamination of our drinking water aquifers. If injection wells are being considered for stormwater management or wastewater disposal, the Draft Environmental Impact Statement should include a discussion of the proposed injection well use. The regulations for the construction and operation of an injection well are found in Hawaii Administrative Rules, Title 11, Chapter 23, Underground Injection Control. More UIC information can be found at the following website: http://health.hawaii.gov/sdwb/underground-injection-control-program/

3. If you have any questions or comments on our project review or the UIC program, please contact Mr. Norris Uehara, Supervisor of the SDWB UIC Program at (808) 586-4258 or call from Maui the direct toll free number 984-2400, ext. 64258.

If there are any questions, please call Ms. Jennifer Nikaido of the Engineering Section at (808) 586-4258 or call from Maui the direct toll free number 984-2400, ext. 64258.

Sincerely,

JOANNA L. SETO, P.E., CHIEF
Safe Drinking Water Branch

JN:cb

c: Waikapu Properties, LLC
1670 Honoapi'ilani Highway
Wailuku, Hawaii 96793

State of Hawai'i
Land Use Commission
Department of Business,
Economic Development and Tourism
P.O. Box 2359
Honolulu, Hawaii 96804-2359

EPO (EPO 117)

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Ms. Joanna L. Seto, P.E. Chief
Department of Health
Safe Drinking Water Branch
919 Ala Moana Blvd. Room 308
Honolulu, Hawaii 96814-4920

Dear Ms. Seto:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 1, 2015 letter providing comments in response to the above-referenced project. In response to your comments, please find the following responses:

- ***Drinking water source.*** Water and fire protection for the Project will be provided from a private onsite water system. Five (5) wells have been drilled on the site. Three (3) wells have been designated for potable use and two (2) for non-potable purposes. All of the wells are located within the Waikapu Aquifer. The three potable water wells have been approved by the State of Hawaii, Commission on Water Resource Management (CWRM) for a total pumping capacity of 2,300 gallons per minute (gpm). Water pumped from the non-potable wells will be used for agriculture and irrigation of parks, open space and irrigation of commercial and residential lots.
- ***Public water system.*** The Applicant understands that the Project's private water system may be subject to Federal and State regulations defining a public water system. The Applicant acknowledges that all public water system owners and operators are required to comply with HAR Chapter 11-20, "Rules Relating to Public Water Systems." The Applicant also understands that compliance with HAR Section 11-20-29.5, HAR Section

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

11-20-29, HAR Section 11-20-30 and HAR Chapter 11-25, "Rules Relating to Certification of Public Water System Operators" is also required of such systems.

- ***Dual water systems.*** As noted, the Applicant does intend to use non-potable well water for agricultural irrigation, irrigation of parks and open space and irrigation of residential and commercial lots. The Applicant understands that measures must be taken to design and operate the dual system in a manner that will prevent backflow of water from the non-potable system to the drinking water system.
- ***Potentially Contaminating Activities.*** The Applicant is aware that any activities that are identified in the Hawai`i Source Water Assessment Plan, which are potentially contaminating and located within the source water protection area, should be addressed to mitigate potential impacts to the source.
- ***Underground Injection Control.*** The Applicant is aware that the Project is bisected by the UIC line. Wastewater will be treated in accordance with State and County requirements. Storm water will be retained on-site through a series of detention basins as is described within the Draft Environmental Impact Statement (DEIS).

Thank you for your interest in the project, while we look forward to working with your office as we proceed through the development review process. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

9. State of Hawai'i. Department of Health, Clean Air Branch

DAVID Y. IGE
GOVERNOR OF HAWAII

COPY

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3378
HONOLULU, HAWAII 96801-3378

In reply, please refer to:
File:

15-366A CAB

June 3, 2015

Mr. Michael Summers
President
Planning Consultants Hawaii, LLC
2331 W. Main Street
Wailuku, Hawaii 96793

LAND USE COMMISSION
STATE OF HAWAII
2015 JUN 12 A 8:

Dear Mr. Summers:

SUBJECT: **Environmental Impact Statement Preparation Notice**
Proposed Waikapu Country Town Project
Waikapu, Wailuku, Maui

A significant potential for fugitive dust emissions exists during all phases of construction. The activities must comply with the provisions of Hawaii Administrative Rules, §11-60.1-33 on Fugitive Dust.

We encourage the contractor to implement a dust control plan, which does not require approval by the Department of Health, to comply with the fugitive dust regulations. The dust control measures listed in your document should be implemented where appropriate; additional measures may include, but are not limited to, the following:

a) Planning the different phases of construction, focusing on minimizing the amount of dust-generating materials and activities, centralizing on-site vehicular traffic routes, and locating potential dust-generating equipment in areas of the least impact;
b) Providing an adequate water source at the site prior to start-up of construction activities;
c) Landscaping and providing rapid covering of bare areas, including slopes, starting from the initial grading phase;
d) Minimizing dust from shoulders and access roads;
e) Providing adequate dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and
f) Controlling dust from debris being hauled away from the project site. Also, controlling dust from daily operations of material being processed, stockpiled, and hauled to and from the facility.

If you have any questions, please contact Mr. Barry Ching of the Clean Air Branch at (808) 586-4200.

Sincerely,

NOLAN S. HIRAI, P.E.
Manager, Clean Air Branch

BC:rg
c: Daniel Orodenker, Executive Officer, State Land Use Commission, DBED&T
Michael Atherton, Waikapu Properties, LLC

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. Nolan S. Hirai, P.E.
Manager
Clean Air Branch
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, HI 96801-3378

Dear Mr. Hirai:

Re: **Environmental Assessment** / Environmental Impact Statement Preparation Notice for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 3, 2015 letter providing comments in response to the above-referenced project.

Please note that an Air Quality Study was prepared to address construction and operation phase air quality impacts associated with the project. It is expected that during the construction phase, impacts to neighboring properties from wind born dust could arise if an appropriate dust control plan is not implemented. The Applicant acknowledges the following additional mitigation measures offered to address fugitive dust emissions during construction:

- Planning the different phases of construction, focusing on minimizing the amount of dust-generating materials and activities, centralizing on-site vehicular routes, and locating potential dust-generating equipment in areas of least impact;
- Providing an adequate water source at the site prior to start-up of construction activities;

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

- Landscaping and providing rapid covering of bare areas, including slopes, starting from the initial grading phase;
- Minimizing dust from shoulders and access roads;
- Providing adequate dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and
- Controlling dust from debris being hauled away from the project site. Also, controlling dust from daily operations of material being processed, stockpiled, and hauled to and from the facility.

Thank you very much for your interest in the project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

10. State of Hawai'i, Department of Health, Clean Water Branch

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:

06018PCTM.15

June 09, 2015

Mr. Michael Summers
President
Planning Consultants Hawaii, LLC
2331 W. Main Street
Wailuku, Hawaii 96793

Dear Mr. Summers:

SUBJECT: Comments on the Environmental Impact Statement Preparation Notice (EISPN) for Proposed Waikapu Country Town Project Waikapu, Island of Maui, Hawaii

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated May 11, 2015, requesting comments on your project. The DOH-CWB has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://health.hawaii.gov/epo/files/2013/05/Clean-Water-Branch-Std-Comments.pdf

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. You may be required to obtain National Pollutant Discharge Elimination System (NPDES) permit coverage for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55).

For NPDES general permit coverage, a Notice of Intent (NOI) form must be submitted at least 30 calendar days before the commencement of the discharge. An application for a NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. To request NPDES permit coverage, you must submit the applicable form ("CWB Individual NPDES Form" or "CWB NOI Form") through the e-Permitting Portal and the hard copy certification statement with the respective filing fee ($1,000 for an individual NPDES permit or $500 for a Notice of General Permit Coverage). Please open the e-Permitting Portal website located at: https://eha-cloud.doh.hawaii.gov/epermit/. You will be asked to do a one-time registration to obtain your login and password. After you register, click on the Application Finder tool and locate the appropriate form. Follow the instructions to complete and submit the form.

3. If your project involves work in, over, or under waters of the United States, it is highly recommended that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 835-4303) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and Hawaii Administrative Rules (HAR), Chapter 11-54.

4. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

5. It is the State's position that all projects must reduce, reuse, and recycle to protect, restore, and sustain water quality and beneficial uses of State waters. Project planning should:

   a. Treat storm water as a resource to be protected by integrating it into project planning and permitting. Storm water has long been recognized as a source of irrigation that will not deplete potable water resources. What is often overlooked is that storm water recharges ground water supplies and feeds streams and estuaries; to ensure that these water cycles are not disrupted, storm water cannot be relegated as a waste product of impervious surfaces. Any project planning must recognize storm water as an asset that sustains and protects natural ecosystems and traditional beneficial uses of State waters, like community beautification, beach going, swimming, and fishing. The approaches necessary to do so, including low impact development methods or ecological

bio-engineering of drainage ways must be identified in the planning stages to allow designers opportunity to include those approaches up front, prior to seeking zoning, construction, or building permits.

b. Clearly articulate the State's position on water quality and the beneficial uses of State waters. The plan should include statements regarding the implementation of methods to conserve natural resources (e.g. minimizing potable water for irrigation, gray water re-use options, energy conservation through smart design) and improve water quality.

c. Consider storm water Best Management Practice (BMP) approaches that minimize the use of potable water for irrigation through storm water storage and reuse, percolate storm water to recharge groundwater to revitalize natural hydrology, and treat storm water which is to be discharged.

d. Consider the use of green building practices, such as pervious pavement and landscaping with native vegetation, to improve water quality by reducing excessive runoff and the need for excessive fertilization, respectively.

e. Identify opportunities for retrofitting or bio-engineering existing storm water infrastructure to restore ecological function while maintaining, or even enhancing, hydraulic capacity. Particular consideration should be given to areas prone to flooding, or where the infrastructure is aged and will need to be rehabilitated.

If you have any questions, please visit our website at: http://health.hawaii.gov/cwb/, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

ALEC WONG, P.E., CHIEF
Clean Water Branch

CTM:ay

C: Mr. Daniel Orodenker, Land Use Commission – DBEDT
[via e-mail daniel.e.orodenker@dbedt.hawaii.gov only]
DOH-EPO #15-117 (via e-mail only)

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. Alec Wong, P.E., Chief
Department of Health
Clean Water Branch
P.O. Box 3378
Honolulu, HI 96801-3378

Dear Mr. Wong:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 9, 2015 letter providing comments in response to the above-referenced project. In response to your comments, please find the following responses:

- ***Compliance with Hawaii Administrative Rules.*** The Applicant understands that the Project must be in compliance with HAR, Section 11-54-1.1 (Antidegradation policy), HAR, Section 11-54-3 (Designated uses), and HAR, Sections 11-54-4 through 11-54-8) (Water quality criteria).

- ***NPDES Permit.*** The Applicant understands that the Project may be subject to NPDES permit coverage and will comply with the requirements of HAR, Chapter 11-55.

- ***Waters of the United States.*** The WCT does not anticipate any work that will encroach upon navigable waters of the U.S. or that will produce discharges into U.S. waters. However, should such activities be proposed, the Applicant will obtain all required Federal and State permits before commencing such activities.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

- ***Water Conservation and Reuse.*** The Applicant is committed to reducing the Project's potable water demand through conservation and reuse. The Applicant will require that water conserving low flow fixtures be installed throughout the development. The Applicant is also developing non-potable wells to be used for irrigation of parks and open space as well as the irrigation of individual commercial and residential lots. It is expected that potable water demand will be reduced by at least one-third through the investment into a dual water system.

  Regarding storm water, this resource will be directed into on-site detention basins where the water will be collected and will be allowed to recharge the aquifer. Grassed swales, parks, and open space areas will also be maintained with appropriate grasses and ground covers to allow natural filtration and percolation into the soils. The Applicant is also investigating the feasibility of storm water storage and reuse to see if it is an economically and environmentally feasible measure to reuse storm water for irrigation.

Thank you for your interest in the project, while we look forward to working with you Department as we proceed through the development review process. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

11. State of Hawai'i. Department of Health, Maui District Office

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

LORRIN W. PANG, M.D., M.P.H.
DISTRICT HEALTH OFFICER

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, HAWAII 96793-3378

June 23, 2015

Mr. Michael Summers
President
Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Hawai`i 96793

Dear Mr. Summers:

Subject: EISPN for the Proposed Waikapu Country Town Project, Maui, Hawaii
TMK: (2) 3-6-002:001, 3-6-002:003, 3-6-004:003, 3-6-004:006, 3-6-005:007 and 3-6-006:036

Thank you for the opportunity to review this project. We have the following comments to offer:

1. National Pollutant Discharge Elimination System (NPDES) permit coverage maybe required for this project. The Clean Water Branch should be contacted at 808 586-4309.

2. The Wastewater Branch cannot make comments as the wastewater disposal method for the proposed project was not addressed on the EISPN. Please provide us with the wastewater disposal method for our review and comments under Chapter 11-62, "Wastewater Systems" if applicable. If you have any questions, please call Roland Tejano, Environmental Engineer, at 808 984-8232.

3. Project land was formerly used in sugar cane production. Please consult with the Hazard Evaluation and Emergency Response (HEER) Office of the Department of Health. Please contact them at 808 586-4249.

It is strongly recommended that the Standard Comments found at the Department's website: http://health.hawaii.gov/epo/home/landuse-planning-review-program/ be reviewed and any comments specifically applicable to this project should be adhered to.

Should you have any questions, please contact me at patricia.kitkowski@doh.hawaii.gov or 808 984-8230.

Sincerely,

Patti Kitkowski

Patti Kitkowski
District Environmental Health Program Chief

c EPO
Daniel Orodenker, DBEDT
Michael Atherton, Waikapu Properties LLC

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Ms. Patti Kitkowski
District Environmental Health Program Chief
State of Hawaii
Department of Health
Maui District Health Office
54 High Street
Wailuku, HI 96793-3378

Dear Ms. Kitkowski:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 23, 2015 letter providing comments in response to the above-referenced project. In response to your comments, please find the following responses:

- ***NPDES Permit.*** The Applicant understands that the Project may be subject to NPDES permit coverage and will consult with the Clean Water Branch at the appropriate time.

- ***Wastewater Disposal.*** The DEIS describes the wastewater disposal options being considered for the Project. The Applicant will coordinate with the County Department of Environmental Management and the Clean Water Branch to finalize plans for the Project's wastewater treatment.

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

- ***Hazard Evaluation and Emergency Response Office (HEER).*** The Applicant will consult with the HEER Office regarding concerns they may have with potential contaminants.

Thanks you for your interest in the project, while we look forward to working with your office as we proceed through the development review process. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

12. State of Hawai'i. Department of Health, Wastewater Branch

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:
LUD – 2 3 6 002 001 EISPN
Waikapu Country Town-ID2269

June 9, 2015

Mr. Michael Summers, President
Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Maui, Hawaii 96793
Dear Mr. Summers:

Subject: EISPN for the proposed Waikapu Country Town Project
TMK (2) 3-6-002: 001, 3-6-004: 003, 3-6-005: 007 and 3-6-006: 036

Thank you for allowing us the opportunity to provide comments on the above subject project. We have the following information to offer.

The subject project is located in the critical wastewater disposal area as determined by the Maui County Wastewater Advisory Committee. However, we are unable to offer approval or any further comments on the proposed project at this time as domestic wastewater collection, treatment, and disposal have not been addressed in the subject document. Information pertaining to the wastewater collection, treatment, and disposal system should be provided in order that we may be able to evaluate and make any determinations related to the wastewater plans for the subject project.

Please be informed that the proposed wastewater systems for the subdivision/development may have to include design considerations to address any effects associated with the construction of and/or discharges from the wastewater systems to any public trust, Native Hawaiian resources or the exercise of traditional cultural practices. In addition, all wastewater plans must conform to applicable provisions of the Hawaii Administrative Rules, Chapter 11-62, "Wastewater Systems."

Should you have any questions, please contact Mr. Mark Tomomitsu of my staff at (808) 586-4294.

Sincerely,

SINA PRUDER, P.E., CHIEF
Wastewater Branch

LM/MST:lmj

c: State of Hawaii, Land Use Commission
Mr. Michael Atherton, Waikapu Properties, LLC
Ms. Laura McIntyre, DOH-Environmental Planning Office (15-117)
Ms. Patricia Kitkowski, DOH-DEHP Maui Chief
Mr. Roland Tejano, OOH-WWB's Maui Staff
Mr. Kurt Wollenhaupt, County of Maui, Department of Planning

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Ms. Sina Pruder, P.E. Chief
State of Hawaii
Department of Health
Wastewater Branch
P.O. Box 3378
Honolulu, HI 96801-3378

Dear Ms. Pruder:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 25, 2015 letter providing comments in response to the above-referenced project. In response to your comments, please find the following responses:

- *Critical Wastewater Disposal Area.* The Applicant understands that the subject project is located in a critical wastewater disposal area and that future wastewater treatment plans must comply with Hawaii Administrative Rules, Chapter 11-62, "Wastewater Systems."

  Information pertaining to future wastewater treatment is provided in the Draft Environmental Impact Statement (DEIS) and the Applicant will work closely with your Division as plans are further developed.

Thank you for your interest in the project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

13. State of Hawai'i, Department of Transportation

DAVID Y. IGE
GOVERNOR

FORD N. FUCHIGAMI
DIRECTOR

Deputy Directors
JADE T. BUTAY
ROSS M. HIGASHI
EDWIN H. SNIFFEN
DARRELL T. YOUNG

IN REPLY REFER TO:
STP 8.1814

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

June 17, 2015

Mr. Michael J. Summers
President
Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Hawaii 96793

Dear Mr. Summers:

Subject: Waikapu Country Town
Environmental Impact Statement Preparation Notice (EISPN)
Waikapu, Maui, Hawaii
TMK: (2) 3-6-002:001 and 003, 3-6-004:003 and 006, 3-6-005:007 and 3-6-006:036

Our Department of Transportation (DOT) comments on the subject project are as follows:

DOT Airports Division

1. Federal Aviation Administration (FAA) Advisory Circular 150/5200-33B, Hazardous Wildlife Attractants On or Near Airports (copy attached), recommends a distance of five (5) statute miles between the farthest edge of the airfield's Air Operations Area and land use activities that could attract hazardous wildlife movement into or across aircraft approach or departure space. The subject project is of concern because it is within five (5) statute miles from Kahului Airport (OGG).

2. According to an earlier illustration of the Waikapu County Town Master Plan, several existing plantation reservoirs were identified as detention basins. To prevent the attraction of hazard wildlife, the FAA recommends that stormwater detention ponds be designed, engineered, constructed, and maintained for a maximum 48-hour detention period after the design storm and remain completely dry between storms.

3. According to the EISPN, photovoltaic (PV) panels are located above the large rural lots in the mauka agricultural lands. PV systems can create a hazardous condition for a pilot due to possible glint and glare reflected from the PV array. If glint or glare from the PV array creates a hazard condition for pilots, the applicant must be prepared to immediately mitigate the hazard, upon notification by the DOT Airports Division or the FAA. The following website may assist the applicant with preparation of a glint and glare analysis in order to minimize any potential hazard: www.sandia.gov/glare.

4. The project lies within the approach surface to the Kahului Airport and will be subject to aircraft overflights and noise.

DOT Highways Division

1. The Traffic Impact Analysis Report (TIAR) should be submitted to the DOT Highways Division for review and acceptance.

2. Project construction plans, including grading and drainage plans, within or affecting the highways rights-of-way must be submitted to DOT Highways Division for review and approval.

3. No additional surface water run-off from the project will be permitted onto Honoapiilani Highway rights-of-way.

4. The developer should be aware of DOT's plans for a bikeway on Honoapiilani Highway.

5. The developer is required to obtain a permit from DOT Highways Division, Maui District Office, for the transport of oversized and/or overweight materials and equipment on State highway facilities.

If there are any questions, please contact Mr. Norren Kato of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

Sincerely,

FORD N. FUCHIGAMI
Director of Transportation

Attachment: FAA Advisory Circular 150/5200-33B

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING
Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. Ford N. Fuchigami
Director of Transportation
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813-5097

Dear Ms. Fuchigami:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 17, 2015 letter providing comments in response to the above-referenced project. The following response is provided in response to your comments:

DOT Airports Division

1. ***Federal Aviation Administration (FAA) Advisory Circular 150/5200-33B).*** The DEIS documents existing agricultural reservoirs and proposed future agricultural reservoirs and detention basins planned on the property. The Applicant will consider the recommendations provided in the design, operation and maintenance of these facilities.
2. ***Photovoltaic (PV) Panels.*** The Applicant acknowledges the concern regarding possible glint and glare created by PV panels and will carefully consider this issue in locating and designing such facilities.
3. ***Kahului Airport.*** The Applicant acknowledges that the project site may be subject to aircraft overflight and noise.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

DOT Highways Division

1. The TIAR has been summarized in the DEIS and incorporated into the report as an Appendix. The Applicant will have the traffic engineer contact your office to coordinate the review and acceptance of the report.
2. The Applicant acknowledges that project construction, grading and drainage plans, within or affecting the rights-of-way must be submitted to the DOT Highways Division for review and approval.
3. The Applicant understands that no additional surface runoff will be permitted onto Honoapiilani Highway.
4. The Applicant is pleased to hear that the DOT is planning to install a bikeway along Honoapiilani Highway. We will coordinate with the Highways Division on the implementation of this improvement.
5. The Applicant understands that a permit is required from the DOT Highways Division, Maui District Office, for the transport of oversized and/or overweight materials and equipment on State highway facilities.

Thank you for your interest in the project, while we look forward to working with your office as we proceed through the development review process. Should you have any questions, please contact me at (808) 269-6220 or bye-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

U.S. Department
of Transportation

Federal Aviation Administration

Advisory Circular

Subject: HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS	**Date:** 8/28/2007	**AC No:** 150/5200-33B
	Initiated by: AAS-300	**Change:**

1. PURPOSE. This Advisory Circular (AC) provides guidance on certain land uses that have the potential to attract hazardous wildlife on or near public-use airports. It also discusses airport development projects (including airport construction, expansion, and renovation) affecting aircraft movement near hazardous wildlife attractants. Appendix 1 provides definitions of terms used in this AC.

2. APPLICABILITY. The Federal Aviation Administration (FAA) recommends that public-use airport operators implement the standards and practices contained in this AC. The holders of Airport Operating Certificates issued under Title 14, Code of Federal Regulations (CFR), Part 139, Certification of Airports, Subpart D (Part 139), may use the standards, practices, and recommendations contained in this AC to comply with the wildlife hazard management requirements of Part 139. Airports that have received Federal grant-in-aid assistance must use these standards. The FAA also recommends the guidance in this AC for land-use planners, operators of non-certificated airports, and developers of projects, facilities, and activities on or near airports.

3. CANCELLATION. This AC cancels AC 150/5200-33A, *Hazardous Wildlife Attractants on or near Airports*, dated July 27, 2004.

4. PRINCIPAL CHANGES. This AC contains the following major changes, which are marked with vertical bars in the margin:

a. Technical changes to paragraph references.

b. Wording on storm water detention ponds.

c. Deleted paragraph 4-3.b, *Additional Coordination.*

5. BACKGROUND. Information about the risks posed to aircraft by certain wildlife species has increased a great deal in recent years. Improved reporting, studies, documentation, and statistics clearly show that aircraft collisions with birds and other wildlife are a serious economic and public safety problem. While many species of wildlife can pose a threat to aircraft safety, they are not equally hazardous. Table 1

ranks the wildlife groups commonly involved in damaging strikes in the United States according to their relative hazard to aircraft. The ranking is based on the 47,212 records in the FAA National Wildlife Strike Database for the years 1990 through 2003. These hazard rankings, in conjunction with site-specific Wildlife Hazards Assessments (WHA), will help airport operators determine the relative abundance and use patterns of wildlife species and help focus hazardous wildlife management efforts on those species most likely to cause problems at an airport.

Most public-use airports have large tracts of open, undeveloped land that provide added margins of safety and noise mitigation. These areas can also present potential hazards to aviation if they encourage wildlife to enter an airport's approach or departure airspace or air operations area (AOA). Constructed or natural areas—such as poorly drained locations, detention/retention ponds, roosting habitats on buildings, landscaping, odor-causing rotting organic matter (putrescible waste) disposal operations, wastewater treatment plants, agricultural or aquaculture activities, surface mining, or wetlands—can provide wildlife with ideal locations for feeding, loafing, reproduction, and escape. Even small facilities, such as fast food restaurants, taxicab staging areas, rental car facilities, aircraft viewing areas, and public parks, can produce substantial attractions for hazardous wildlife.

During the past century, wildlife-aircraft strikes have resulted in the loss of hundreds of lives worldwide, as well as billions of dollars in aircraft damage. Hazardous wildlife attractants on and near airports can jeopardize future airport expansion, making proper community land-use planning essential. This AC provides airport operators and those parties with whom they cooperate with the guidance they need to assess and address potentially hazardous wildlife attractants when locating new facilities and implementing certain land-use practices on or near public-use airports.

6. MEMORANDUM OF AGREEMENT BETWEEN FEDERAL RESOURCE AGENCIES. The FAA, the U.S. Air Force, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the U.S. Department of Agriculture - Wildlife Services signed a Memorandum of Agreement (MOA) in July 2003 to acknowledge their respective missions in protecting aviation from wildlife hazards. Through the MOA, the agencies established procedures necessary to coordinate their missions to address more effectively existing and future environmental conditions contributing to collisions between wildlife and aircraft (wildlife strikes) throughout the United States. These efforts are intended to minimize wildlife risks to aviation and human safety while protecting the Nation's valuable environmental resources.

DAVID L. BENNETT
Director, Office of Airport Safety
and Standards

Table 1. Ranking of 25 species groups as to relative hazard to aircraft (1=most hazardous) based on three criteria (damage, major damage, and effect-on-flight), a composite ranking based on all three rankings, and a relative hazard score. Data were derived from the FAA National Wildlife Strike Database, January 1990–April 2003.[1]

Species group	Ranking by criteria			Composite ranking[2]	Relative hazard score[3]
	Damage[4]	Major damage[5]	Effect on flight[6]		
Deer	1	1	1	1	100
Vultures	2	2	2	2	64
Geese	3	3	6	3	55
Cormorants/pelicans	4	5	3	4	54
Cranes	7	6	4	5	47
Eagles	6	9	7	6	41
Ducks	5	8	10	7	39
Osprey	8	4	8	8	39
Turkey/pheasants	9	7	11	9	33
Herons	11	14	9	10	27
Hawks (buteos)	10	12	12	11	25
Gulls	12	11	13	12	24
Rock pigeon	13	10	14	13	23
Owls	14	13	20	14	23
H. lark/s. bunting	18	15	15	15	17
Crows/ravens	15	16	16	16	16
Coyote	16	19	5	17	14
Mourning dove	17	17	17	18	14
Shorebirds	19	21	18	19	10
Blackbirds/starling	20	22	19	20	10
American kestrel	21	18	21	21	9
Meadowlarks	22	20	22	22	7
Swallows	24	23	24	23	4
Sparrows	25	24	23	24	4
Nighthawks	23	25	25	25	1

[1] Excerpted from the *Special Report for the FAA, "Ranking the Hazard Level of Wildlife Species to Civil Aviation in the USA: Update #1, July 2, 2003"*. Refer to this report for additional explanations of criteria and method of ranking.

[2] Relative rank of each species group was compared with every other group for the three variables, placing the species group with the greatest hazard rank for ≥ 2 of the 3 variables above the next highest ranked group, then proceeding down the list.

[3] Percentage values, from Tables 3 and 4 in Footnote 1 of the *Special Report*, for the three criteria were summed and scaled down from 100, with 100 as the score for the species group with the maximum summed values and the greatest potential hazard to aircraft.

[4] Aircraft incurred at least some damage (destroyed, substantial, minor, or unknown) from strike.

[5] Aircraft incurred damage or structural failure, which adversely affected the structure strength, performance, or flight characteristics, and which would normally require major repair or replacement of the affected component, or the damage sustained makes it inadvisable to restore aircraft to airworthy condition.

[6] Aborted takeoff, engine shutdown, precautionary landing, or other.

This page intentionally left blank.

Table of Contents

SECTION 1. GENERAL SEPARATION CRITERIA FOR HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS. 1
1-1. INTRODUCTION 1
1-2. AIRPORTS SERVING PISTON-POWERED AIRCRAFT 1
1-3. AIRPORTS SERVING TURBINE-POWERED AIRCRAFT 1
1-4. PROTECTION OF APPROACH, DEPARTURE, AND CIRCLING AIRSPACE 1
SECTION 2. LAND-USE PRACTICES ON OR NEAR AIRPORTS THAT POTENTIALLY ATTRACT HAZARDOUS WILDLIFE 3
2-1. GENERAL 3
2-2. WASTE DISPOSAL OPERATIONS 3
2-3. WATER MANAGEMENT FACILITIES 5
2-4. WETLANDS 8
2-5. DREDGE SPOIL CONTAINMENT AREAS 9
2-6. AGRICULTURAL ACTIVITIES 9
2-7. GOLF COURSES, LANDSCAPING AND OTHER LAND-USE CONSIDERATIONS 10
2-8. SYNERGISTIC EFFECTS OF SURROUNDING LAND USES 11
SECTION 3. PROCEDURES FOR WILDLIFE HAZARD MANAGEMENT BY OPERATORS OF PUBLIC-USE AIRPORTS 13
3.1. INTRODUCTION 13
3.2. COORDINATION WITH USDA WILDLIFE SERVICES OR OTHER QUALIFIED WILDLIFE DAMAGE MANAGEMENT BIOLOGISTS 13
3-3. WILDLIFE HAZARD MANAGEMENT AT AIRPORTS: A MANUAL FOR AIRPORT PERSONNEL 13
3-4. WILDLIFE HAZARD ASSESSMENTS, TITLE 14, CODE OF FEDERAL REGULATIONS, PART 139 13
3-5. WILDLIFE HAZARD MANAGEMENT PLAN (WHMP) 14
3-6. LOCAL COORDINATION 14
3-7. COORDINATION/NOTIFICATION OF AIRMEN OF WILDLIFE HAZARDS 14
SECTION 4. FAA NOTIFICATION AND REVIEW OF PROPOSED LAND-USE PRACTICE CHANGES IN THE VICINITY OF PUBLIC-USE AIRPORTS 15
4-1. FAA REVIEW OF PROPOSED LAND-USE PRACTICE CHANGES IN THE VICINITY OF PUBLIC-USE AIRPORTS 15
4-2. WASTE MANAGEMENT FACILITIES 15
4-3. OTHER LAND-USE PRACTICE CHANGES 16
APPENDIX 1. DEFINITIONS OF TERMS USED IN THIS ADVISORY CIRCULAR 19

This page intentionally left blank.

SECTION 1.

GENERAL SEPARATION CRITERIA FOR HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS.

1-1. INTRODUCTION. When considering proposed land uses, airport operators, local planners, and developers must take into account whether the proposed land uses, including new development projects, will increase wildlife hazards. Land-use practices that attract or sustain hazardous wildlife populations on or near airports can significantly increase the potential for wildlife strikes.

The FAA recommends the minimum separation criteria outlined below for land-use practices that attract hazardous wildlife to the vicinity of airports. Please note that FAA criteria include land uses that cause movement of hazardous wildlife onto, into, or across the airport's approach or departure airspace or air operations area (AOA). (See the discussion of the synergistic effects of surrounding land uses in Section 2-8 of this AC.)

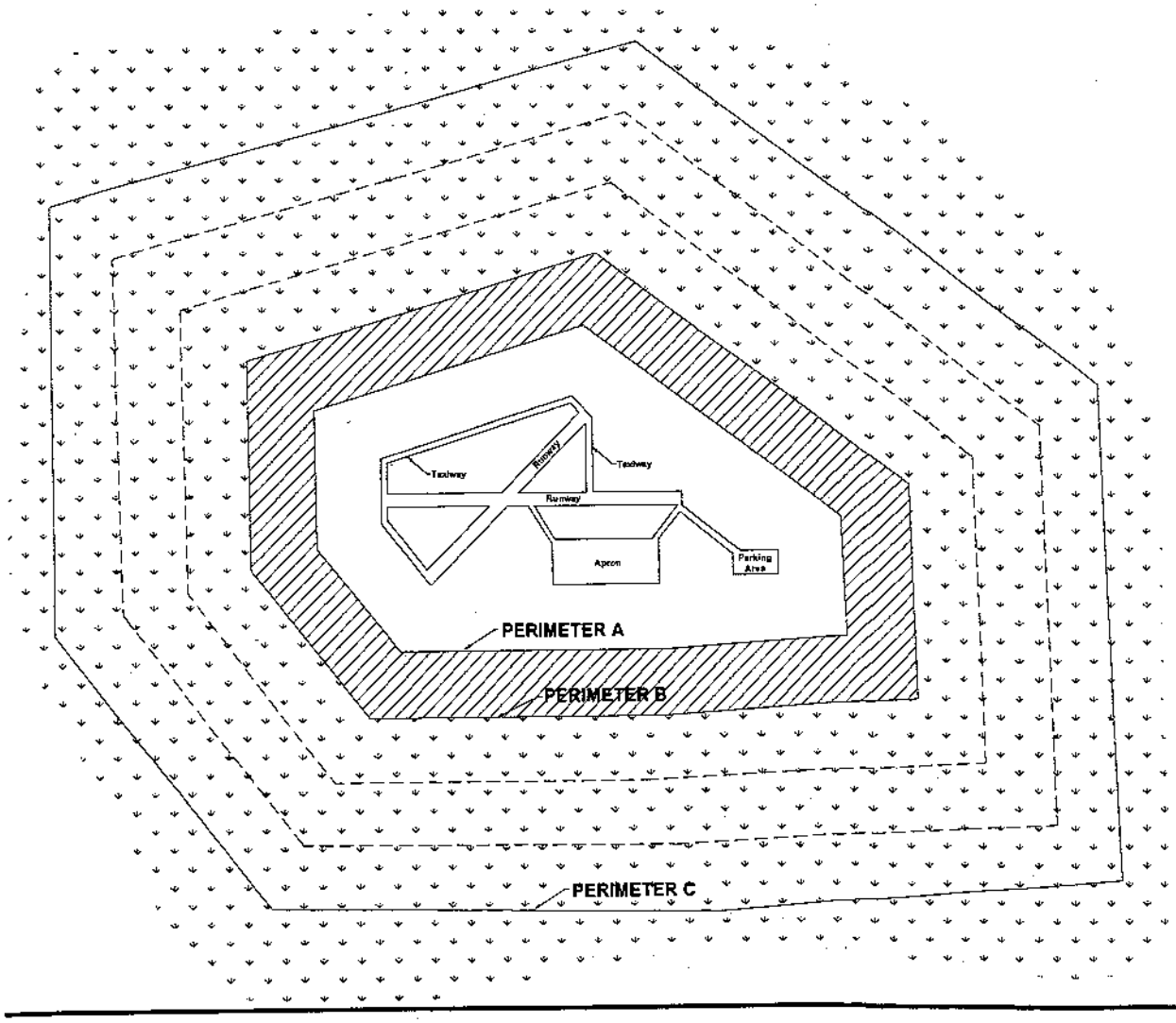
The basis for the separation criteria contained in this section can be found in existing FAA regulations. The separation distances are based on (1) flight patterns of piston-powered aircraft and turbine-powered aircraft, (2) the altitude at which most strikes happen (78 percent occur under 1,000 feet and 90 percent occur under 3,000 feet above ground level), and (3) National Transportation Safety Board (NTSB) recommendations.

1-2. AIRPORTS SERVING PISTON-POWERED AIRCRAFT. Airports that do not sell Jet-A fuel normally serve piston-powered aircraft. Notwithstanding more stringent requirements for specific land uses, the FAA recommends a separation distance of 5,000 feet at these airports for any of the hazardous wildlife attractants mentioned in Section 2 or for new airport development projects meant to accommodate aircraft movement. This distance is to be maintained between an airport's AOA and the hazardous wildlife attractant. Figure 1 depicts this separation distance measured from the nearest aircraft operations areas.

1-3. AIRPORTS SERVING TURBINE-POWERED AIRCRAFT. Airports selling Jet-A fuel normally serve turbine-powered aircraft. Notwithstanding more stringent requirements for specific land uses, the FAA recommends a separation distance of 10,000 feet at these airports for any of the hazardous wildlife attractants mentioned in Section 2 or for new airport development projects meant to accommodate aircraft movement. This distance is to be maintained between an airport's AOA and the hazardous wildlife attractant. Figure 1 depicts this separation distance from the nearest aircraft movement areas.

1-4. PROTECTION OF APPROACH, DEPARTURE, AND CIRCLING AIRSPACE. For all airports, the FAA recommends a distance of 5 statute miles between the farthest edge of the airport's AOA and the hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace.

Figure 1. Separation distances within which hazardous wildlife attractants should be avoided, eliminated, or mitigated.



PERIMETER A: For airports serving piston-powered aircraft, hazardous wildlife attractants must be 5,000 feet from the nearest air operations area.

PERIMETER B: For airports serving turbine-powered aircraft, hazardous wildlife attractants must be 10,000 feet from the nearest air operations area.

PERIMETER C: 5-mile range to protect approach, departure and circling airspace.

SECTION 2.

LAND-USE PRACTICES ON OR NEAR AIRPORTS THAT POTENTIALLY ATTRACT HAZARDOUS WILDLIFE.

2-1. GENERAL. The wildlife species and the size of the populations attracted to the airport environment vary considerably, depending on several factors, including land-use practices on or near the airport. This section discusses land-use practices having the potential to attract hazardous wildlife and threaten aviation safety. In addition to the specific considerations outlined below, airport operators should refer to *Wildlife Hazard Management at Airports,* prepared by FAA and U.S. Department of Agriculture (USDA) staff. (This manual is available in English, Spanish, and French. It can be viewed and downloaded free of charge from the FAA's wildlife hazard mitigation web site: http://wildlife-mitigation.tc.FAA.gov.). And, *Prevention and Control of Wildlife Damage,* compiled by the University of Nebraska Cooperative Extension Division. (This manual is available online in a periodically updated version at: ianrwww.unl.edu/wildlife/solutions/handbook/.)

2-2. WASTE DISPOSAL OPERATIONS. Municipal solid waste landfills (MSWLF) are known to attract large numbers of hazardous wildlife, particularly birds. Because of this, these operations, when located within the separations identified in the siting criteria in Sections 1-2 through 1-4, are considered incompatible with safe airport operations.

a. **Siting for new municipal solid waste landfills subject to AIR 21.** Section 503 of the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (Public Law 106-181) (AIR 21) prohibits the construction or establishment of a new MSWLF within 6 statute miles of certain public-use airports. Before these prohibitions apply, both the airport and the landfill must meet the very specific conditions described below. These restrictions do not apply to airports or landfills located within the state of Alaska.

   The airport must (1) have received a Federal grant(s) under 49 U.S.C. § 47101, et. seq.; (2) be under control of a public agency; (3) serve some scheduled air carrier operations conducted in aircraft with less than 60 seats; and (4) have total annual enplanements consisting of at least 51 percent of scheduled air carrier enplanements conducted in aircraft with less than 60 passenger seats.

   The proposed MSWLF must (1) be within 6 miles of the airport, as measured from airport property line to MSWLF property line, and (2) have started construction or establishment on or after April 5, 2001. Public Law 106-181 only limits the construction or establishment of some new MSWLF. It does not limit the expansion, either vertical or horizontal, of existing landfills.

   NOTE: Consult the most recent version of AC 150/5200-34, *Construction or Establishment of Landfills Near Public Airports,* for a more detailed discussion of these restrictions.

b. **Siting for new MSWLF not subject to AIR 21.** If an airport and MSWLF do not meet the restrictions of Public Law 106-181, the FAA recommends against locating MSWLF within the separation distances identified in Sections 1-2 through 1-4. The separation distances should be measured from the closest point of the airport's AOA to the closest planned MSWLF cell.

c. **Considerations for existing waste disposal facilities within the limits of separation criteria.** The FAA recommends against airport development projects that would increase the number of aircraft operations or accommodate larger or faster aircraft near MSWLF operations located within the separations identified in Sections 1-2 through 1-4. In addition, in accordance with 40 CFR 258.10, owners or operators of existing MSWLF units that are located within the separations listed in Sections 1-2 through 1-4 must demonstrate that the unit is designed and operated so it does not pose a bird hazard to aircraft. (See Section 4-2(b) of this AC for a discussion of this demonstration requirement.)

d. **Enclosed trash transfer stations.** Enclosed waste-handling facilities that receive garbage behind closed doors; process it via compaction, incineration, or similar manner; and remove all residue by enclosed vehicles generally are compatible with safe airport operations, provided they are not located on airport property or within the Runway Protection Zone (RPZ). These facilities should not handle or store putrescible waste outside or in a partially enclosed structure accessible to hazardous wildlife. Trash transfer facilities that are open on one or more sides; that store uncovered quantities of municipal solid waste outside, even if only for a short time; that use semi-trailers that leak or have trash clinging to the outside; or that do not control odors by ventilation and filtration systems (odor masking is not acceptable) do not meet the FAA's definition of fully enclosed trash transfer stations. The FAA considers these facilities incompatible with safe airport operations if they are located closer than the separation distances specified in Sections 1-2 through 1-4.

e. **Composting operations on or near airport property.** Composting operations that accept only yard waste (e.g., leaves, lawn clippings, or branches) generally do not attract hazardous wildlife. Sewage sludge, woodchips, and similar material are not municipal solid wastes and may be used as compost bulking agents. The compost, however, must never include food or other municipal solid waste. Composting operations should not be located on airport property. Off-airport property composting operations should be located no closer than the greater of the following distances: 1,200 feet from any AOA or the distance called for by airport design requirements (see AC 150/5300-13, *Airport Design*). This spacing should prevent material, personnel, or equipment from penetrating any Object Free Area (OFA), Obstacle Free Zone (OFZ), Threshold Siting Surface (TSS), or Clearway. Airport operators should monitor composting operations located in proximity to the airport to ensure that steam or thermal rise does not adversely affect air traffic. On-airport disposal of compost by-products should not be conducted for the reasons stated in 2-3f.

f. **Underwater waste discharges.** The FAA recommends against the underwater discharge of any food waste (e.g., fish processing offal) within the separations identified in Sections 1-2 through 1-4 because it could attract scavenging hazardous wildlife.

g. **Recycling centers.** Recycling centers that accept previously sorted non-food items, such as glass, newspaper, cardboard, or aluminum, are, in most cases, not attractive to hazardous wildlife and are acceptable.

h. **Construction and demolition (C&D) debris facilities.** C&D landfills do not generally attract hazardous wildlife and are acceptable if maintained in an orderly manner, admit no putrescible waste, and are not co-located with other waste disposal operations. However, C&D landfills have similar visual and operational characteristics to putrescible waste disposal sites. When co-located with putrescible waste disposal operations, C&D landfills are more likely to attract hazardous wildlife because of the similarities between these disposal facilities. Therefore, a C&D landfill co-located with another waste disposal operation should be located outside of the separations identified in Sections 1-2 through 1-4.

i. **Fly ash disposal.** The incinerated residue from resource recovery power/heat-generating facilities that are fired by municipal solid waste, coal, or wood is generally not a wildlife attractant because it no longer contains putrescible matter. Landfills accepting only fly ash are generally not considered to be wildlife attractants and are acceptable as long as they are maintained in an orderly manner, admit no putrescible waste of any kind, and are not co-located with other disposal operations that attract hazardous wildlife.

   Since varying degrees of waste consumption are associated with general incineration (not resource recovery power/heat-generating facilities), the FAA considers the ash from general incinerators a regular waste disposal by-product and, therefore, a hazardous wildlife attractant if disposed of within the separation criteria outlined in Sections 1-2 through 1-4.

2-3. WATER MANAGEMENT FACILITIES. Drinking water intake and treatment facilities, storm water and wastewater treatment facilities, associated retention and settling ponds, ponds built for recreational use, and ponds that result from mining activities often attract large numbers of potentially hazardous wildlife. To prevent wildlife hazards, land-use developers and airport operators may need to develop management plans, in compliance with local and state regulations, to support the operation of storm water management facilities on or near all public-use airports to ensure a safe airport environment.

a. **Existing storm water management facilities.** On-airport storm water management facilities allow the quick removal of surface water, including discharges related to aircraft deicing, from impervious surfaces, such as pavement and terminal/hangar building roofs. Existing on-airport detention ponds collect storm water, protect water quality, and control runoff. Because they slowly release water

after storms, they create standing bodies of water that can attract hazardous wildlife. Where the airport has developed a Wildlife Hazard Management Plan (WHMP) in accordance with Part 139, the FAA requires immediate correction of any wildlife hazards arising from existing storm water facilities located on or near airports, using appropriate wildlife hazard mitigation techniques. Airport operators should develop measures to minimize hazardous wildlife attraction in consultation with a wildlife damage management biologist.

Where possible, airport operators should modify storm water detention ponds to allow a maximum 48-hour detention period for the design storm. The FAA recommends that airport operators avoid or remove retention ponds and detention ponds featuring dead storage to eliminate standing water. Detention basins should remain totally dry between rainfalls. Where constant flow of water is anticipated through the basin, or where any portion of the basin bottom may remain wet, the detention facility should include a concrete or paved pad and/or ditch/swale in the bottom to prevent vegetation that may provide nesting habitat.

When it is not possible to drain a large detention pond completely, airport operators may use physical barriers, such as bird balls, wires grids, pillows, or netting, to deter birds and other hazardous wildlife. When physical barriers are used, airport operators must evaluate their use and ensure they will not adversely affect water rescue. Before installing any physical barriers over detention ponds on Part 139 airports, airport operators must get approval from the appropriate FAA Regional Airports Division Office.

The FAA recommends that airport operators encourage off-airport storm water treatment facility operators to incorporate appropriate wildlife hazard mitigation techniques into storm water treatment facility operating practices when their facility is located within the separation criteria specified in Sections 1-2 through 1-4.

b. **New storm water management facilities.** The FAA strongly recommends that off-airport storm water management systems located within the separations identified in Sections 1-2 through 1-4 be designed and operated so as not to create above-ground standing water. Stormwater detention ponds should be designed, engineered, constructed, and maintained for a maximum 48–hour detention period after the design storm and remain completely dry between storms. To facilitate the control of hazardous wildlife, the FAA recommends the use of steep-sided, rip-rap lined, narrow, linearly shaped water detention basins. When it is not possible to place these ponds away from an airport's AOA, airport operators should use physical barriers, such as bird balls, wires grids, pillows, or netting, to prevent access of hazardous wildlife to open water and minimize aircraft-wildlife interactions. When physical barriers are used, airport operators must evaluate their use and ensure they will not adversely affect water rescue. Before installing any physical barriers over detention ponds on Part 139 airports, airport operators must get approval from the appropriate FAA Regional Airports Division Office. All vegetation in or around detention basins that provide food or cover for hazardous wildlife should be eliminated. If soil conditions and other requirements allow, the FAA encourages

the use of underground storm water infiltration systems, such as French drains or buried rock fields, because they are less attractive to wildlife.

c. **Existing wastewater treatment facilities.** The FAA strongly recommends that airport operators immediately correct any wildlife hazards arising from existing wastewater treatment facilities located on or near the airport. Where required, a WHMP developed in accordance with Part 139 will outline appropriate wildlife hazard mitigation techniques. Accordingly, airport operators should encourage wastewater treatment facility operators to incorporate measures, developed in consultation with a wildlife damage management biologist, to minimize hazardous wildlife attractants. Airport operators should also encourage those wastewater treatment facility operators to incorporate these mitigation techniques into their standard operating practices. In addition, airport operators should consider the existence of wastewater treatment facilities when evaluating proposed sites for new airport development projects and avoid such sites when practicable.

d. **New wastewater treatment facilities.** The FAA strongly recommends against the construction of new wastewater treatment facilities or associated settling ponds within the separations identified in Sections 1-2 through 1-4. Appendix 1 defines wastewater treatment facility as "any devices and/or systems used to store, treat, recycle, or reclaim municipal sewage or liquid industrial wastes." The definition includes any pretreatment involving the reduction of the amount of pollutants or the elimination of pollutants prior to introducing such pollutants into a publicly owned treatment works (wastewater treatment facility). During the site-location analysis for wastewater treatment facilities, developers should consider the potential to attract hazardous wildlife if an airport is in the vicinity of the proposed site, and airport operators should voice their opposition to such facilities if they are in proximity to the airport.

e. **Artificial marshes.** In warmer climates, wastewater treatment facilities sometimes employ artificial marshes and use submergent and emergent aquatic vegetation as natural filters. These artificial marshes may be used by some species of flocking birds, such as blackbirds and waterfowl, for breeding or roosting activities. The FAA strongly recommends against establishing artificial marshes within the separations identified in Sections 1-2 through 1-4.

f. **Wastewater discharge and sludge disposal.** The FAA recommends against the discharge of wastewater or sludge on airport property because it may improve soil moisture and quality on unpaved areas and lead to improved turf growth that can be an attractive food source for many species of animals. Also, the turf requires more frequent mowing, which in turn may mutilate or flush insects or small animals and produce straw, both of which can attract hazardous wildlife. In addition, the improved turf may attract grazing wildlife, such as deer and geese. Problems may also occur when discharges saturate unpaved airport areas. The resultant soft, muddy conditions can severely restrict or prevent emergency vehicles from reaching accident sites in a timely manner.

2-4. WETLANDS. Wetlands provide a variety of functions and can be regulated by local, state, and Federal laws. Normally, wetlands are attractive to many types of wildlife, including many which rank high on the list of hazardous wildlife species (Table 1).

NOTE: If questions exist as to whether an area qualifies as a wetland, contact the local division of the U.S. Army Corps of Engineers, the Natural Resources Conservation Service, or a wetland consultant qualified to delineate wetlands.

a. **Existing wetlands on or near airport property.** If wetlands are located on or near airport property, airport operators should be alert to any wildlife use or habitat changes in these areas that could affect safe aircraft operations. At public-use airports, the FAA recommends immediately correcting, in cooperation with local, state, and Federal regulatory agencies, any wildlife hazards arising from existing wetlands located on or near airports. Where required, a WHMP will outline appropriate wildlife hazard mitigation techniques. Accordingly, airport operators should develop measures to minimize hazardous wildlife attraction in consultation with a wildlife damage management biologist.

b. **New airport development.** Whenever possible, the FAA recommends locating new airports using the separations from wetlands identified in Sections 1-2 through 1-4. Where alternative sites are not practicable, or when airport operators are expanding an existing airport into or near wetlands, a wildlife damage management biologist, in consultation with the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, and the state wildlife management agency should evaluate the wildlife hazards and prepare a WHMP that indicates methods of minimizing the hazards.

c. **Mitigation for wetland impacts from airport projects.** Wetland mitigation may be necessary when unavoidable wetland disturbances result from new airport development projects or projects required to correct wildlife hazards from wetlands. Wetland mitigation must be designed so it does not create a wildlife hazard. The FAA recommends that wetland mitigation projects that may attract hazardous wildlife be sited outside of the separations identified in Sections 1-2 through 1-4.

   (1) Onsite mitigation of wetland functions. The FAA may consider exceptions to locating mitigation activities outside the separations identified in Sections 1-2 through 1-4 if the affected wetlands provide unique ecological functions, such as critical habitat for threatened or endangered species or ground water recharge, which cannot be replicated when moved to a different location. Using existing airport property is sometimes the only feasible way to achieve the mitigation ratios mandated in regulatory orders and/or settlement agreements with the resource agencies. Conservation easements are an additional means of providing mitigation for project impacts. Typically the airport operator continues to own the property, and an easement is created stipulating that the property will be maintained as habitat for state or Federally listed species.

Mitigation must not inhibit the airport operator's ability to effectively control hazardous wildlife on or near the mitigation site or effectively maintain other aspects of safe airport operations. Enhancing such mitigation areas to attract hazardous wildlife must be avoided. The FAA will review any onsite mitigation proposals to determine compatibility with safe airport operations. A wildlife damage management biologist should evaluate any wetland mitigation projects that are needed to protect unique wetland functions and that must be located in the separation criteria in Sections 1-2 through 1-4 before the mitigation is implemented. A WHMP should be developed to reduce the wildlife hazards.

(2) Offsite mitigation of wetland functions. The FAA recommends that wetland mitigation projects that may attract hazardous wildlife be sited outside of the separations identified in Sections 1-2 through 1-4 unless they provide unique functions that must remain onsite (see 2-4c(1)). Agencies that regulate impacts to or around wetlands recognize that it may be necessary to split wetland functions in mitigation schemes. Therefore, regulatory agencies may, under certain circumstances, allow portions of mitigation to take place in different locations.

(3) Mitigation banking. Wetland mitigation banking is the creation or restoration of wetlands in order to provide mitigation credits that can be used to offset permitted wetland losses. Mitigation banking benefits wetland resources by providing advance replacement for permitted wetland losses; consolidating small projects into larger, better-designed and managed units; and encouraging integration of wetland mitigation projects with watershed planning. This last benefit is most helpful for airport projects, as wetland impacts mitigated outside of the separations identified in Sections 1-2 through 1-4 can still be located within the same watershed. Wetland mitigation banks meeting the separation criteria offer an ecologically sound approach to mitigation in these situations. Airport operators should work with local watershed management agencies or organizations to develop mitigation banking for wetland impacts on airport property.

2-5. DREDGE SPOIL CONTAINMENT AREAS. The FAA recommends against locating dredge spoil containment areas (also known as Confined Disposal Facilities) within the separations identified in Sections 1-2 through 1-4 if the containment area or the spoils contain material that would attract hazardous wildlife.

2-6. AGRICULTURAL ACTIVITIES. Because most, if not all, agricultural crops can attract hazardous wildlife during some phase of production, the FAA recommends against the used of airport property for agricultural production, including hay crops, within the separations identified in Sections 1-2 through 1-4. . If the airport has no financial alternative to agricultural crops to produce income necessary to maintain the viability of the airport, then the airport shall follow the crop distance guidelines listed in the table titled "Minimum Distances between Certain Airport Features and Any On-Airport Agricultural Crops" found in AC 150/5300-13, *Airport Design*, Appendix 17. The cost of wildlife control and potential accidents should be weighed against the income produced by the on-airport crops when deciding whether to allow crops on the airport.

a. **Livestock production.** Confined livestock operations (i.e., feedlots, dairy operations, hog or chicken production facilities, or egg laying operations) often attract flocking birds, such as starlings, that pose a hazard to aviation. Therefore, The FAA recommends against such facilities within the separations identified in Sections 1-2 through 1-4. Any livestock operation within these separations should have a program developed to reduce the attractiveness of the site to species that are hazardous to aviation safety. Free-ranging livestock must not be grazed on airport property because the animals may wander onto the AOA. Furthermore, livestock feed, water, and manure may attract birds.

b. **Aquaculture.** Aquaculture activities (i.e. catfish or trout production) conducted outside of fully enclosed buildings are inherently attractive to a wide variety of birds. Existing aquaculture facilities/activities within the separations listed in Sections 1-2 through 1-4 must have a program developed to reduce the attractiveness of the sites to species that are hazardous to aviation safety. Airport operators should also oppose the establishment of new aquaculture facilities/activities within the separations listed in Sections 1-2 through 1-4.

c. **Alternative uses of agricultural land.** Some airports are surrounded by vast areas of farmed land within the distances specified in Sections 1-2 through 1-4. Seasonal uses of agricultural land for activities such as hunting can create a hazardous wildlife situation. In some areas, farmers will rent their land for hunting purposes. Rice farmers, for example, flood their land during waterfowl hunting season and obtain additional revenue by renting out duck blinds. The duck hunters then use decoys and call in hundreds, if not thousands, of birds, creating a tremendous threat to aircraft safety. A wildlife damage management biologist should review, in coordination with local farmers and producers, these types of seasonal land uses and incorporate them into the WHMP.

2-7. GOLF COURSES, LANDSCAPING AND OTHER LAND-USE CONSIDERATIONS.

a. **Golf courses.** The large grassy areas and open water found on most golf courses are attractive to hazardous wildlife, particularly Canada geese and some species of gulls. These species can pose a threat to aviation safety. The FAA recommends against construction of new golf courses within the separations identified in Sections 1-2 through 1-4. Existing golf courses located within these separations must develop a program to reduce the attractiveness of the sites to species that are hazardous to aviation safety. Airport operators should ensure these golf courses are monitored on a continuing basis for the presence of hazardous wildlife. If hazardous wildlife is detected, corrective actions should be immediately implemented.

b. **Landscaping and landscape maintenance.** Depending on its geographic location, landscaping can attract hazardous wildlife. The FAA recommends that airport operators approach landscaping with caution and confine it to airport areas not associated with aircraft movements. A wildlife damage management biologist should review all landscaping plans. Airport operators should also monitor all landscaped areas on a continuing basis for the presence of hazardous wildlife. If

hazardous wildlife is detected, corrective actions should be immediately implemented.

Turf grass areas can be highly attractive to a variety of hazardous wildlife species. Research conducted by the USDA Wildlife Services' National Wildlife Research Center has shown that no one grass management regime will deter all species of hazardous wildlife in all situations. In cooperation with wildlife damage management biologist, airport operators should develop airport turf grass management plans on a prescription basis, depending on the airport's geographic locations and the type of hazardous wildlife likely to frequent the airport

Airport operators should ensure that plant varieties attractive to hazardous wildlife are not used on the airport. Disturbed areas or areas in need of re-vegetating should not be planted with seed mixtures containing millet or any other large-seed producing grass. For airport property already planted with seed mixtures containing millet, rye grass, or other large-seed producing grasses, the FAA recommends disking, plowing, or another suitable agricultural practice to prevent plant maturation and seed head production. Plantings should follow the specific recommendations for grass management and seed and plant selection made by the State University Cooperative Extension Service, the local office of Wildlife Services, or a qualified wildlife damage management biologist. Airport operators should also consider developing and implementing a preferred/prohibited plant species list, reviewed by a wildlife damage management biologist, which has been designed for the geographic location to reduce the attractiveness to hazardous wildlife for landscaping airport property.

c. **Airports surrounded by wildlife habitat.** The FAA recommends that operators of airports surrounded by woodlands, water, or wetlands refer to Section 2.4 of this AC. Operators of such airports should provide for a Wildlife Hazard Assessment (WHA) conducted by a wildlife damage management biologist. This WHA is the first step in preparing a WHMP, where required.

d. **Other hazardous wildlife attractants.** Other specific land uses or activities (e.g., sport or commercial fishing, shellfish harvesting, etc.), perhaps unique to certain regions of the country, have the potential to attract hazardous wildlife. Regardless of the source of the attraction, when hazardous wildlife is noted on a public-use airport, airport operators must take prompt remedial action(s) to protect aviation safety.

2-8. SYNERGISTIC EFFECTS OF SURROUNDING LAND USES. There may be circumstances where two (or more) different land uses that would not, by themselves, be considered hazardous wildlife attractants or that are located outside of the separations identified in Sections 1-2 through 1-4 that are in such an alignment with the airport as to create a wildlife corridor directly through the airport and/or surrounding airspace. An example of this situation may involve a lake located outside of the separation criteria on the east side of an airport and a large hayfield on the west side of an airport, land uses that together could create a flyway for Canada geese directly across the airspace of the airport. There are numerous examples of such situations;

therefore, airport operators and the wildlife damage management biologist must consider the entire surrounding landscape and community when developing the WHMP.

SECTION 3.

PROCEDURES FOR WILDLIFE HAZARD MANAGEMENT BY OPERATORS OF PUBLIC-USE AIRPORTS.

3.1. INTRODUCTION. In recognition of the increased risk of serious aircraft damage or the loss of human life that can result from a wildlife strike, the FAA may require the development of a Wildlife Hazard Management Plan (WHMP) when specific triggering events occur on or near the airport. Part 139.337 discusses the specific events that trigger a Wildlife Hazard Assessment (WHA) and the specific issues that a WHMP must address for FAA approval and inclusion in an Airport Certification Manual.

3.2. COORDINATION WITH USDA WILDLIFE SERVICES OR OTHER QUALIFIED WILDLIFE DAMAGE MANAGEMENT BIOLOGISTS. The FAA will use the Wildlife Hazard Assessment (WHA) conducted in accordance with Part 139 to determine if the airport needs a WHMP. Therefore, persons having the education, training, and expertise necessary to assess wildlife hazards must conduct the WHA. The airport operator may look to Wildlife Services or to qualified private consultants to conduct the WHA. When the services of a wildlife damage management biologist are required, the FAA recommends that land-use developers or airport operators contact a consultant specializing in wildlife damage management or the appropriate state director of Wildlife Services.

NOTE: Telephone numbers for the respective USDA Wildlife Services state offices can be obtained by contacting USDA Wildlife Services Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD, 20737-1234, Telephone (301) 734-7921, Fax (301) 734-5157 *(http://www.aphis.usda.gov/ws/)*.

3-3. WILDLIFE HAZARD MANAGEMENT AT AIRPORTS: A MANUAL FOR AIRPORT PERSONNEL. This manual, prepared by FAA and USDA Wildlife Services staff, contains a compilation of information to assist airport personnel in the development, implementation, and evaluation of WHMPs at airports. The manual includes specific information on the nature of wildlife strikes, legal authority, regulations, wildlife management techniques, WHAs, WHMPs, and sources of help and information. The manual is available in three languages: English, Spanish, and French. It can be viewed and downloaded free of charge from the FAA's wildlife hazard mitigation web site: http://wildlife-mitigation.tc.FAA.gov/. This manual only provides a starting point for addressing wildlife hazard issues at airports. Hazardous wildlife management is a complex discipline and conditions vary widely across the United States. Therefore, qualified wildlife damage management biologists must direct the development of a WHMP and the implementation of management actions by airport personnel.

There are many other resources complementary to this manual for use in developing and implementing WHMPs. Several are listed in the manual's bibliography.

3-4. WILDLIFE HAZARD ASSESSMENTS, TITLE 14, CODE OF FEDERAL REGULATIONS, PART 139. Part 139.337(b) requires airport operators to conduct a Wildlife Hazard Assessment (WHA) when certain events occur on or near the airport.

Part 139.337 (c) provides specific guidance as to what facts must be addressed in a WHA.

3-5. WILDLIFE HAZARD MANAGEMENT PLAN (WHMP). The FAA will consider the results of the WHA, along with the aeronautical activity at the airport and the views of the airport operator and airport users, in determining whether a formal WHMP is needed, in accordance with Part 139.337. If the FAA determines that a WHMP is needed, the airport operator must formulate and implement a WHMP, using the WHA as the basis for the plan.

The goal of an airport's Wildlife Hazard Management Plan is to minimize the risk to aviation safety, airport structures or equipment, or human health posed by populations of hazardous wildlife on and around the airport.

The WHMP must identify hazardous wildlife attractants on or near the airport and the appropriate wildlife damage management techniques to minimize the wildlife hazard. It must also prioritize the management measures.

3-6. LOCAL COORDINATION. The establishment of a Wildlife Hazards Working Group (WHWG) will facilitate the communication, cooperation, and coordination of the airport and its surrounding community necessary to ensure the effectiveness of the WHMP. The cooperation of the airport community is also necessary when new projects are considered. Whether on or off the airport, the input from all involved parties must be considered when a potentially hazardous wildlife attractant is being proposed. Airport operators should also incorporate public education activities with the local coordination efforts because some activities in the vicinity of your airport, while harmless under normal leisure conditions, can attract wildlife and present a danger to aircraft. For example, if public trails are planned near wetlands or in parks adjoining airport property, the public should know that feeding birds and other wildlife in the area may pose a risk to aircraft.

Airport operators should work with local and regional planning and zoning boards so as to be aware of proposed land-use changes, or modification of existing land uses, that could create hazardous wildlife attractants within the separations identified in Sections 1-2 through 1-4. Pay particular attention to proposed land uses involving creation or expansion of waste water treatment facilities, development of wetland mitigation sites, or development or expansion of dredge spoil containment areas. At the very least, airport operators must ensure they are on the notification list of the local planning board or equivalent review entity for all communities located within 5 miles of the airport, so they will receive notification of any proposed project and have the opportunity to review it for attractiveness to hazardous wildlife.

3-7 COORDINATION/NOTIFICATION OF AIRMEN OF WILDLIFE HAZARDS. If an existing land-use practice creates a wildlife hazard and the land-use practice or wildlife hazard cannot be immediately eliminated, airport operators must issue a Notice to Airmen (NOTAM) and encourage the land–owner or manager to take steps to control the wildlife hazard and minimize further attraction.

SECTION 4.

FAA NOTIFICATION AND REVIEW OF PROPOSED LAND-USE PRACTICE CHANGES IN THE VICINITY OF PUBLIC-USE AIRPORTS

4-1. FAA REVIEW OF PROPOSED LAND-USE PRACTICE CHANGES IN THE VICINITY OF PUBLIC-USE AIRPORTS.

a. The FAA discourages the development of waste disposal and other facilities, discussed in Section 2, located within the 5,000/10,000-foot criteria specified in Sections 1-2 through 1-4.

b. For projects that are located outside the 5,000/10,000-foot criteria but within 5 statute miles of the airport's AOA, the FAA may review development plans, proposed land-use changes, operational changes, or wetland mitigation plans to determine if such changes present potential wildlife hazards to aircraft operations. The FAA considers sensitive airport areas as those that lie under or next to approach or departure airspace. This brief examination should indicate if further investigation is warranted.

c. Where a wildlife damage management biologist has conducted a further study to evaluate a site's compatibility with airport operations, the FAA may use the study results to make a determination.

4-2. WASTE MANAGEMENT FACILITIES.

a. Notification of new/expanded project proposal. Section 503 of the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (Public Law 106-181) limits the construction or establishment of new MSWLF within 6 statute miles of certain public-use airports, when both the airport and the landfill meet very specific conditions. See Section 2-2 of this AC and AC 150/5200-34 for a more detailed discussion of these restrictions.

The Environmental Protection Agency (EPA) requires any MSWLF operator proposing a new or expanded waste disposal operation within 5 statute miles of a runway end to notify the appropriate FAA Regional Airports Division Office and the airport operator of the proposal (40 CFR 258, *Criteria for Municipal Solid Waste Landfills*, Section 258.10, *Airport Safety*). The EPA also requires owners or operators of new MSWLF units, or lateral expansions of existing MSWLF units, that are located within 10,000 feet of any airport runway end used by turbojet aircraft, or within 5,000 feet of any airport runway end used only by piston-type aircraft, to demonstrate successfully that such units are not hazards to aircraft. (See 4-2.b below.)

When new or expanded MSWLF are being proposed near airports, MSWLF operators must notify the airport operator and the FAA of the proposal as early as possible pursuant to 40 CFR 258.

b. **Waste handling facilities within separations identified in Sections 1-2 through 1-4.** To claim successfully that a waste-handling facility sited within the separations identified in Sections 1-2 through 1-4 does not attract hazardous wildlife and does not threaten aviation, the developer must establish convincingly that the facility will not handle putrescible material other than that as outlined in 2-2.d. The FAA strongly recommends against any facility other than that as outlined in 2-2.d (enclosed transfer stations). The FAA will use this information to determine if the facility will be a hazard to aviation.

c. **Putrescible-Waste Facilities.** In their effort to satisfy the EPA requirement, some putrescible-waste facility proponents may offer to undertake experimental measures to demonstrate that their proposed facility will not be a hazard to aircraft. To date, no such facility has been able to demonstrate an ability to reduce and sustain hazardous wildlife to levels that existed before the putrescible-waste landfill began operating. For this reason, demonstrations of experimental wildlife control measures may not be conducted within the separation identified in Sections 1-2 through 1-4.

4-3. OTHER LAND-USE PRACTICE CHANGES. As a matter of policy, the FAA encourages operators of public-use airports who become aware of proposed land use practice changes that may attract hazardous wildlife within 5 statute miles of their airports to promptly notify the FAA. The FAA also encourages proponents of such land use changes to notify the FAA as early in the planning process as possible. Advanced notice affords the FAA an opportunity (1) to evaluate the effect of a particular land-use change on aviation safety and (2) to support efforts by the airport sponsor to restrict the use of land next to or near the airport to uses that are compatible with the airport.

The airport operator, project proponent, or land-use operator may use FAA Form 7460-1, *Notice of Proposed Construction or Alteration*, or other suitable documents similar to FAA Form 7460-1 to notify the appropriate FAA Regional Airports Division Office. Project proponents can contact the appropriate FAA Regional Airports Division Office for assistance with the notification process.

It is helpful if the notification includes a 15-minute quadrangle map of the area identifying the location of the proposed activity. The land-use operator or project proponent should also forward specific details of the proposed land-use change or operational change or expansion. In the case of solid waste landfills, the information should include the type of waste to be handled, how the waste will be processed, and final disposal methods.

a. **Airports that have received Federal grant-in-aid assistance.** Airports that have received Federal grant-in-aid assistance are required by their grant assurances to take appropriate actions to restrict the use of land next to or near the airport to uses that are compatible with normal airport operations. The FAA recommends that airport operators to the extent practicable oppose off-airport land-use changes or practices within the separations identified in Sections 1-2 through 1-4 that may attract hazardous wildlife. Failure to do so may lead to noncompliance with applicable grant assurances. The FAA will not approve the placement of airport

development projects pertaining to aircraft movement in the vicinity of hazardous wildlife attractants without appropriate mitigating measures. Increasing the intensity of wildlife control efforts is not a substitute for eliminating or reducing a proposed wildlife hazard. Airport operators should identify hazardous wildlife attractants and any associated wildlife hazards during any planning process for new airport development projects.

This page intentionally left blank.

APPENDIX 1. DEFINITIONS OF TERMS USED IN THIS ADVISORY CIRCULAR.

1. **GENERAL.** This appendix provides definitions of terms used throughout this AC.

   1. **Air operations area.** Any area of an airport used or intended to be used for landing, takeoff, or surface maneuvering of aircraft. An air operations area includes such paved areas or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiways, or apron.

   2. **Airport operator.** The operator (private or public) or sponsor of a public-use airport.

   3. **Approach or departure airspace.** The airspace, within 5 statute miles of an airport, through which aircraft move during landing or takeoff.

   4. **Bird balls.** High-density plastic floating balls that can be used to cover ponds and prevent birds from using the sites.

   5. **Certificate holder.** The holder of an Airport Operating Certificate issued under Title 14, Code of Federal Regulations, Part 139.

   6. **Construct a new MSWLF.** To begin to excavate, grade land, or raise structures to prepare a municipal solid waste landfill as permitted by the appropriate regulatory or permitting agency.

   7. **Detention ponds.** Storm water management ponds that hold storm water for short periods of time, a few hours to a few days.

   8. **Establish a new MSWLF.** When the first load of putrescible waste is received on-site for placement in a prepared municipal solid waste landfill.

   9. **Fly ash.** The fine, sand-like residue resulting from the complete incineration of an organic fuel source. Fly ash typically results from the combustion of coal or waste used to operate a power generating plant.

   10. **General aviation aircraft.** Any civil aviation aircraft not operating under 14 CFR Part 119, Certification: Air Carriers and Commercial Operators.

   11. **Hazardous wildlife.** Species of wildlife (birds, mammals, reptiles), including feral animals and domesticated animals not under control, that are associated with aircraft strike problems, are capable of causing structural damage to airport facilities, or act as attractants to other wildlife that pose a strike hazard

   12. **Municipal Solid Waste Landfill (MSWLF).** A publicly or privately owned discrete area of land or an excavation that receives household waste and that is not a land application unit, surface impoundment, injection well, or waste pile, as those terms are defined under 40 CFR § 257.2. An MSWLF may receive

other types wastes, such as commercial solid waste, non-hazardous sludge, small-quantity generator waste, and industrial solid waste, as defined under 40 CFR § 258.2. An MSWLF can consist of either a stand alone unit or several cells that receive household waste.

13. **New MSWLF.** A municipal solid waste landfill that was established or constructed after April 5, 2001.

14. **Piston-powered aircraft.** Fixed-wing aircraft powered by piston engines.

15. **Piston-use airport.** Any airport that does not sell Jet-A fuel for fixed-wing turbine-powered aircraft, and primarily serves fixed-wing, piston-powered aircraft. Incidental use of the airport by turbine-powered, fixed-wing aircraft would not affect this designation. However, such aircraft should not be based at the airport.

16. **Public agency.** A State or political subdivision of a State, a tax-supported organization, or an Indian tribe or pueblo (49 U.S.C. § 47102(19)).

17. **Public airport.** An airport used or intended to be used for public purposes that is under the control of a public agency; and of which the area used or intended to be used for landing, taking off, or surface maneuvering of aircraft is publicly owned (49 U.S.C. § 47102(20)).

18. **Public-use airport.** An airport used or intended to be used for public purposes, and of which the area used or intended to be used for landing, taking off, or surface maneuvering of aircraft may be under the control of a public agency or privately owned and used for public purposes (49 U.S.C. § 47102(21)).

19. **Putrescible waste.** Solid waste that contains organic matter capable of being decomposed by micro-organisms and of such a character and proportion as to be capable of attracting or providing food for birds (40 CFR §257.3-8).

20. **Putrescible-waste disposal operation.** Landfills, garbage dumps, underwater waste discharges, or similar facilities where activities include processing, burying, storing, or otherwise disposing of putrescible material, trash, and refuse.

21. **Retention ponds.** Storm water management ponds that hold water for several months.

22. **Runway protection zone (RPZ).** An area off the runway end to enhance the protection of people and property on the ground (see AC 150/5300-13). The dimensions of this zone vary with the airport design, aircraft, type of operation, and visibility minimum.

23. **Scheduled air carrier operation.** Any common carriage passenger-carrying operation for compensation or hire conducted by an air carrier or commercial

operator for which the air carrier, commercial operator, or their representative offers in advance the departure location, departure time, and arrival location. It does not include any operation that is conducted as a supplemental operation under 14 CFR Part 119 or as a public charter operation under 14 CFR Part 380 (14 CFR § 119.3).

24. **Sewage sludge.** Any solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes, but is not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment process; and a material derived from sewage sludge. Sewage does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screenings generated during preliminary treatment of domestic sewage in a treatment works. (40 CFR 257.2)

25. **Sludge.** Any solid, semi-solid, or liquid waste generated form a municipal, commercial or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility or any other such waste having similar characteristics and effect. (40 CFR 257.2)

26. **Solid waste.** Any garbage, refuse, sludge, from a waste treatment plant, water supply treatment plant or air pollution control facility and other discarded material, including, solid liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved material in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act, as amended (86 Stat. 880), or source, special nuclear, or by product material as defined by the Atomic Energy Act of 1954, as amended, (68 Stat. 923). (40 CFR 257.2)

27. **Turbine-powered aircraft.** Aircraft powered by turbine engines including turbojets and turboprops but excluding turbo-shaft rotary-wing aircraft.

28. **Turbine-use airport.** Any airport that sells Jet-A fuel for fixed-wing turbine-powered aircraft.

29. **Wastewater treatment facility.** Any devices and/or systems used to store, treat, recycle, or reclaim municipal sewage or liquid industrial wastes, including Publicly Owned Treatment Works (POTW), as defined by Section 212 of the Federal Water Pollution Control Act (P.L. 92-500) as amended by the Clean Water Act of 1977 (P.L. 95-576) and the Water Quality Act of 1987 (P.L. 100-4). This definition includes any pretreatment involving the reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater prior to or in lieu of discharging or otherwise introducing such pollutants into a POTW. (See 40 CFR Section 403.3 (q), (r), & (s)).

30. **Wildlife.** Any wild animal, including without limitation any wild mammal, bird, reptile, fish, amphibian, mollusk, crustacean, arthropod, coelenterate, or other invertebrate, including any part, product, egg, or offspring thereof (50 CFR 10.12, *Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants*). As used in this AC, wildlife includes feral animals and domestic animals out of the control of their owners (14 CFR Part 139, Certification of Airports).

31. **Wildlife attractants.** Any human-made structure, land-use practice, or human-made or natural geographic feature that can attract or sustain hazardous wildlife within the landing or departure airspace or the airport's AOA. These attractants can include architectural features, landscaping, waste disposal sites, wastewater treatment facilities, agricultural or aquaculture activities, surface mining, or wetlands.

32. **Wildlife hazard.** A potential for a damaging aircraft collision with wildlife on or near an airport.

33. **Wildlife strike.** A wildlife strike is deemed to have occurred when:

    a. A pilot reports striking 1 or more birds or other wildlife;

    b. Aircraft maintenance personnel identify aircraft damage as having been caused by a wildlife strike;

    c. Personnel on the ground report seeing an aircraft strike 1 or more birds or other wildlife;

    d. Bird or other wildlife remains, whether in whole or in part, are found within 200 feet of a runway centerline, unless another reason for the animal's death is identified;

    e. The animal's presence on the airport had a significant negative effect on a flight (i.e., aborted takeoff, aborted landing, high-speed emergency stop, aircraft left pavement area to avoid collision with animal) (Transport Canada, Airports Group, *Wildlife Control Procedures Manual*, Technical Publication 11500E, 1994).

2. RESERVED.

14. County of Maui, Department of Environmental Management

ALAN M. ARAKAWA
Mayor

KYLE K. GINOZA, P.E.
Director

MICHAEL M. MIYAMOTO
Deputy Director

MICHAEL RATTE
Solid Waste Division

ERIC NAKAGAWA, P.E.
Wastewater Reclamation Division

COUNTY OF MAUI
DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
2050 MAIN STREET, SUITE 1C
WAILUKU, MAUI, HAWAII 96793

June 17, 2015

Planning Consultants Hawaii LLC
2331 W. Main Street
Wailuku, Hawaii 96793

SUBJECT: WAIKAPU COUNTRY TOWN ENVIRONMENTAL IMPACT STATEMENT PREPRARATION NOTICE TMK (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007, (2) 3-6-006:036, WAILUKU, MAUI

We reviewed the subject application and have the following comments:

1. Solid Waste Division comments:

    a. Estimate quantities for the types of construction waste that will be landfilled.

2. Wastewater Reclamation Division (WWRD) comments:

    a. The development will not be allowed to connect to the existing County wastewater collection system and treatment plant as its ultimate disposal plan.
    b. The Wailuku-Kahului Wastewater Reclamation Facility does not have the capacity to accept flows from outside the current service area in perpetuity without a project to increase its capacity.
    c. The existing collection system is inadequate and unable to accept flows from this development without significant upgrades.
    d. Developer shall work with the County of Maui and adjacent developers to complete a master planned treatment solution for the Waikapu area.
    e. Developer shall contribute their fair share to the implementation of the final treatment solution.
    f. The Department of Environmental Management and the Wastewater Reclamation Division will provide additional comments upon review of the Preliminary Engineering Report prepared for the EIS.

If you have any questions regarding this memorandum, please contact Michael Miyamoto at 270-8230.

Sincerely,

KYLE K. GINOZA, P.E.
Director of Environmental Management

PLANNING
CONSULTANTS
HAWAII, LLC

URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. Stewart Stant
Director of Environmental Management
County of Maui
Department of Environmental Management
2050 Main Street, Suite 1C
Wailuku, Maui, Hawaii 96793

Dear Mr. Stant:

Re: **Environmental Assessment** / Environmental Impact Statement Preparation Notice for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

This is in response to former Director Kyle Ginoza's letter dated June 17, 2015 regarding the above-referenced project. In response to the Department's comments, please find the following responses:

- **Solid Waste Division**

Construction Waste. During the construction phase, construction activities will require the disposal of the existing on-site waste, as well as cleared vegetation and construction-related solid waste. Using a 2003 publication by the Environmental Protection Agency (EPA) entitled "Estimating 2003 Building-Related Construction and Demolition Material Amounts", multipliers of 4.39 pounds per square feet of construction for residential and 4.34 pounds per square feet of construction for commercial buildings were used to determine potential construction waste generated by the Project. Using these factors, it is estimated that during the construction phase (2017-2026) residential construction waste might total approximately 8.7 million pounds or 4,350 tons of waste. The commercial component would generate approximately 736,000 pounds or 368 tons of waste through 2026.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

- **Wastewater Division Comments**

Wailuku-Kahului Wastewater Reclamation Facility. The Applicant has consulted with the Wastewater Division to discuss wastewater treatment options for the project since 2013. During these meetings, and in a subsequent letter dated July 16, 2013 from the Division, it was noted that significant off-site improvements to the transmission system would be required to accept additional flows from the project (See Exhibit 1, "Letter date July 16, 2013" and Exhibit 2, "Meeting Minutes dated November 25, 2013"). The Division has stated that a master planned wastewater treatment system to accommodate growth within the Waikapu area will be required for full built-out of the Project, as well as for other proposed developments within the immediate area.

The Applicant intends to continue working with the Department to develop a wastewater treatment program for the Project that best serves the immediate and long-term needs of the County.

Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

15. County of Maui, Department of Housing and Human Concerns

DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
HOUSING DIVISION
COUNTY OF MAUI

ALAN M. ARAKAWA
Mayor
JO-ANN T. RIDAO
Director
JAN SHISHIDO
Deputy Director

35 LUNALILO STREET, SUITE 102 • WAILUKU, HAWAII 96793 • PHONE (808) 270-7351 • FAX (808) 270-6284

June 1, 2015

Mr. Michael J. Summers, President
Planning Consultants Hawaii LLC
2331 W. Main Street
Wailuku, HI 96793

Dear Mr. Summers:

Subject: **Environmental Impact Statement Preparation Notice (EISPN) for Waikapu Country Town of Maui, Hawaii. TMK's (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036**

Thank you for the opportunity to review the Environmental Impact Statement Preparation Notice for the subject property. Based on our review, we have determined that the subject project is subject to Chapter 2.96, Maui County Code that a Residential Workforce Housing agreement is required with the Department of Housing and Human Concerns. At the present time, the Department has no additional comments to offer.

Please call Mr. Veranio Tongson Jr. of our Housing Division at 270-1741 if you have any questions.

Sincerely,

WAYDE T. OSHIRO
Housing Administrator

cc: Director of Housing and Human Concerns
Land Use Commission

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING
Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. Wayde T. Oshiro
Housing Administrator
County of Maui
Department of Housing and Human Concerns
35 Lunalilo Street, Suite 102
Wailuku, Maui, Hawaii 96793

Dear Mr. Oshiro:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated June 1, 2015 regarding the above-referenced project.

The Applicant acknowledges that the project will be subject to the requirements of Chapter 2.96, Maui County Code, which requires that the Applicant enter into a workforce housing agreement with the Department.

Thank you for your interest in the project. The Applicant looks forward to working closely with the Department as the project proceeds through the land use entitlement process. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

16. County of Maui, Department of Parks and Recreation

ALAN M. ARAKAWA
Mayor

KA'ALA BUENCONSEJO
Director

BRIANNE L. SAVAGE
Deputy Director

(808) 270-7230
FAX (808) 270-7934

DEPARTMENT OF PARKS & RECREATION

700 Hali'a Nakoa Street, Unit 2, Wailuku, Hawaii 96793

May 27, 2015

Mr. Michael Summers, President
Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Hawaii 96793

Dear Mr. Summers:

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) FOR PROPOSED WAIKAPU COUNTRY TOWN AT TMK: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007 AND (2) 3-6-006:036 WAILUKU, MAUI, HAWAII

Thank you for the opportunity to review and comment on the subject project.

The Department of Parks & Recreation has concerns regarding the effect the proposed project will have on the neighboring Waikapu Park and Community Center, and future County Baseyard and Central Maui Regional Park. We request for the EIS to address these concerns, as well as include detailed plans for the park areas proposed to be developed. We reserve further comments until such detailed plans for the park areas can be reviewed.

Should you have any questions or concerns, please feel free to contact me, or Robert Halvorson, Chief of Planning and Development, at 270-7931.

Sincerely,

KA'ALA BUENCONSEJO
Director of Parks & Recreation

c: Robert Halvorson, Chief of Planning and Development

KB:RH:csa

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. Ka`ala Buenconsejo
Director of Environmental Management
County of Maui
Department of Parks & Recreation
700 Hali'a Nakoa Street, Unit 2
Wailuku, Maui, Hawaii 96793

Dear Mr. Buenconsejo:

Re: **Environmental Assessment** / Environmental Impact Statement Preparation Notice for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated May 27, 2015 regarding the above-referenced project.

The Project will include active and passive recreation opportunities in a variety of configurations throughout the project site. The proposed park sites are identified and described in the DEIS. Moreover, the DEIS documents the Project's impacts upon neighboring lands uses, including County park facilities.

The Applicant looks forward to working closely with the Department of Parks and Recreation to ensure that the Project's park facilities adequately serve the needs of future project residents as well as current and future residents of Waikapu. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

17. County of Maui, Department of Planning

ALAN M. ARAKAWA
Mayor

WILLIAM R. SPENCE
Director

MICHELE CHOUTEAU McLEAN
Deputy Director

COUNTY OF MAUI

DEPARTMENT OF PLANNING

June 9, 2015

Mr. Michael J. Summers, President
Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Hawaii 96793

Dear Mr. Summers:

SUBJECT: REQUEST FOR COMMENT ON EARLY CONSULTATION FOR THE PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) PREPARED FOR A PETITION FOR A STATE LAND USE DISTRICT BOUNDARY AMENDMENT AND ANTICIPATED APPLICATIONS FOR A COMMUNITY PLAN AMENDMENT, CHANGE IN ZONING, AND PROJECT DISTRICT FOR THE PROPOSED WAIKAPU COUNTRY TOWN, LOCATED AT WAIKAPU, ISLAND OF MAUI, HAWAII; TMK: (2) 3-6-002:003 (POR), (2) 3-6-004:003 (POR), (2) 3-6-004:006 (POR), AND (2) 3-6-005:007 (POR) (RFC 2015/0069)

The Department of Planning (Department) is in receipt of the above-referenced document for the proposed Waikapu Country Town (Project). The Department concurred with the Petitioner that the State of Hawaii Land Use Commission should be the Accepting Authority for an environmental document and that an EIS is the appropriate document and that the Petitioner should proceed in the preparation of an EIS. On April 29, 2015, the State of Hawaii Land Use Commission agreed to be the Accepting Authority pursuant to Chapter 343, Hawaii Revised Statutes; and, determined that the proposed action may have a significant impact upon the environment to warrant proceeding directly to the preparation of an EIS.

Based on the foregoing, the Department provides the following comments with regards to the scope of work for the proposed Project and related District Boundary Amendment, Community Plan Amendment, Change in Zoning, and Project District applications:

1. Clearly outline how the Project is consistent with and meets the policies, goals, objectives, and implementing actions of the Maui County General Plan with an in-depth review of the Maui Island Plan, the Wailuku-Kahului Community Plan, and County Zoning;

2. Provide an in-depth analysis of Project impacts and mitigation measures to: 1) roadway infrastructure, 2) utilities, 3) drainage, 4) water supply, 5) wastewater, and any other public services;

3. Particular attention should be made to the Project's impact to views along the Honoapiilani Highway (Highway) of proposed construction. View simulations along the Highway should be included in the presentation and measures implemented to minimize impacts to views especially to the West Maui mountains;

4. Provide model streetscape scenes in various Project locations in order to help the Commissioners visualize the final build-out of the Project;

5. Outline road, infrastructure, landscape, and design connections of the proposed Project to adjacent neighborhoods; and

6. Outline energy, water, and other conservation measures to be employed during and after construction of the Project.

Thank you for the opportunity to comment on this Project of considerable magnitude and impact to the Maui Island community. The complexity of this Project is reflected in the decision to move forward on an EIS. The Department appreciates your anticipated responsiveness to the above comments regarding the proposed Draft EIS and will be reviewing the Draft EIS in detail along with submitting the Draft EIS for review and comment by the Maui Planning Commission prior to deliberations by the State of Hawaii Land Use Commission. Should you have any questions about the comments in this letter, please contact Staff Planner Kurt Wollenhaupt by email at kurt.wollenhaupt@mauicounty.gov or by phone at (808) 270-1789.

Sincerely,

WILLIAM SPENCE
Planning Director

xc: Clayton I. Yoshida, AICP, Planning Program Administrator (PDF)
John S. Rapacz, Planning Program Administrator (PDF)
Kurt F. Wollenhaupt, Staff Planner (PDF)
Project File
General File

WRS:KFW:nt
K:\WP_DOCS\PLANNING\RFC\2015\0069_WaikapuCountryTown\WaikapuCTEISPN_Comments.DOC

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. William Spence
Planning Director
County of Maui
Department of Planning
One Main Plaza Building
2200 Main Street, Suite 315
Wailuku, Maui, Hawaii 96793

Dear Mr. Spence:

Re: **Environmental Assessment** / Environmental Impact Statement Preparation Notice for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated June 9, 2015 regarding the above-referenced project. In response to your comments, please find the following responses:

1. The Draft Environmental Impact Statement (DEIS) provides an in-depth discussion of the Project's consistency with the goals, objectives, policies and implementing actions of the Maui Island Plan, Wailuku-Kahului Community Plan and County Zoning.

2. The DEIS provides an in-depth analysis of the Project's potential impacts and mitigation measures to infrastructure and public facilities including the following: 1) roadways, 2) utilities, 3) drainage, 4) water supply, 5) wastewater and other infrastructure and public facility systems.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

3. The DEIS addresses the Project's visual impacts along the Honoapiilani Highway. Visual simulations of expected post-project conditions have been conducted and are included in the report.

4. The DEIS includes model streetscape renderings in various project locations. These design renderings provide a sense of vision and place that the Applicant and Design Team hope to achieve through development of the project site in accordance with the to be adopted project district ordinance and supporting design guidelines.

5. The DEIS identifies and describes infrastructure and public facility connectivity between the Project and present and future neighboring residential and commercial developments.

6. The DIES includes a thorough description of energy, water and other conservation measures to be implemented by the Project. Sustainability goals, objectives and policies are included in the DEIS and a more detailed Sustainability Plan is being prepared.

Thank you very much for your interest in the project, while we look forward to working with your office as we proceed through the land use entitlement process. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

18. County of Maui, Police Department

POLICE DEPARTMENT
COUNTY OF MAUI

ALAN M. ARAKAWA
MAYOR

OUR REFERENCE

YOUR REFERENCE

55 MAHALANI STREET
WAILUKU, HAWAII 96793
(808) 244-6400
FAX (808) 244-6411

TIVOLI S. FAAUMU
CHIEF OF POLICE

DEAN M. RICKARD
DEPUTY CHIEF OF POLICE

June 2, 2015

Mr. Michael J. Summers
President
Planning Consultants Hawaii LLC
2331 W. Main Street
Wailuku, HI 96793

Dear Mr. Summers:

SUBJECT: Waikapu Country Town

This is in response to your letter, requesting comments and information on the above project.

We have reviewed the Environmental Impact Statement prepared for the project. Please refer to the enclosed copy of a report submitted by Officer Aylett Wallwork from Wailuku Patrol.

Thank you for giving us the opportunity to comment on this project.

Sincerely,

Assistant Chief Victor K. Ramos
for: Tivoli S. Faaumu
Chief of Police

c: Mr. Will Spence, Planning Dept.

Enclosure

TO : **TIVOLI S. FAAUMU, CHIEF OF POLICE, COUNTY OF MAUI**

VIA : **CHANNELS**

FROM : **AYLETT WALLWORK, POLICE OFFICER III, COMMUNITY POLICING**

SUBJECT : **WAIKAPU COUNTRY TOWN PROJECT**

Victor K. Ramos
Assistant Chief
06/01/15

This communication is submitted regarding the Waikapu Country Town project's request for any additional comments or questions that the department would liked addressed in their Draft Environmental Impact Statement (DEIS).

In review of the submitted documents, concerns from the police perspective are upon the safety of pedestrian and vehicular movement. However a Traffic Impact Analysis Report (TIAR) will be conducted at a later date.

Police coverage should be addressed, due to the study on Police protection that was done in 2005, and since then there has been several new developments such as Department of Hawaiian Homelands (Waiehu Kou, 2005 – 2014), Wailuku Country Estates (2005), Kehalani (2007 - 2020), Waikapu Gardens (2007 – 2016), Waiolani Phase II (2009), and Maui Lani (1998 – 2018). Waikapu County Town will be adding over 1,400 new residences, taxing the Police Department services. Fire and other emergency services have been considered for this project, but not Police Services.

CONCLUSION:

Draft Environmental Impact Statement should include the results of the Traffic Impact Analysis Report (TIAR). The impact upon Polices services should also be considered as over 1,400 new residences will be added to Waikapu. As a result, Police services in Wailuku and Kahului will be directly affected.

Respectfully submitted,

11764

Aylett WALLORK e#11764
P.O.III, Wailuku Patrol, Community Policing
05/26/2015@1215 hours

6/1/15

Ofc Aylett Wallwork points out that with a new development, the traffic will definitely impact the area (waikapu). Safety of pedestrian and vehicular movement is also affected. Other concerns are the effects upon all emergency services.

Sgt R. Lusher 10862
6-1-15 @ 0745 hrs

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. Tivoli S. Faaumu
Chief of Police
County of Maui
Police Department
55 Mahalani Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Faaumu:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated June 2, 2015 regarding the above-referenced project.

The Applicant acknowledges your concerns regarding the impact that the Project may have upon traffic and the additional demand it may generate for Police Department services. A Traffic Impact Analysis Report (TIAR) was prepared and has been incorporated into the Draft Environmental Impact Statement (DEIS). The DEIS also addresses the Project's impact upon Police Department services.

We look forward to working with your office as we proceed through the development review and land use entitlement processes. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

19. Department of the Interior, Fish and Wildlife Service

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

In Reply Refer To:
01EPIF00-2015-TA-0283

JUN 1 8 2015

Mr. Michael J. Summers, President
Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Hawaii 96793

Subject: Technical Assistance for Proposed Development of Waikapu Country Town, Wailuku, Maui

Dear Mr. Summers:

The U.S. Fish and Wildlife Service (Service) received your correspondence on May 22, 2015, requesting technical assistance regarding possible presence of endangered, threatened or protected flora and fauna on 499 acres of land located in central Maui at Waikapu that is proposed for urban and rural development (Waikapu Country Town). Lands not proposed for urban or rural development will remain within the State Agricultural District. The entire property, including the land to remain in agricultural use, comprises 1,576 acres and is identified by Tax Map Key Numbers (TMKs) (2) 3-6-005:007; (2) 3-6-002:001 and 003; (2) 3-6-006:036; and (2) 3-6-004:003 and 006. The property proposed for development as Waikapu Country Town includes TMKs (2) 3-6-004: Portion of 003; (2) 3-6-005: Portion of 007; (2) 3-6-002: Portion of 003; (2) 3-6-004:006; and (2) 3-6-005:007.

Based on information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Project, there are three listed animals, the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*), and the threatened Newell's shearwater (*Puffinus auricularis newelli*), and one endangered insect, the Blackburn's sphinx moth (*Manduca blackburni*) within or near the project area. There is no proposed or designated final critical habitat within the described project footprint. To help you minimize potential impacts to listed species, the Service is providing you the following avoidance and minimization measures. Please note that implementation of these measures does not ensure that impacts to listed species can be avoided, and further coordination with the Service on compliance with the ESA may be required.

Hawaiian hoary bat
The Hawaiian hoary bat is known to occur across a broad range of habitats throughout the State of Hawaii. This bat roosts in both exotic and native woody vegetation and, while foraging, leaves young unattended in "nursery" trees and shrubs. If trees or shrubs suitable for bat roosting are cleared during the Hawaiian hoary bat breeding season (June 1 to September 15),

there is a risk that young bats that cannot yet fly on their own could inadvertently be harmed or killed. As a result, the Service recommends that woody plants greater than 15 feet tall should not be removed or trimmed during the Hawaiian hoary bat breeding season. Additionally, Hawaiian hoary bats forage for insects from as low as three feet to higher than 500 feet above the ground. When barbed wire is used in fencing, Hawaiian hoary bats can become entangled. The Service, therefore, recommends that barbed wire not be used for fencing as part of this proposed action. Although bats were not documented as port of the 2013 surveys, please be aware that Hawaiian hoary bats are a cryptic species and have seasonal variations in range and distribution. Therefore, the Service recommends the incorporation of the above avoidance measures into the project description.

Seabirds

Hawaiian petrels and Newell's shearwaters (collectively known as seabirds) may transit over the proposed project area when flying between the ocean and nesting sites in the mountains during their breeding season (March through November). Seabird fatalities resulting from collisions with artificial structures that extend above the surrounding vegetation have been documented in Hawaii where high densities of transiting seabirds occur. Additionally, artificial lighting, such as flood lighting for construction work and site security, can adversely impact seabirds by causing disorientation which may result in collision with utility lines, buildings, fences and vehicles. Fledgling seabirds are especially affected by artificial lighting and have a tendency to exhaust themselves while circling the light sources and become grounded. Too weak to fly, these birds become vulnerable to depredation by feral predators such as cats (*Felis cattus*), dogs (*Canis familiaris*), and small Indian mongoose (*Herpestres auropunctatus*). Therefore the Service recommends that any telecommunications towers be unguyed and without lighting. We also recommend that night work requiring artificial illumination be avoided during the seabird fledging season (approximately September 15 through December 15). All project-related installed lighting should be minimized and shielded so the bulb is not visible at or above bulb-height.

Blackburn's sphinx moth

Blackburn's sphinx moths feed on nectar from native plants, including beach morning glory (*Ipomoea pes-caprae*), iliee (*Plumbago zeylanica*), and maiapilo (*Capparis sandwichiana*); larvae feed upon non-native tree tobacco (*Nicotiana glauca*) and native aiea (*Nothocestrum latifolium*). Tree tobacco is a weed species that grows rapidly and inhabits disturbed places, roadsides, urban waste areas, gravel quarries, landscaped sites, and natural communities, including riparian areas, grassland, and woodland. Mature tree tobacco can grow between 2 and 7 meters tall and Blackburn's sphinx moths may occupy tree tobacco that is less than 1-meter tall. Blackburn's sphinx moth pupae may occupy the soil within 250 feet of larval host plants for up to a year.

Two tree tobacco plants were found during surveys of the proposed project area at the northern end of a series of sugar cane fields at the base of a stockpiled sand pile. These two plants were carefully examined for eggs, larvae and signs of feeding. One plant was found to have two mature eggs on separate leaves. The eggs had turned brown, indicating they were ready to hatch out young larvae. As the site becomes disturbed, tree tobacco will spread and it is likely Blackburn's sphinx moth will utilize these plants. Tree tobacco plants are not native to Hawaii, but fall under the protection of the ESA during the period of their association with the endangered Blackburn's sphinx moth. We therefore recommend that you include an invasive species policy to remove all tree tobacco before it reaches 1-meter tall. All tree tobacco plants

greater than 1-meter may have Blackburn's sphinx moth eggs and/or larvae and should not be cut or otherwise disturbed. In addition, pupae may be in the ground near these plants. Therefore, we recommend all ground disturbing activities be avoided within 250 feet of tree tobacco that is greater than 1-meter tall.

Because surveys were conducted in 2013 (two years ago), we recommend that a qualified biologist survey the project area for the presence of Blackburn's sphinx moth and its host plants prior to construction. We further recommend that these surveys be conducted during the wettest portion of the year (usually November-April) and approximately four to eight weeks following a significant rainfall event. Surveys should include looking for eggs, larvae, and signs of larval feeding (chewed stems, frass, or leaf damage). If present, we recommend you coordinate with the Service to develop appropriate avoidance and minimization measures dependent upon the site specific information.

Thank you for your efforts to conserve listed species and native habitats. Please contact Fish and Wildlife Biologist Jay Nelson (808-792-9441) if you have any questions or for further guidance.

Sincerely,

Michelle Bogardus
Island Team Leader
Maui Nui and Hawaii Island

PLANNING CONSULTANTS HAWAII, LLC

URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Ms. Michelle Bogardus
Island Team Leader
Maui Nui and Hawaii Island
United States Department of the Interior
Fish and Wildlife Service
Pacific Island Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

Dear Ms. Bogardus:

Re: **Environmental Assessment** / Environmental Impact Statement Preparation Notice for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 18, 2015 letter providing comments in response to the above-referenced project.

The Draft Environmental Impact Statement (DEIS) incorporates the additional guidance provided in your letter regarding the Hawaiian hoary bat (*Lasiurus cinereus semotus),* Hawaiian petrel ((*Pterodroma phaeopygia sandwichensis),* Newell's shearwater *(Puffinus auricularis newelli)* and Blackburn's sphinx moth *(Manduca blackburni).* In response to your comments regarding the Blackburn's sphinx moth, we consulted with Recovery Biologist Rachel Rounds of your office and were provided with the additional guidance attached as Exhibit 1.

Thank you for your interest in the project, while we look forward to coordinating with your office as we proceed through the development review process. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

Sincerely yours,

Michael J. Summers

Michael J. Summers
President

Attachments

c: Mr. Michael Atherton
Mr. Albert Boyce

Michael Summers

From: Rachel Rounds <rachel_rounds@fws.gov>
Sent: Friday, December 18, 2015 10:19 AM
To: msummers@planningconsultantshawaii.com
Subject: Blackburn's sphinx moth guidance

Below find our latest Blackburn's sphinx moth guidance. Please let me know if you have any questions.

Rachel

Blackburn's sphinx moth – Adult Blackburn's sphinx moths feed on nectar from native plants, including pohuehue (*Ipomoea pescaprae*), iliee (*Plumbago zeylanica*), and maiapilo (*Capparis sandwichiana*). Blackburn's sphinx moth larvae feed upon the native aiea (*Nothocestrum sp.*), which is found in dry to moist forests at elevations ranging from 1,500 to 5,000 ft, and also the non-native tree tobacco (*Nicotiana glauca*), which occupies disturbed areas such as open fields and roadway margins.

1. Survey protocol:

Surveys for Blackburn's sphinx moth and its potential host plants will be conducted by a qualified individual during the wettest portion of the year (Hawaii Island: January to April; Maui North shore: November to April; rest of Maui: October to April – early surveys can be done if there have been Kona storms), approximately four to eight weeks following a significant rainfall event. In some cases, multiple surveys may be recommended.
If *Nothocestrum sp.* or *N. glauca* are detected during surveys, the plants will be visibly marked with flagging and the following documented: 1) general larval plant density; 2) proximity of larval plants to project sites; 3) average height of the larval plants; 4) signs of larval feeding damage on leaves; and 5) presence of Blackburn's sphinx moth larvae on leaves.

2. Avoidance and minimization: *N. glauca* frequently occurs in disturbed areas. Blackburn's sphinx moth adults lay eggs on *N. glauca* and moth larvae feed on the leaves of the plant before they crawl from the plant and burrow into the soil or crevices in rock where they pupate for up to a year or longer. They are most likely to pupate within 33 ft (10 m) of the larval host plant, although they may transit farther over paved and hardened surfaces to find a suitable site to enter the ground. The minimization measures below are conservative because our understanding of the species' resource limitations and behavior is limited. Clearing of the *N. glauca* would be completed using the following safeguards to ensure the potential for direct effects to Blackburn's sphinx moth eggs, larvae, and pupae are minimized:

- If *N. glauca* is less than three feet in height and no Blackburn's sphinx moth eggs, larvae, or signs indicating the possibility of pupating larvae (such as frass, chewed stems or other browsing characteristics) are detected, the entire plant(s) may be removed and the soil within 33 ft (10 m) may be disturbed.
- If *N. glauca* is more than three feet in height, it is possible that the signs of Blackburn's sphinx moth foraging have been shed and pupating larvae may be in the ground in the area beneath the plant(s). Therefore, if there are no signs of Blackburn's sphinx moth on *N. glauca* more than three feet in height, the above-ground portion of the plant(s) may be cut off and removed and the following measures implemented to minimize the potential for future use of the plant by Blackburn's sphinx moth and potential impact to a pupae that may already be in the soil near the plant:
  - Stems will be treated with herbicide or re-trimmed to prevent leaf growth and potential use by the Blackburn's sphinx moth.
  - A 33-ft (10-m) disturbance-free buffer will be established around the plant's location for one year. After one year, the plant roots may be removed and the soil disturbed if necessary. The one-year waiting period will ensure any larvae pupating in the soil will have pupated and emerged from the soil prior to disturbance of the plant(s) or soil.

Rachel Rounds
Recovery Biologist
Maui Nui/Hawaii Island Team

Exhibit 1, "E-mail from Rachel Rounds"

20. Department of Agriculture, National Resources Conservation Service

USDA

United States Department of Agriculture

June 2, 2015

Planning Consultants Hawaii LLC
Attn: Michael J. Summers
2331 W. Main Street
Wailuku, Hawaii 96793

Subject: USDA-NRCS Review for Waikapu Country Town Environmental Impact Statement Preparation Notice (EISPN)

Dear Mr. Summers,

Thank you for providing the NRCS the opportunity to review and comment on the EISPN for the proposed Waikapu Country Town project.

The majority of the project area proposed for Waikapu Country Town is classified by Agricultural Lands Important to the State of Hawaii (ALISH) as "Prime Agricultural Lands", as shown in Figures 18a and 18b of Appendix C "Agricultural Impact Assessment" of the "Environmental Impact Statement Preparation Notice for Waikapu Country Town". Furthermore, as shown in Table 11 and Figure 19 of Appendix C, the soils are considered "prime farmland if irrigated" according to the United States Department of Agriculture (USDA) soil survey.

As defined by "Agricultural Lands of Importance to the State of Hawaii Revised" (State Department of Agriculture, November, 1977), "Prime Agricultural Land" is:

> *"...land best suited for the production of food, feed, forage and fiber crops. The land has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops economically when treated and managed, including water management, according to modern farming methods."*

Typically, a Farmland Impact Conversion Rating Form (AD-1006) is needed on projects that convert farmlands into non-farmland uses, and which have federal programs attached to the project. Federal programs are activities or responsibilities of a Federal agency that involve undertaking, financing, or assisting construction or improvement projects, or acquiring, managing, or disposing of Federal lands and facilities. See the website link below for more information on the Farmland Protection Policy Act and a copy of the AD-1006 form with instructions.

There are no hydric soils mapped within the Project Area, though this does not mean they do not exist. There are small areas identified as "Water (W)" on the USDA soil map that are identified as "Unknown Hydric", as shown in the attached map.

Natural Resources Conservation Service
Pacific Islands Area
P.O. Box 50004 Rm. 4-118
Honolulu, HI 96850-0050
808-541-2600

If wetlands do exist, any proposed impacts to these wetlands would need to demonstrate compliance with the Clean Water Act, and may need an Army Corp of Engineers 404 permit.

The NRCS Soil Survey is a general planning tool and does not eliminate the need for an onsite investigation. If you have any questions concerning the soils or interpretations for this project, please contact Tony Rolfes, Assistant Director for Soil Science and Natural Resource Assessment, at (808) 541-2600 x119, or by email at Tony.Rolfes@hi.usda.gov.

NRCS - Farmland Protection Policy Act Website:
http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/fppa/

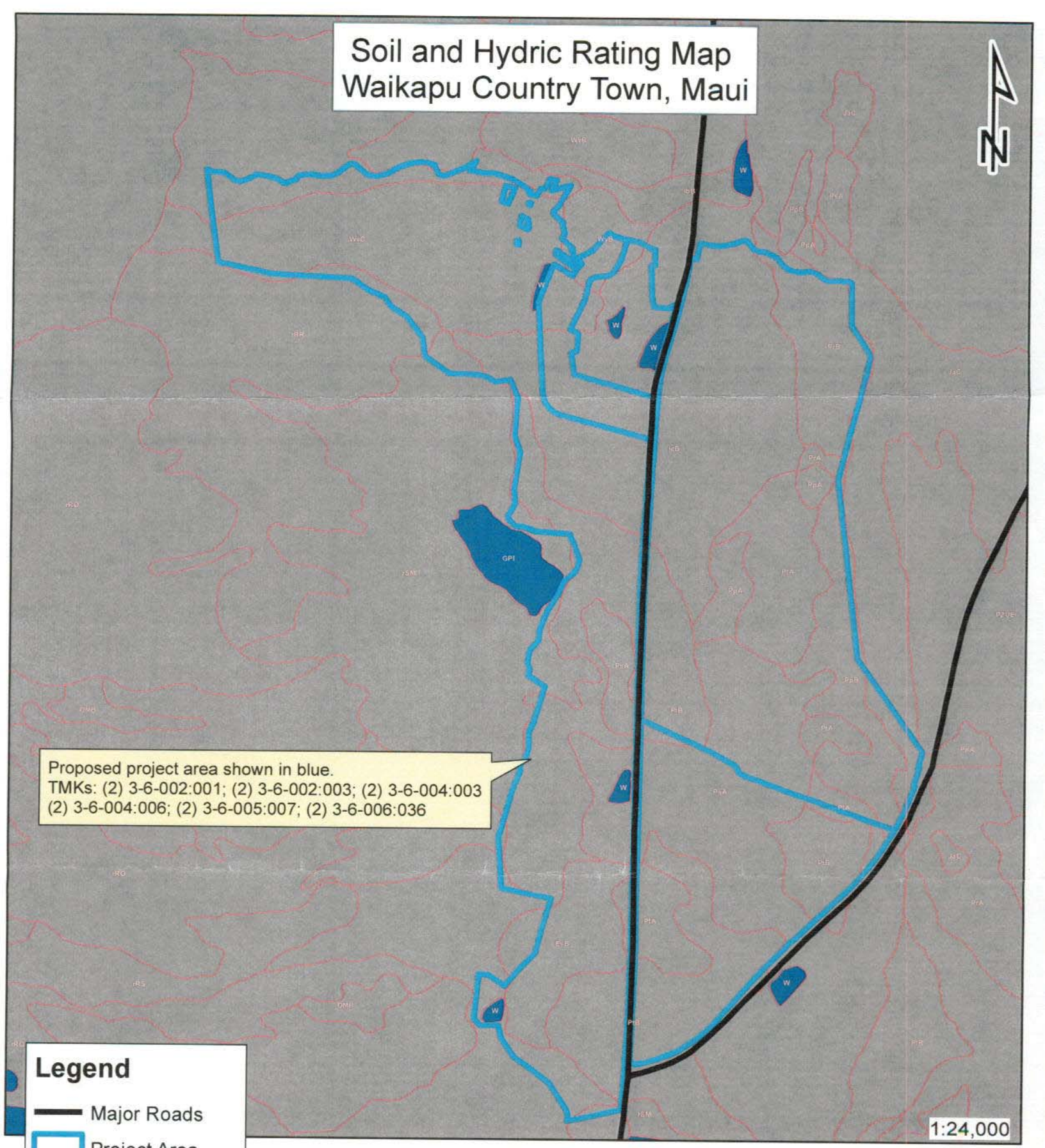
Sincerely,

Jason W Peel, ACTING FOR:

BRUCE PETERSEN
Director
Pacific Islands Area

cc: Tony Rolfes, Assistant Director for Soil Science and Natural Resource Assessment, NRCS, Honolulu, HI

Enclosures (1): Hydric soil map



USDA

United States Department of Agriculture
Natural Resources Conservation Service

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Mr. Bruce Peterson
Director
Pacific Island Area
United States Department of Agriculture
Natural Resource Conservation Service
P.O. Box 50004 Rm. 4-118
Honolulu, HI 96850-0050

Dear Mr. Peterson:

Re: **Environmental Assessment / Environmental Impact Statement Preparation Notice** for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 2, 2015 letter providing comments in response to the above-referenced project. In response to your comments, please find the following response:

- ***Farmland Impact Conversion Rating Form (AD-1006).*** Please note that while the project will convert farmland to non-farm use there are no Federal programs attached to the project. As such, it is our understanding that the subject form is not required.

- ***Hydric Soils / Wetlands.*** Please note that the areas identified as "Water (W)" on the USDA soil map are man-made agricultural reservoirs. The area proposed for development has been predominately in sugar production through the prior century and wetlands are not present on the site.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

Thank you for your interest in the project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

In Reply Refer To:
01EPIF00-2015-TA-0283

JUN 1 8 2015

Mr. Michael J. Summers, President
Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Hawaii 96793

Subject: Technical Assistance for Proposed Development of Waikapu Country Town, Wailuku, Maui

Dear Mr. Summers:

The U.S. Fish and Wildlife Service (Service) received your correspondence on May 22, 2015, requesting technical assistance regarding possible presence of endangered, threatened or protected flora and fauna on 499 acres of land located in central Maui at Waikapu that is proposed for urban and rural development (Waikapu Country Town). Lands not proposed for urban or rural development will remain within the State Agricultural District. The entire property, including the land to remain in agricultural use, comprises 1,576 acres and is identified by Tax Map Key Numbers (TMKs) (2) 3-6-005:007; (2) 3-6-002:001 and 003; (2) 3-6-006:036; and (2) 3-6-004:003 and 006. The property proposed for development as Waikapu Country Town includes TMKs (2) 3-6-004: Portion of 003; (2) 3-6-005: Portion of 007; (2) 3-6-002: Portion of 003; (2) 3-6-004:006; and (2) 3-6-005:007.

Based on information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Project, there are three listed animals, the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*), and the threatened Newell's shearwater (*Puffinus auricularis newelli*), and one endangered insect, the Blackburn's sphinx moth (*Manduca blackburni*) within or near the project area. There is no proposed or designated final critical habitat within the described project footprint. To help you minimize potential impacts to listed species, the Service is providing you the following avoidance and minimization measures. Please note that implementation of these measures does not ensure that impacts to listed species can be avoided, and further coordination with the Service on compliance with the ESA may be required.

Hawaiian hoary bat
The Hawaiian hoary bat is known to occur across a broad range of habitats throughout the State of Hawaii. This bat roosts in both exotic and native woody vegetation and, while foraging, leaves young unattended in "nursery" trees and shrubs. If trees or shrubs suitable for bat roosting are cleared during the Hawaiian hoary bat breeding season (June 1 to September 15),

there is a risk that young bats that cannot yet fly on their own could inadvertently be harmed or killed. As a result, the Service recommends that woody plants greater than 15 feet tall should not be removed or trimmed during the Hawaiian hoary bat breeding season. Additionally, Hawaiian hoary bats forage for insects from as low as three feet to higher than 500 feet above the ground. When barbed wire is used in fencing, Hawaiian hoary bats can become entangled. The Service, therefore, recommends that barbed wire not be used for fencing as part of this proposed action. Although bats were not documented as port of the 2013 surveys, please be aware that Hawaiian hoary bats are a cryptic species and have seasonal variations in range and distribution. Therefore, the Service recommends the incorporation of the above avoidance measures into the project description.

Seabirds

Hawaiian petrels and Newell's shearwaters (collectively known as seabirds) may transit over the proposed project area when flying between the ocean and nesting sites in the mountains during their breeding season (March through November). Seabird fatalities resulting from collisions with artificial structures that extend above the surrounding vegetation have been documented in Hawaii where high densities of transiting seabirds occur. Additionally, artificial lighting, such as flood lighting for construction work and site security, can adversely impact seabirds by causing disorientation which may result in collision with utility lines, buildings, fences and vehicles. Fledgling seabirds are especially affected by artificial lighting and have a tendency to exhaust themselves while circling the light sources and become grounded. Too weak to fly, these birds become vulnerable to depredation by feral predators such as cats (*Felis cattus*), dogs (*Canis familiaris*), and small Indian mongoose (*Herpestres auropunctatus*). Therefore the Service recommends that any telecommunications towers be unguyed and without lighting. We also recommend that night work requiring artificial illumination be avoided during the seabird fledging season (approximately September 15 through December 15). All project-related installed lighting should be minimized and shielded so the bulb is not visible at or above bulb-height.

Blackburn's sphinx moth

Blackburn's sphinx moths feed on nectar from native plants, including beach morning glory (*Ipomoea pes-caprae*), iliee (*Plumbago zeylanica*), and maiapilo (*Capparis sandwichiana*); larvae feed upon non-native tree tobacco (*Nicotiana glauca*) and native aiea (*Nothocestrum latifolium*). Tree tobacco is a weed species that grows rapidly and inhabits disturbed places, roadsides, urban waste areas, gravel quarries, landscaped sites, and natural communities, including riparian areas, grassland, and woodland. Mature tree tobacco can grow between 2 and 7 meters tall and Blackburn's sphinx moths may occupy tree tobacco that is less than 1-meter tall. Blackburn's sphinx moth pupae may occupy the soil within 250 feet of larval host plants for up to a year.

Two tree tobacco plants were found during surveys of the proposed project area at the northern end of a series of sugar cane fields at the base of a stockpiled sand pile. These two plants were carefully examined for eggs, larvae and signs of feeding. One plant was found to have two mature eggs on separate leaves. The eggs had turned brown, indicating they were ready to hatch out young larvae. As the site becomes disturbed, tree tobacco will spread and it is likely Blackburn's sphinx moth will utilize these plants. Tree tobacco plants are not native to Hawaii, but fall under the protection of the ESA during the period of their association with the endangered Blackburn's sphinx moth. We therefore recommend that you include an invasive species policy to remove all tree tobacco before it reaches 1-meter tall. All tree tobacco plants

greater than 1-meter may have Blackburn's sphinx moth eggs and/or larvae and should not be cut or otherwise disturbed. In addition, pupae may be in the ground near these plants. Therefore, we recommend all ground disturbing activities be avoided within 250 feet of tree tobacco that is greater than 1-meter tall.

Because surveys were conducted in 2013 (two years ago), we recommend that a qualified biologist survey the project area for the presence of Blackburn's sphinx moth and its host plants prior to construction. We further recommend that these surveys be conducted during the wettest portion of the year (usually November-April) and approximately four to eight weeks following a significant rainfall event. Surveys should include looking for eggs, larvae, and signs of larval feeding (chewed stems, frass, or leaf damage). If present, we recommend you coordinate with the Service to develop appropriate avoidance and minimization measures dependent upon the site specific information.

Thank you for your efforts to conserve listed species and native habitats. Please contact Fish and Wildlife Biologist Jay Nelson (808-792-9441) if you have any questions or for further guidance.

Sincerely,

Michelle Bogardus
Island Team Leader
Maui Nui and Hawaii Island

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

January 7, 2016

Ms. Michelle Bogardus
Island Team Leader
Maui Nui and Hawaii Island
United States Department of the Interior
Fish and Wildlife Service
Pacific Island Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

Dear Ms. Bogardus:

Re: **Environmental Assessment** / Environmental Impact Statement Preparation Notice for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your June 18, 2015 letter providing comments in response to the above-referenced project.

The Draft Environmental Impact Statement (DEIS) incorporates the additional guidance provided in your letter regarding the Hawaiian hoary bat *(Lasiurus cinereus semotus)*, Hawaiian petrel *((Pterodroma phaeopygia sandwichensis)*, Newell's shearwater *(Puffinus auricularis newelli)* and Blackburn's sphinx moth *(Manduca blackburni)*. In response to your comments regarding the Blackburn's sphinx moth, we consulted with Recovery Biologist Rachel Rounds of your office and were provided with the additional guidance attached as Exhibit 1.

Thank you for your interest in the project, while we look forward to coordinating with your office as we proceed through the development review process. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

Sincerely yours,

Michael J. Summers

Michael J. Summers
President

Attachments

c: Mr. Michael Atherton
Mr. Albert Boyce

Michael Summers

From: Rachel Rounds <rachel_rounds@fws.gov>
Sent: Friday, December 18, 2015 10:19 AM
To: msummers@planningconsultantshawaii.com
Subject: Blackburn's sphinx moth guidance

Below find our latest Blackburn's sphinx moth guidance. Please let me know if you have any questions.

Rachel

Blackburn's sphinx moth – Adult Blackburn's sphinx moths feed on nectar from native plants, including pohuehue (*Ipomoea pescaprae*), iliee (*Plumbago zeylanica*), and maiapilo (*Capparis sandwichiana*). Blackburn's sphinx moth larvae feed upon the native aiea (*Nothocestrum sp.*), which is found in dry to moist forests at elevations ranging from 1,500 to 5,000 ft, and also the non-native tree tobacco (*Nicotiana glauca*), which occupies disturbed areas such as open fields and roadway margins.

1. Survey protocol:

Surveys for Blackburn's sphinx moth and its potential host plants will be conducted by a qualified individual during the wettest portion of the year (Hawaii Island: January to April; Maui North shore: November to April; rest of Maui: October to April – early surveys can be done if there have been Kona storms), approximately four to eight weeks following a significant rainfall event. In some cases, multiple surveys may be recommended.
If *Nothocestrum sp.* or *N. glauca* are detected during surveys, the plants will be visibly marked with flagging and the following documented: 1) general larval plant density; 2) proximity of larval plants to project sites; 3) average height of the larval plants; 4) signs of larval feeding damage on leaves; and 5) presence of Blackburn's sphinx moth larvae on leaves.

2. Avoidance and minimization: *N. glauca* frequently occurs in disturbed areas. Blackburn's sphinx moth adults lay eggs on *N. glauca* and moth larvae feed on the leaves of the plant before they crawl from the plant and burrow into the soil or crevices in rock where they pupate for up to a year or longer. They are most likely to pupate within 33 ft (10 m) of the larval host plant, although they may transit farther over paved and hardened surfaces to find a suitable site to enter the ground. The minimization measures below are conservative because our understanding of the species' resource limitations and behavior is limited. Clearing of the *N. glauca* would be completed using the following safeguards to ensure the potential for direct effects to Blackburn's sphinx moth eggs, larvae, and pupae are minimized:

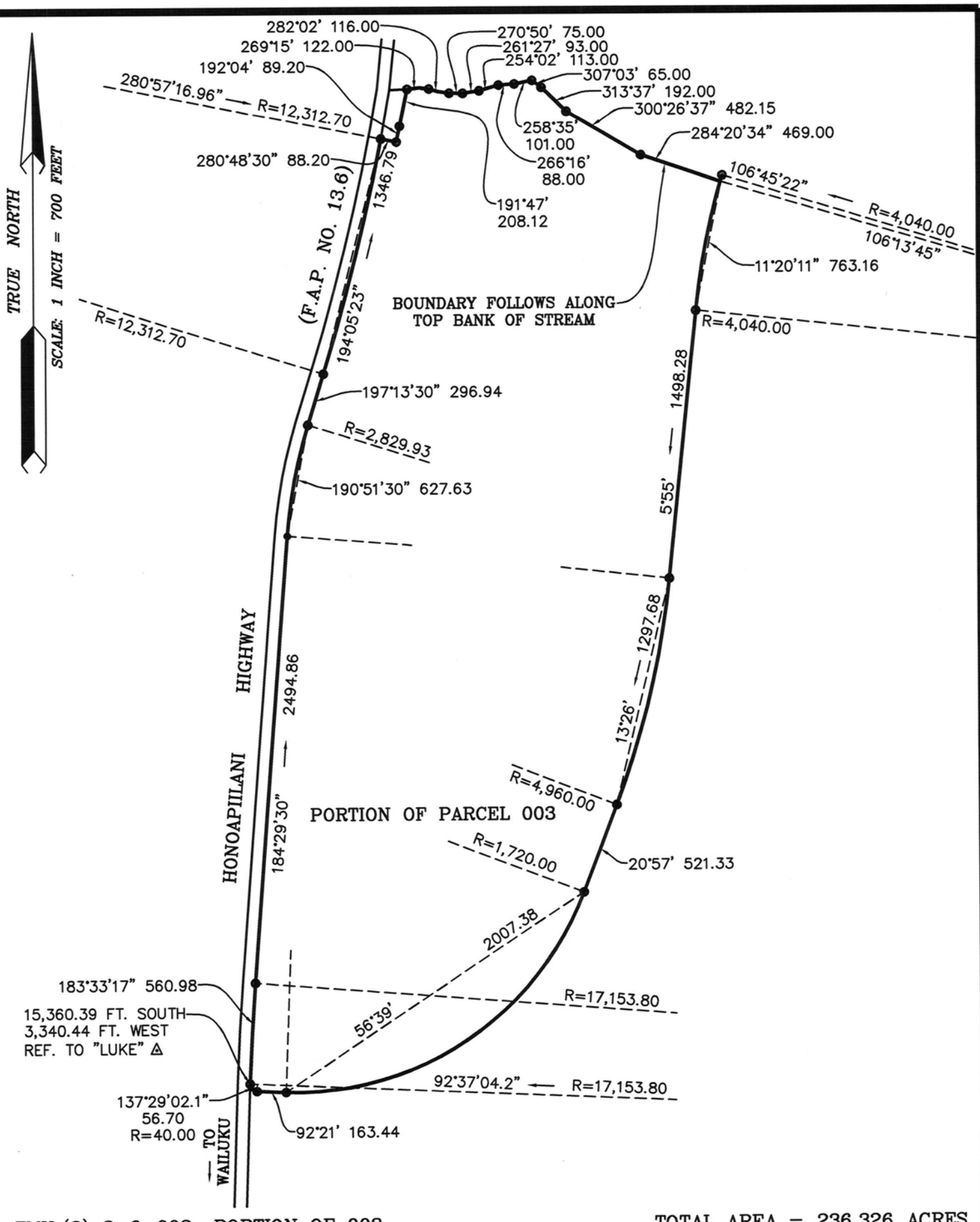
- If *N. glauca* is less than three feet in height and no Blackburn's sphinx moth eggs, larvae, or signs indicating the possibility of pupating larvae (such as frass, chewed stems or other browsing characteristics) are detected, the entire plant(s) may be removed and the soil within 33 ft (10 m) may be disturbed.
- If *N. glauca* is more than three feet in height, it is possible that the signs of Blackburn's sphinx moth foraging have been shed and pupating larvae may be in the ground in the area beneath the plant(s). Therefore, if there are no signs of Blackburn's sphinx moth on *N. glauca* more than three feet in height, the above-ground portion of the plant(s) may be cut off and removed and the following measures implemented to minimize the potential for future use of the plant by Blackburn's sphinx moth and potential impact to a pupae that may already be in the soil near the plant:
  - Stems will be treated with herbicide or re-trimmed to prevent leaf growth and potential use by the Blackburn's sphinx moth.
  - A 33-ft (10-m) disturbance-free buffer will be established around the plant's location for one year. After one year, the plant roots may be removed and the soil disturbed if necessary. The one-year waiting period will ensure any larvae pupating in the soil will have pupated and emerged from the soil prior to disturbance of the plant(s) or soil.

Rachel Rounds
Recovery Biologist
Maui Nui/Hawaii Island Team

Exhibit 1, "E-mail from Rachel Rounds"

APPENDIX R

District Boundary Amendment Petition Maps



TMK: (2) 3-6-002: PORTION OF 003

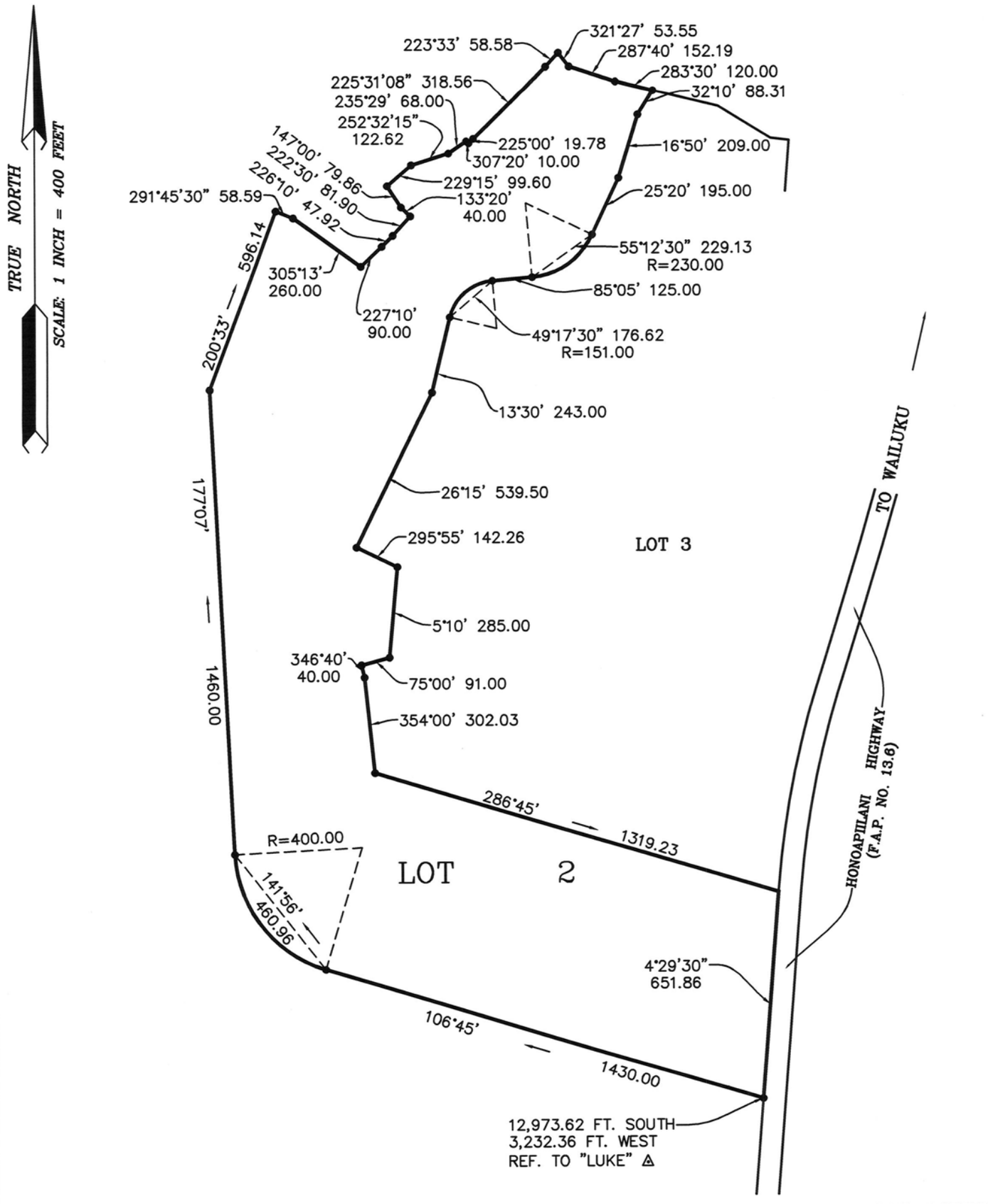
TOTAL AREA = 236.326 ACRES

LAND USE DISTRICT BOUNDARY AMENDMENT MAP NO.

FROM: AGRICULTURE
TO: URBAN

APPROVED: COUNTY CLERK	PUBLIC HEARING: ADOPTED–COUNCIL: ADOPTED–MAYOR: ORDINANCE:
APPROVED: PLANNING DIRECTOR	DATE: MAY 29, 2014 | SCALE: 1" = 700'

OFFICE OF THE COUNTY CLERK
200 HIGH STREET, WAILUKU, MAUI, HAWAII 96793



TMK: (2) 3-6-004: 006

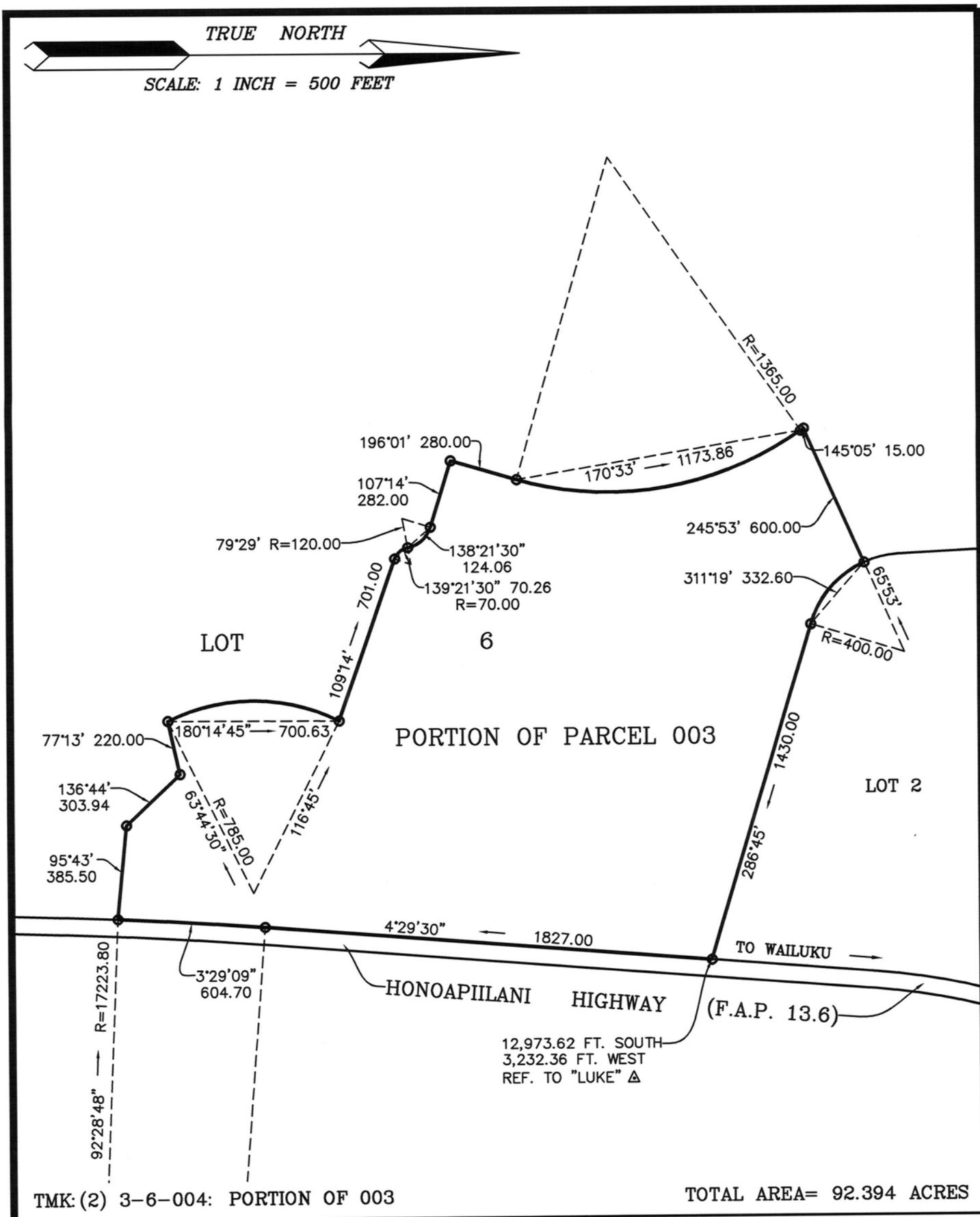
TOTAL AREA= 53.775 ACRES

LAND USE DISTRICT BOUNDARY AMENDMENT MAP NO.

FROM: AGRICULTURE
TO: URBAN

APPROVED: COUNTY CLERK	PUBLIC HEARING: ADOPTED-COUNCIL: ADOPTED-MAYOR: ORDINANCE:
APPROVED: PLANNING DIRECTOR	DATE: MAY 29, 2014 | SCALE: 1" = 400'

OFFICE OF THE COUNTY CLERK
200 HIGH STREET, WAILUKU, MAUI, HAWAII 96793



LAND USE DISTRICT BOUNDARY AMENDMENT MAP NO.

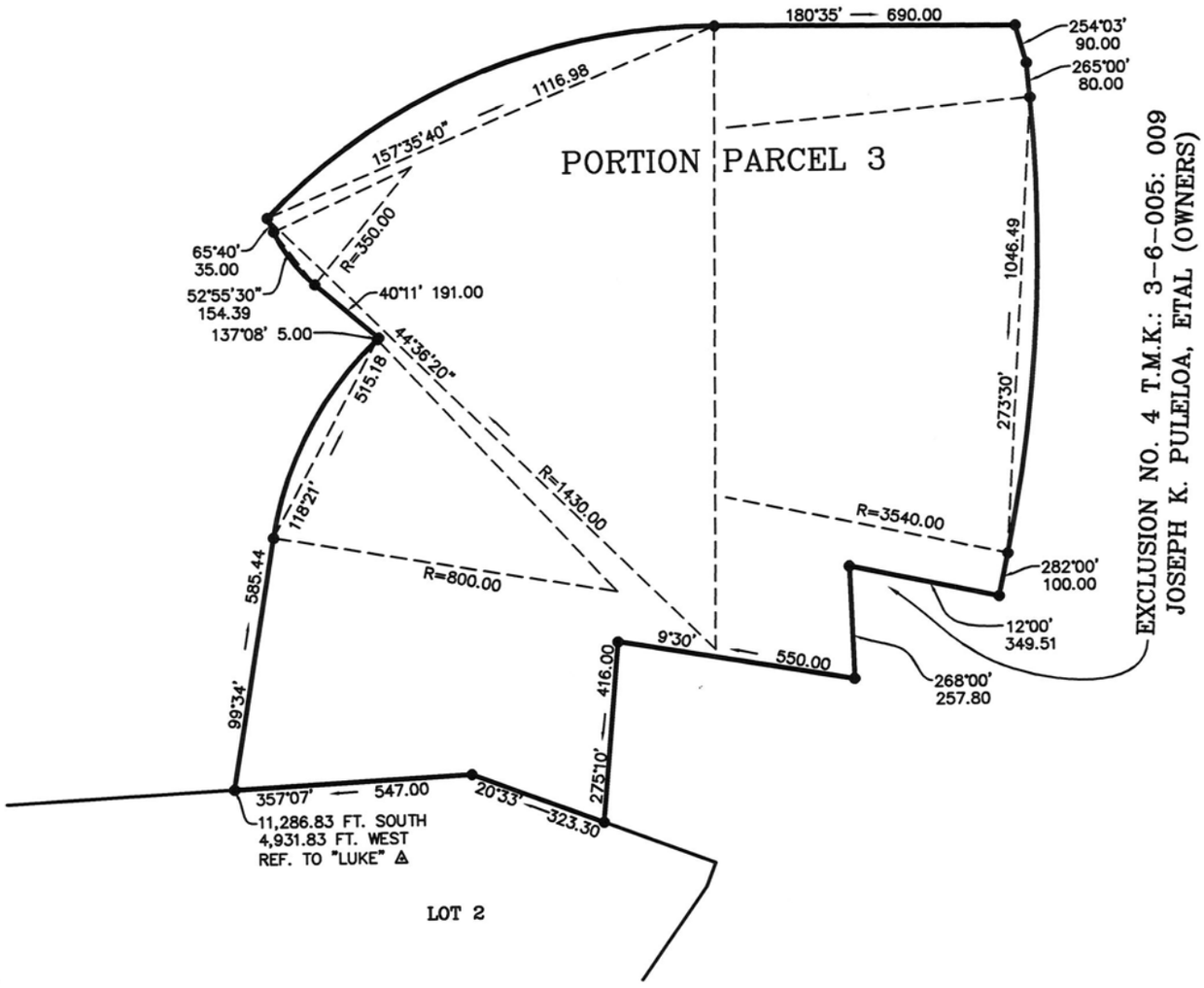
FROM: AGRICULTURE
TO: RURAL

APPROVED: COUNTY CLERK	PUBLIC HEARING: ADOPTED–COUNCIL: ADOPTED–MAYOR: ORDINANCE:
APPROVED: PLANNING DIRECTOR	DATE: MAY 28, 2014 | SCALE: 1" = 500'

OFFICE OF THE COUNTY CLERK
200 HIGH STREET, WAILUKU, MAUI, HAWAII 96793

TRUE NORTH

SCALE: 1 INCH = 400 FEET



TMK: (2) 3-6-004: PORTION OF 003

TOTAL AREA= 57.454 ACRES

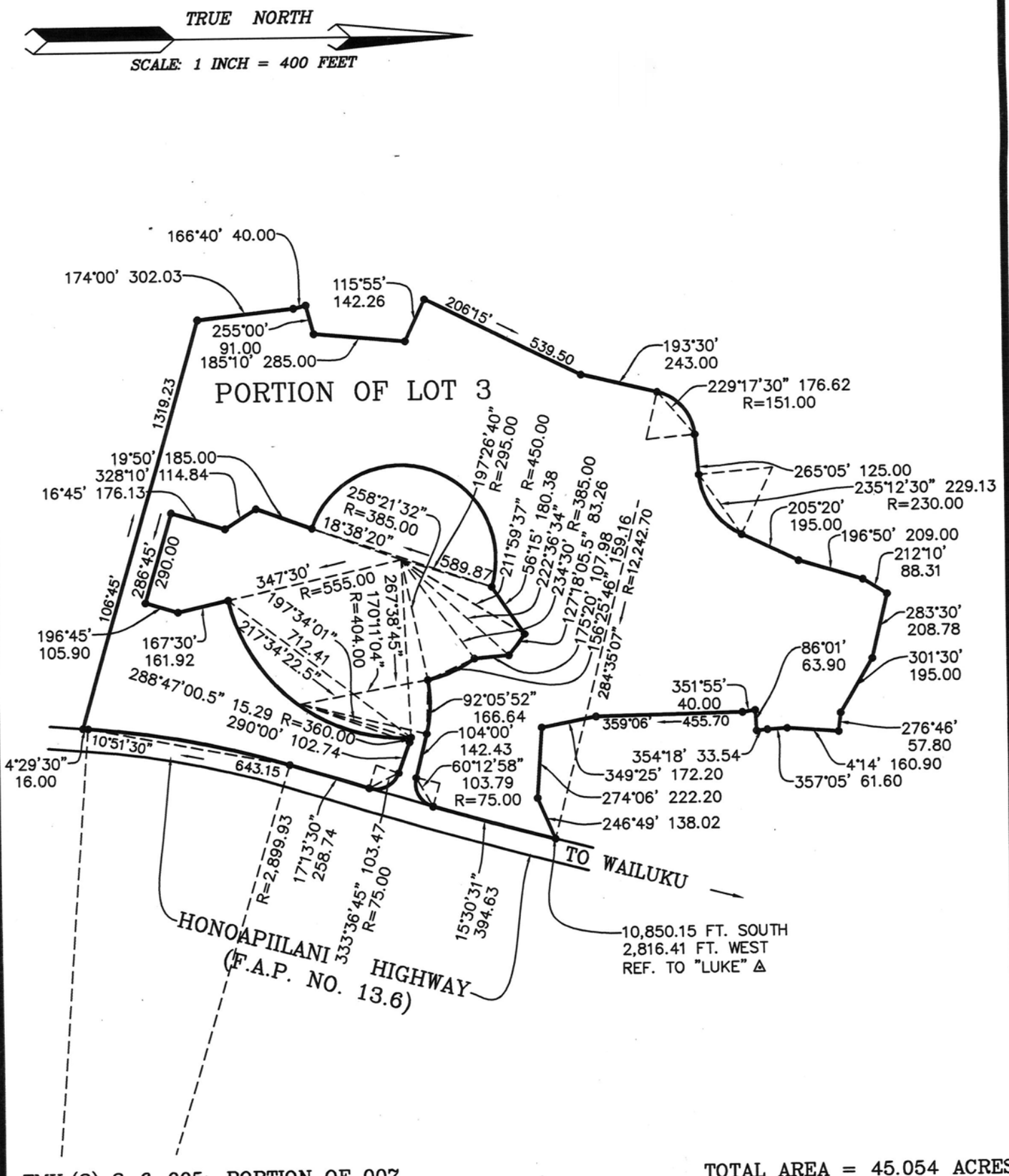
LAND USE DISTRICT BOUNDARY AMENDMENT MAP NO.

FROM: AGRICULTURE
TO: RURAL

APPROVED: COUNTY CLERK	PUBLIC HEARING: ADOPTED–COUNCIL: ADOPTED–MAYOR: ORDINANCE:
APPROVED: PLANNING DIRECTOR	DATE: MAY 28, 2014 | SCALE: 1" = 400'

OFFICE OF THE COUNTY CLERK

200 HIGH STREET, WAILUKU, MAUI, HAWAII 96793



TMK: (2) 3-6-005: PORTION OF 007

TOTAL AREA = 45.054 ACRES

LAND USE DISTRICT BOUNDARY AMENDMENT MAP NO.

FROM: AGRICULTURE
TO: URBAN

APPROVED: _____ COUNTY CLERK	PUBLIC HEARING: ADOPTED–COUNCIL: ADOPTED–MAYOR: ORDINANCE:
APPROVED: _____ PLANNING DIRECTOR	DATE: MAY 29, 2014 | SCALE: 1" = 400'

OFFICE OF THE COUNTY CLERK
200 HIGH STREET, WAILUKU, MAUI, HAWAII 96793

APPENDIX S

DEIS Agency and Community Comment and Response Letters

FEIS AGENCY & PUPLIC COMMENT AND RESPONSE LETTERS	COMMENT LETTER DATE
1. County of Maui, Department of Public Works	May 23, 2016
2. County of Maui, Department of Water Supply	June 20, 2016
3. County of Maui, Fire Prevention Bureau, Department of Fire and Public Safety	February 10, 2016
4. County of Maui, Department of Housing and Human Concerns, Housing Division	February 11, 2016
5. County of Maui, Department of Parks and Recreation	February 29, 2016
6. County of Maui, Department of Planning	March 9, 2016
7. County of Maui, Department of Environmental Management	April 13, 2016
8. County of Maui, Police Department	February 25, 2016
9. State of Hawaii, Department of Accounting and General Services	February 9, 2016
10. State of Hawaii, Department of Land and Natural Resources, Land Division	May 24, 2016
11. State of Hawaii, Department of Land and Natural Resources, State Historic Preservation Division	March 24, 2016
12. State of Hawaii, Department of Agriculture	March 30, 2016
13. State of Hawaii, Department of Defense	March 24, 2016
14. State of Hawaii, Department of Education	March 23, 2016
15. State of Hawaii, Department of Health, Environmental Planning Office	February 10, 2016
16. State of Hawaii, Department of Health, Maui District Health Office	March 8, 2016
17. State of Hawaii, Department of Health, Wastewater Branch	February 12, 2016
18. State of Hawaii, Department of Transportation, Airports Division	May 18, 2016
19. State of Hawaii, Department of Transportation, Highways Division	
20. State of Hawaii, Department of Health, Office of Environmental Quality Control	March 24, 2016
21. State of Hawaii, Office of Hawaiian Affairs	March 24, 2016
22. State of Hawaii, Department of Business Economic Development and Tourism, Office of Planning	March 28, 2016
23. Mr. Richard “Dick” Mayer	March 28, 2016
24. Mr. Richard “Dick” Mayer	March 28, 2016
25. Mr. Albert Perez, Executive Director, Maui Tomorrow	March 30, 2016

1. County of Maui, Department of Public Works

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7845
Fax: (808) 270-7955

GLEN A. UENO, P.E., P.L.S.
Development Services Administration

CARY YAMASHITA, P.E.
Engineering Division

LESLI L. OTANI, P.E., L.S.
Highways Division

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
200 SOUTH HIGH STREET, ROOM NO. 434
WAILUKU, MAUI, HAWAII 96793

May 23, 2016

Mr. Michael J. Summers, President
PLANNING CONSULTANTS HAWAII, LLC
2331 West Main Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Summers:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR WAIKAPU COUNTRY TOWN; TMK: (2) 3-6-002:001, 003; 3-6-004:003, 006; 3-6-005:007; 3-6-006:036

We reviewed the subject application and have the following comments:

Comments from the Engineering Division:

1. Applicant shall have U.S. Army Corps of Engineers review the drainage plan affecting Waikapu Stream. The Corps response shall be provided to the Engineering Division for confirmation of action.

2. The applicant shall be responsible for all required improvements as required by Hawaii Revised Statutes, Maui County Code and rules and regulations.

3. As applicable, construction plans shall be designed in conformance with Hawaii Standard Specifications for Road and Bridge Construction dated 2005 and Standard Detail for Public Works Construction, 1984, as amended.

4. As applicable, worksite traffic-control plans/devices shall conform to the most recent version of the "Manual on Uniform Traffic Control Devices for Streets and Highways", used by the County of Maui.

5. The applicant shall provide a comprehensive Storm Water Management plan for the development. The plan shall conform to County of Maui Municipal Separate Stormwater System (MS4) regulations.

6. The following comments relate to traffic:

   a. Page I-31, Schools: Provide discussion on the timing of construction of the mentioned elementary school in relation to the anticipated build out of the Waikapu Country Town (WCT) project.

   b. Page V-69, Existing Levels of Service (LOS): Counts were done in 2013, we recommend updating data to reflect current conditions.

   c. Appendix I, Page 27-28, Baseline Street System Improvements: Add note to clarify which listed roadway projects are outside of the WCT's study area.

   d. Appendix I, Page 35, Project Street System Improvements, Intersection 10, Waiale Road & Main Street: Intersection is assumed in the report to be a single-lane roundabout, however, existing easement for roadway purposes (proposed roadway lot) for the Waiale Road Extension is not configured to accommodate a roundabout. The WCT project should plan ahead with respect to any needed roadway right-of-way expansions should a roundabout be the pursued intersection design.

   e. Appendix I, Page 37, Project Trip Generation Estimates: Provide discussion on how 15% for daily and 25% peak hour reductions were determined to be appropriate. Are there mixed use developments on Maui or in the State of Hawaii which support the selected percent reductions?

   f. Appendix I, Page 53, Paragraph 1: For support, provide an example of why adding lanes to improve LOS at the movement level may have negative impacts.

   g. Appendix I, Table 40, Intersection 2: With Project conditions degrade the LOS from D to E in the PM peak hour and further degrade an already projected LOS E in the AM peak

hour. Project should fully fund improvements at this location similar to Honoapiilani Highway and Kuikahi Drive.

h. Appendix I: Analysis assumes completion of Waiale Road between Waiko Road and Honoapiilani Highway. What are plans should the roadway not be constructed by 2022 (Phase 1 horizon)?

7. General comment: Please confirm which roadways built within the development will be dedicated to the County of Maui, if any.

8. Funding for improvements to Waiko Road and Waiale Road are currently not included in the six-year Capital Improvement Program (FYs 2017-2022) for the County of Maui. Provide an estimated timeline for the completion of transportation infrastructure based on the anticipated progress rate of development. Provide a discussion regarding roadway infrastructure improvements at the intersection of Waiale Road and Waiko Road, and the development of Waiale Road through the WCT area.

Please call Rowena M. Dagdag-Andaya at 270-7845 if you have any questions regarding this letter.

Sincerely,

DAVID C. GOODE
Director of Public Works

DCG:RMDA:da
xc: Highways Division
Engineering Division
S:\DSA\Engr\CZM\Draft Comments\36002001,003_36004003,006_36005007_36006036_waikapu_cntry_twn_deis.wpd

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. David C. Goode
Director of Public Works
County of Maui
Department of Public Works
200 South High Street, Room No. 434
Wailuku, Maui, Hawaii 96793

Dear Goode:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated May 23, 2016 regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following responses:

Engineering Division Comments

1. The Project's drainage plans will be provided to the U.S. Army Corps of Engineers for comment.

2. The Applicant acknowledges that the Project must comply with all State and County rules and regulations.

3. The Applicant acknowledges that the Project's construction plans must be designed in accordance with the Hawaii Standard Specifications for Road and Bridge Construction dated 2005 and Standard Detail for Public Works Construction, 1984, as amended.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

4. The Applicant acknowledges that worksite traffic control plans/devices shall conform to the most recent version of the "Manual on Uniform Traffic Control Devices for Streets and Highways", used by the County of Maui.

5. The Applicant will provide a comprehensive Storm Water Management plan for the development. The Plan will conform to the County of Maui Municipal Separate Stormwater System (MS4) regulations.

Comments Concerning Traffic

6.a ***Timing of elementary school construction.*** According to the State Department of Education, the timing of the construction of the elementary school is uncertain at this time. However, for the purpose of evaluating the Project's traffic impacts, it was assumed that the school would be constructed by 2026.

6.b ***Level-of-service counts.*** The comment notes that the traffic count data used for the existing level of service (LOS) analysis in the Transportation Impact Analysis Report (TIAR) of the Draft Environmental Impact Statement (DEIS) were collected in 2013. The comment recommends updating this baseline traffic count data to reflect current conditions. In response, Fehr & Peers had new AM and PM peak period traffic counts collected in May 2016 at the same eight intersections that were counted in 2013 when the TIAR was begun. A series of analyses was conducted on the 2016 data to compare it to the baseline data used in the TIAR to determine whether and how local conditions have changed. Furthermore, a memorandum has been prepared that summarizes the key results of the analysis conducted and the comparisons made and is attached as Exhibit A, "Existing 2016 Data Analysis".

6.c ***Roadway improvements outside of WCT's service area.*** The comment requesting clarification on which listed roadway projects in the Baseline Street System subsection are outside of the

WCT study area is noted and hereby made part of the Final Environmental Impact Statement (FEIS). The WCT study area for transportation analysis purposes is generally bounded by Kuikahi Drive/Maui Lani Parkway to the north, Honoapiilani Highway to the west, Kuihelani Highway to the east, and the intersection of Honoapiilani Highway and Kuihelani Highway to the south. Below are the baseline street system improvements that are outside of the WCT study area:

- Hana Highway Widening;
- Honoapiilani Highway Widening;
- Kahului Airport Access Road;
- Lahaina Bypass; and
- Puunene Avenue Widening.

The Baseline Street System Improvements section in the FEIS will denote each of the above improvements located outside of this study area with an asterisk (*).

6.d ***Waiale and Main Street roundabout ROW.*** The Applicant acknowledges that the minimum ROW for a single lane roundabout at the above-referenced intersection exceeds the dedicated ROW at this location. As such, additional ROW may be required in order to construct the subject roundabout. The Applicant acknowledges that ongoing discussion and planning will be required with the Department in order to determine if a roundabout is the preferred intersection design at this location.

6.e ***Peak hour trip reductions.*** Attached is a memorandum dated September 30, 2016 from Fehr & Peers that provides justification for the use of a reduction of 15% for daily and of 25% for peak hour traffic volumes. The memorandum also documents mainland studies that helped to establish these reductions (See: Exhibit B, Fehr & Peers Memorandum dated October 26, 2016).

6.f ***Negative impacts from adding additional lanes.*** In response to Comment 6f, Feher and Peers provides the following response:

> *"Adding lanes to intersections to increase the vehicle carrying capacity will improve their levels of service and reduce the average vehicle delay and queues. This is true of improvements to an intersection overall and to improvements to specific approaches or movements. However, these improvements could have secondary effects, such as right-of-way acquisition and negative effects on pedestrians and bicyclists as they may increase the crossing distance at the intersection and thus increase their level of exposure. The decision to widen intersections should be done on a case-by-case basis by the appropriate agency with jurisdiction that would weigh the effects on all travel modes that use the intersection to mitigate these secondary impacts."*

6.g ***Project induced impacts.*** In response to Comment 6g, Feher and Peers provides the following response:

> *"The comment mistakenly cites Table 40 in Appendix I to the DEIS, when in fact the table referred to is Table 40 of the DEIS (page V-72. The comment correctly cites the data in the table for the PM peak hour but incorrectly states the data for the AM peak hour. In the AM peak hour, intersection LOS would not remain at LOS E, but would decline from a projected LOS E to LOS F (with the addition of project traffic without mitigation). Two levels of mitigation were identified for this location, one that would mitigate the project impact (to the pre-project conditions) and another that would mitigate the intersection to the County's LOS D standard. Table 42 of the DEIS (page V-79) shows the calculated fair-share contribution to off-site traffic mitigation measures at full buildout. Only one location is identified as fully funded by the proposed project: Intersection 6. The table shows that the project should bear its proportional cost at both Intersection 1 and Intersection 2, not that it should fully fund the improvements at either location. The proportions are*

33.8% for Intersection 1 and 28.5% for Intersection 2, based on the project-related share of the total volume growth at each intersection."

6.h ***Waiale Bypass Road Funding and Plans.*** In preparing the Project's TIAR, the Applicant assumed that the Waiale Bypass road would be constructed by 2022. This assumption was predicated upon extensive pre-consultation conducted with the Department leading up to the preparation of the subject TIAR, review of the Final Environmental Assessment prepared by the Department for the Waiale Road Extension and East Waiko Road Improvements, and review of the County of Maui's 2016 6-year Capital Improvement Program. However, it has since come to the Applicant's attention by way of the Department's comment letter in response to the DEIS that the timing of the Waiale Bypass is uncertain and that the Applicant should assume that the roadway may not be constructed. As such, the Applicant conducted an analysis of the Project's traffic impact at full buildout without the Waiale Bypass. Feher & Peers completed the analysis in October 2016. The "No Waiale Bypass Scenario" analysis demonstrates that even under a worst-case scenario where none of these roadways are in place, the subject development can achieve an acceptable level-of-service through off-site intersection improvements. (See: Exhibit C, Fehr & Peers Memorandum dated October 17, 2016). Section V.D.1 of the FEIS, and other pertinent sections of the report, have been updated to reflect the results of the "No Waiale Bypass Scenario".

7. ***Dedication of internal roadways.*** The Applicant intends to dedicate all of the WCT's internal roadways to the County. The Applicant also intends to work closely with the County's Department of Public Works, and other applicable agencies, to ensure that the streets meet County requirements, while also ensuring that the streets are designed to safely accommodate pedestrians and bicyclists and that landscape planting is properly maintained. Section III.B.A of the FEIS has been updated in response to the Department's question.

8. ***Funding of Waiale Bypass Road Improvements.*** The Applicant understands that the Waiale Bypass improvement was not

included in the County of Maui's Fiscal Years 2017-2022 CIP. In response, the Applicant has conducted an analysis at full-buildout of the Project without the Waialae Bypass. The analysis demonstrates that even under a worst-case scenario where the Waiale Bypass is not in place, the subject development can achieve an acceptable level-of-service through off-site intersection improvements (**See**: Exhibit C, Fehr & Peers Memorandum dated October 17, 2016). Section V.D.1 of the FEIS, and other pertinent sections of the report, have been updated to reflect the results of the "No Waiale Bypass Scenario".

Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

FEHR PEERS

MEMORANDUM

Date: September 16, 2016

To: Mike Summers, Planning Consultants Hawaii, LLC

From: Netai Basu & Christine Mercado, Fehr & Peers

Subject: Waikapu Country Town Project – Existing (2016) Data Analysis

SD13-0085.01

Among the comments received from Maui County Department of Public Works was a recommendation to update the baseline traffic counts used in the Transportation Impact Analysis Report (TIAR) for the Waikapu Country Town Project because they were collected in 2013. In response, Fehr & Peers had new AM and PM peak period traffic counts collected in May 2016 at the same eight intersections that were counted in 2013 when the TIAR was begun. A series of analyses was conducted on the 2016 data to compare it to the baseline data used in the TIAR to determine whether and how local conditions have changed. This memorandum presents a summary of the new data collected, key results of the analyses conducted and comparisons made, and our determination regarding the sufficiency of the Existing (2013) baseline used in the TIAR.

TRAFFIC VOLUMES

Traffic counts at the eight existing study intersections were collected in September 2013 for the TIAR. To investigate whether and how the traffic conditions at the analyzed study intersections have changed significantly, new turning movement counts at all locations were collected during the weekday AM and PM peak periods in May 2016 when local schools were in session. Additionally, lane configurations and signal phasing were field-checked in May 2016 so that any changes that have been made in the last three years can be factored into this analysis. Based on the recent field observations, changes were identified at only one location, Intersection 1: Honoapiilani Highway & Kuikahi Drive, where the eastbound and westbound approaches have been re-striped to provide one left-turn lane, one through lane, and one right-turn lane and the eastbound and westbound left-turn phasing have been modified to provide protected/permitted

500 Ala Moana Boulevard | Suite 7-400 | Honolulu, HI 96813 | 808-541-9916 | Fax 808-531-2500
www.fehrandpeers.com

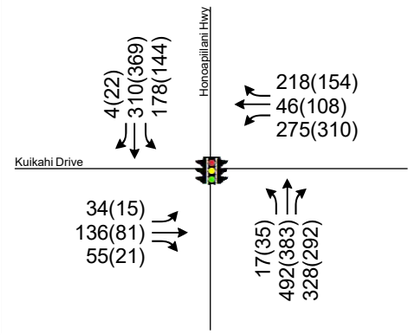
left-turn phasing. These modifications were assumed in the Existing (2016) intersection operations analysis. **Figure 1** presents the Existing (2016) AM and PM peak hour turning movement volumes and corresponding lane configurations.

SUMMARY OF KEY VOLUME COMPARISONS

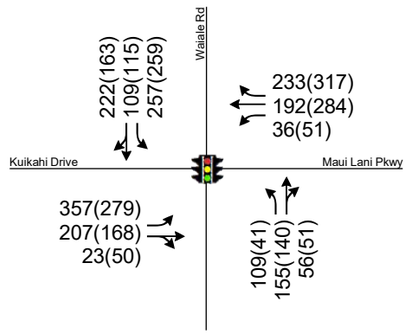
Table 1 shows a comparison of the weekday AM and PM peak hour intersection between years 2013 and 2016 at the eight study intersections that existed in 2013, when the TIAR for the proposed Waikapu Country Town project was begun. As shown, the change in volume ranges from -30 to 159 in the AM peak hour and from 6 to 185 in the PM peak hour. The percentage change in total intersection volumes at each study location between 2013 and 2016 ranged from -1.8% to 34.5% in the AM peak hour and from 0.3% to 42.9% in the PM peak hour. The total intersection volumes primarily increased at the eight locations with the exception of Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway and Intersection 8: Kuihelani Highway (SR 380) & Waiko Road, where the percentage change in total intersection volumes decreased to about -2% in the AM peak hour in 2016. Most of the percentage increases in total peak hour intersection volumes are less than 5%; however, there are some notable exceptions such the 34.5% and 42.9% percentage increases in total peak hour volumes at Intersection 6: Waiale Road & Waiko Road, but these higher percentage increases in traffic are largely due to the small volume of traffic at this location. Overall, the increase in total intersection volume throughout the study area increased by about 2.6% in the AM peak hour and 7.3% in the PM peak hour over the course of three years. Additionally, the compounded annual growth rate at most locations was less than 3% per year.

Study Intersection
Turn Lane
AM (PM) Peak Hour Traffic Volume
Traffic Signal
Stop Sign
Waiale Bypass

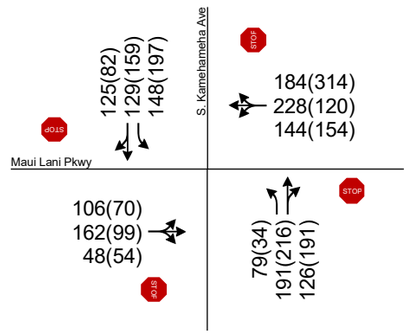
1. Honoapiilani Hwy/Kuikahi Drive



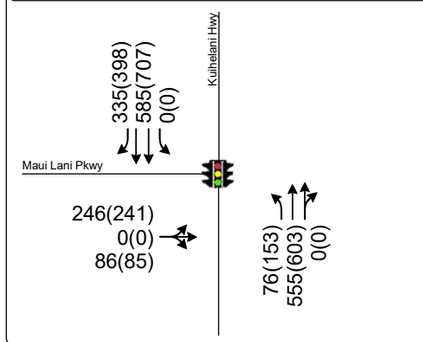
2. Waiale Rd/Kuikahi Drive



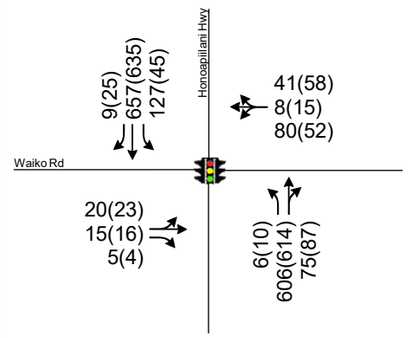
3. S. Kamehameha Ave/Maui Lani Pkwy



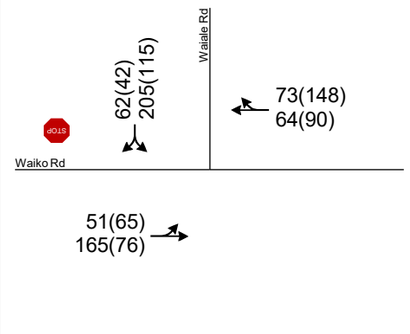
4. Kuihelani Hwy/Maui Lani Pkwy



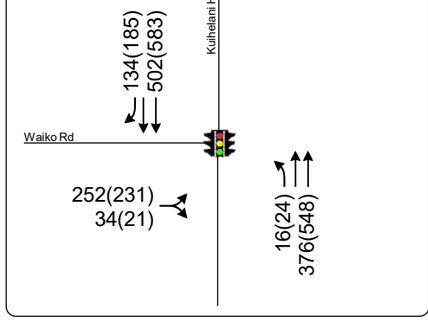
5. Honoapiilani Hwy/Waiko Rd



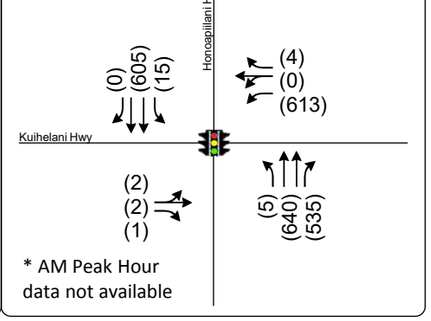
6. Waiale Rd/Waiko Rd



8. Kuihelani Hwy/Waiko Rd



14. Honoapiilani Hwy/Kuihelani Hwy



* AM Peak Hour data not available

Figure 1
Peak Hour Traffic Volumes and Lane Configurations
Existing (2016) Conditions

Table 1: Comparison of Intersection Traffic Volumes Between Years 2013 and 2016

Intersection	Peak Hour	Year 2013 Total Volume[1]	Year 2016 Total Volume[2]	Volume Change	Percentage Change	CAGR[3]
1. Honoapiilani Highway & Kuikahi Drive	AM	2,073	2,093	20	1.0%	0.3%
	PM	1,928	1,934	6	0.3%	0.1%
2. Waiale Road & Kuikahi Drive	AM	1,935	1,956	21	1.1%	0.4%
	PM	1,849	1,918	69	3.7%	1.2%
3. S. Kamehameha Avenue & Maui Lani Parkway	AM	1,700	1,670	-30	-1.8%	-0.6%
	PM	1,593	1,690	97	6.1%	2.0%
4. Kuihelani Highway & Maui Lani Parkway	AM	1,856	1,883	27	1.5%	0.5%
	PM	2,011	2,187	176	8.8%	2.8%
5. Honoapiilani Highway & Waiko Road	AM	1,545	1,649	104	6.7%	2.2%
	PM	1,418	1,584	166	11.7%	3.8%
6. Waiale Road & Waiko Road	AM	461	620	159	34.5%	10.4%
	PM	375	536	**1**61	42.9%	12.6%
8. Kuihelani Highway & Waiko Road	AM	1,336	1,314	-22	-1.6%	-0.6%
	PM	1,407	1,592	185	13.1%	4.2%
14. Honoapiilani Highway & Kuihelani Highway	AM	2,253	No Data[4]	N/A	N/A	N/A
	PM	2,362	2,422	60	2.5%	0.8%
Total for All Analyzed Intersections[4]	AM	10,906	11,185	279	2.6%	1%
	PM	12,943	13,863	920	7.1%	2.3%

Source: Fehr & Peers, 2016.

Notes:

[1] Baseline traffic counts used in the TIAR for the Waikapu Country Town Project were collected during the weekday morning (6:00 to 9:00 AM) and evening (3:00 to 6:00 PM) peak-period conditions in September 2013.

[2] New traffic counts were collected during the weekday morning (6:00 to 9:00 AM) and evening (3:00 to 6:00 PM) peak-period conditions in May 2016.

[3] CAGR = Compounded annual growth rate

[4] Due to an issue in the data collection process, AM peak period counts are not available at Intersection 14: Honoapiilani Highway & Kuihelani Highway. Thus, Intersection 14: Honoapiilani Highway & Kuihelani Highway was excluded from the AM totals.

Additionally, to better understand the change in traffic patterns, a screenline assessment was conducted using the total 3-hour volumes for the AM and PM peak periods to assess the changes in overall north-south directional traffic entering and leaving the northern and southern edges of study area. Results of the screenline assessment, which sums the total volume across Honoapiilani Highway, Kuihelani Highway and, at the northern edge of the study area, Waiale Road and Kamehameha Avenue, are summarized below:

- A total of 12,033 vehicles were counted crossing the northern screenline from Honoapiilani Highway to Kuihelani Highway in 2013 during the AM peak period. In 2016, 12,810 vehicles were counted crossing the northern screenline. This represents an increase of 777 vehicles (6.4%) in AM peak period traffic leaving and entering the study area from the north.
- A total of 5,607 vehicles were counted crossing the southern screenline from Honoapiilani Highway to Kuihelani Highway in 2013 during the AM peak period. In 2016, 6,150 vehicles were counted crossing the southern screenline. This represents an increase of about 550 vehicles (9.7%) leaving and entering the study area from the south.
- A total of 14,353 vehicles were counted crossing the northern screenline from Honoapiilani Highway to Kuihelani Highway in 2013 during the PM peak period. In 2016, 15,114 vehicles were counted crossing the northern screenline. This represents an increase of 761 vehicles (5.3%) in the PM peak period traffic leaving and entering the study area from the north.
- During the PM peak period, the traffic crossing the southern screenline decreased from 6,326 to 5,968, a decrease of 358 vehicles (-5.7%) from 2013 to 2016 data.

Overall, the change in traffic leaving and entering the study area during the peak periods from both the north and south is either fairly modest and reflects the new development that has occurred in this area of Maui over the last several years, including a large grocery store and the residential area along Maui Lani Parkway.

EXISTING INTERSECTION LEVEL OF SERVICE

The 2016 peak hour volumes and current lane configurations were also used to calculate levels of service (LOS) for each of the existing study intersections. The results of the LOS analysis for Existing (2016) Conditions are presented in **Table 2** along with the results of the LOS analysis presented in the TIAR for the Existing (2013) Conditions for comparison purposes.

The Existing Conditions analysis using the May 2016 data yielded fairly similar level of service results as the Existing (2013) LOS results presented in the TIAR, with the exception of the increased peak hour delays at Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway. The significant increase in delay at this intersection is likely due to the completion and occupancy of nearby development (primarily residential), which have further contributed to the degradation of this all-way stop location, which was already failing under 2013 PM peak conditions.

CONCLUSION

A comparison of existing (2016) traffic counts and intersection operating conditions with the existing (2013) conditions analysis presented in the TIAR shows that there has been a modest level of growth in traffic in the study area over the last three years. This has resulted in minor changes in volume and delay the study intersections in the vicinity of the proposed Waikapu Country Town project. This is not unexpected, as the three years that have elapsed represent approximately one-quarter of the total 13-year time period between 2013 and 2026, which was the outlying horizon year analyzed in the TIAR for the project. This increase in traffic is due to the completion of development projects within and beyond the study area, and is accounted for the long-term projections in the TIAR's analysis of the future conditions.

Table 2: Existing Intersection Level of Service

Intersection	Traffic Control	Peak Hour	Existing (2013)[1] Delay (sec/veh)[3]	Existing (2013)[1] LOS[4,5]	Existing (2016)[2] Delay (sec/veh)[3]	Existing (2016)[2] LOS[4,5]	Delta (2016-2013)
1. Honoapiilani Highway & Kuikahi Drive[6]	Signalized	AM	25.2	C	24.3	C	-0.9
		PM	23.3	C	21.2	C	-2.1
2. Waiale Road & Kuikahi Drive	Signalized	AM	26.4	C	30.1	C	3.7
		PM	24.7	C	27.3	C	2.6
3. S. Kamehameha Avenue & Maui Lani Parkway	AWSC	AM	48.3	**E**	73.6	**F**	25.3
		PM	54.4	**F**	89.7	**F**	35.3
4. Kuihelani Highway & Maui Lani Parkway	Signalized	AM	21.4	C	16.1	B	-5.3
		PM	21.9	C	19.7	B	-2.2
5. Honoapiilani Highway & Waiko Road	Signalized	AM	13.3	B	14.6	B	1.3
		PM	11.9	B	12.8	B	0.9
6. Waiale Road & Waiko Road	SSSC	AM	12.4	B	17.2	C	4.8
		PM	10.9	B	13.5	B	2.6
8. Kuihelani Highway & Waiko Road	Signalized	AM	14.5	B	13.1	B	-1.4
		PM	11.2	B	12.9	B	1.7
14. Honoapiilani Highway & Kuihelani Highway	Signalized	AM	15.2	B	NO DATA[7]	NO DATA[7]	N/A
		PM	12.4	B	14.8	B	2.4

Source: Fehr & Peers, 2016.

Notes:

AWSC = All-way stop-controlled intersection

SSSC = Side-street stop-controlled intersection

[1] Results of the existing LOS analysis presented in the *Waikapu Country Town TIAR* (Fehr & Peers, December 2014).

[2] LOS results based on the intersection peak hour volumes collected in May 2016.

[3] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized and all-way stop-controlled intersections. The vehicular delay for the worst movement is reported for side street stop-controlled intersections.

[4] LOS calculations performed using the *2000 Highway Capacity Manual (HCM)* method.

[5] Undesirable LOS highlighted in **bold.**

[6] Recent field observations confirmed changes in the lane configuration and signal phasing at this location. Thus, the LOS analysis at this location under the Existing (2016) Conditions include these modifications.

[7] Due to a problem with the data collection process, AM peak period is not available at Intersection 14 and no AM peak hour intersection operations analysis could be conducted.

FEHR PEERS

MEMORANDUM

Date: October 26, 2016

To: Mike Summers, Planning Consultants Hawaii, LLC

From: Netai Basu & Christine Mercado, Fehr & Peers

Subject: Waikapu Country Town Project – Elaboration on Project Trip Generation Estimates

SD13-0085.01

The comment requests discussion on how 15% for daily and 25% peak hour project trip generation reductions were determined to be appropriate is noted and hereby part of the Final Environmental Impact Statement (FEIS).

The use of MXD was part of the methodology in the TIAR from the outset. This was described in an initial scoping memorandum dated September 19. 2013 that was circulated among relevant agencies, including Maui County Public Works. Current accepted methodologies, such as the Institute of Transportation Engineers (ITE) Trip Generation methodology, are primarily based on data collected at suburban, single-use, free-standing sites. These defining characteristics limit their applicability to mixed-use development projects, such as the proposed WCT project. The land use mix, design features, and setting of the proposed for WCT include characteristics that influence travel behavior differently from typical single-use suburban development projects. In response to the limitations in the ITE methodology, and to provide a straightforward and empirically validated method of estimating vehicle trip generation at mixed-use developments, the US Environmental Protection Agency (EPA) sponsored a national study of the trip generation characteristics of multi-use sites. Travel survey data was gathered from 239 mixed-use developments (MXDs) in six major metropolitan regions, and correlated with the characteristics of the sites and their surroundings. The findings indicate that the amount of external traffic generated is affected by a wide variety of factors, each pertaining to one or more of the following characteristics:

- The relative numbers of residents and jobs on the site

500 Ala Moana Boulevard | Suite 7-400 | Honolulu, HI 96813 | 808-541-9916 | Fax 808-531-2500
www.fehrandpeers.com

- The amount of retail and service use on the site relative to the number of residences
- The amount of retail and service use relative to the number of employees
- The overall size of the development
- The density of development
- The internal connectivity for walking or driving among different activities
- The availability of transit
- The number of convenient trip destinations within the immediate area

These characteristics were related statistically to the trip behavior observed at the study development sites. This quantified relationships between characteristics of the MXDs and the likelihood that trips generated by those MXDs will stay internal and/or use modes of transportation other than the private vehicle. These statistical relationships produced equations, known as the EPA MXD model, that allows predicting external vehicle trip reduction as a function of the MXD characteristics. Applying the external vehicle trip reduction percentage to "raw trips", as predicted by ITE, produces an estimate for the number of vehicle trips traveling in or out of the site.

Since the conclusion of the EPA sponsored study, Fehr & Peers has been actively enhancing the MXD model to improve sensitivity to various site characteristics, improve peak hour performance, and continue to validate the model against MXDs where data is available. Based on the research findings, Fehr & Peers produced a MXD tool (MXD+) that recognizes that traffic generation by mixed-use and other forms of sustainable development relate closely to the density, diversity, design, destination accessibility, transit proximity, and scale of development. MXD+ improves the accuracy of impact estimation and trip internalization and gives planners a tool to rationally balance land use mix and to incorporate urban design, context compatibility, and transit orientation to create lower-impact development. A set of 28 independent MXD sites throughout the mainland of the country that were not included in the initial model development have been tested to validate the model. None of the surveyed sites were in Hawaii. These sites represent locations where it is expected that traditional data and methodologies, such as ITE, would not accurately estimate the project vehicle trip generation.

Based on all statistical measurements from the validation process, the MXD model performs better than the ITE recommended procedures for these types of sites. The MXD model has been approved for use by the EPA.[1] It has also been peer-reviewed in the ASCE Journal of Urban Planning and Development[2], peer-reviewed in a 2012 TRB paper evaluating various smart growth trip generation methodologies[3], recommended by SANDAG for use on mixed-use smart growth developments[4], and has been used successfully in multiple certified environmental documents in

Hawaii, California and other states. The TIAR that Fehr & Peers prepared as part of the EIS for the Villages at Leiali'i Affordable Housing Project (Belt Collins Hawaii, Ltd, November 2010) also used MXD methodology to inform adjustments to the initial trip generation estimates which were based on ITE rates.

Based on the extensive research studies used to develop and validate the MXD model, the trip reduction outputs generated from the model have been found to be more accurate than estimates developed with ITE and other standard methodologies alone.

Endnotes:

[1] Trip Generation Tool for Mixed-Use Developments (2012). www.epa.gov/dced/mxd_tripgeneration.html

[2] "Traffic Generated by Mixed-Use Developments—Six-Region Study Using Consistent Built Environmental Measures." Journal of Urban Planning and Development, 137(3), 248–261.

[3] Shafizadeh, Kevan et al. "Evaluation of the Operation and Accuracy of Available Smart Growth Trip Generation Methodologies for Use in California". Presented at 91st Annual Meeting of the Transportation Research Board, Washington, D.C., 2012.

[4] SANDAG Smart Growth Trip Generation and Parking Study.
http://www.sandag.org/index.asp?projectid=378&fuseaction=projects.detail

FEHR PEERS

MEMORANDUM

Date: October 17, 2016

To: Mike Summers, Planning Consultants Hawaii, LLC

From: Netai Basu & Christine Mercado, Fehr & Peers

Subject: Waikapu Country Town Project – Analysis of 2026 Conditions without the Waiale Bypass

SD13-0085.01

Coordination with local and state agencies, such as the County of Maui, and the project team during the early preparation stages of the Transportation Impact Analysis Report (TIAR) for the Waikapu Country Town Project led to the decision to assume the completion of the planned Waiale Bypass in the study's future analysis scenarios. The Waiale Bypass is a planned southward extension of Waiale Road from its existing terminus at Waiko Road to intersect with Honoapi'ilani Highway approximately one mile south of Honoapi'ilani Highway/Waiko Road. The roadway extension would provide additional access to the project land uses on the makai side via a roundabout intersection with the future east-west roadway within the project ("Main Street") and via a 3-legged intersection with the major North-South Residential Street. This bypass is not identified in the County's FY 2017 CIP, and the precise schedule for construction of this roadway is now uncertain. As planned, Waiale Road would be extended southward from Waiko Road to a new connection with Honoapiilani Highway. It would create a new north-south roadway connection in this area with multiple connections to Kuihelani Highway through the County's planned Base Yard and Regional Park.

During the DEIS public circulation period, some comments have questioned this baseline street improvement assumption, especially given the significance of the bypass road for project circulation, and have asked about impacts on project design and the study area's transportation facilities if the roadway improvement is not funded and built in time for the project. In response, Fehr & Peers has developed and analyzed forecast traffic volumes in Year 2026 without the Waiale Bypass in place, both before and after the addition of project traffic. These traffic volumes

Exhibit C, Feher & Peers Memorandum Dated October 17, 2016

were then used to conduct a full quantitative impact analysis of future no-bypass scenarios. The results of the analysis are summarized in this memorandum.

FUTURE TRAFFIC PROJECTIONS

Estimates of the future traffic conditions without the proposed project in place were derived using the Maui Travel Demand Forecasting Model. Particularly, the same 2026 model developed for the TIAR was used; however, the Waiale Bypass (north of the intersection with the planned north-south residential street that would be constructed as part of the project [Study Intersection #12]) was excluded from the roadway network. The resulting post-processed cumulative base traffic volumes and the anticipated lane configurations, representing future conditions without the project and the bypass for year 2026, is presented in **Figure 1**.

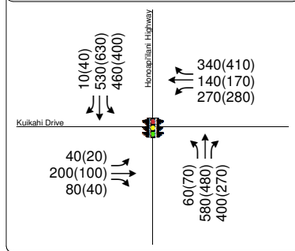
2026 NO PROJECT VOLUME COMPARISON

A comparison of the 2026 No Project peak hour volumes with and without the Waiale Bypass showed that the traffic projected to use the roadway extension would shift to use Honoapi'ilani Highway and Kuihelani Highway. Details of the shift in traffic volumes in the study area between Waiko Road and the intersection of Honoapi'ilani Highway & Kuihelani Highway under the 2026 No Project, No Bypass Condition are summarized below:

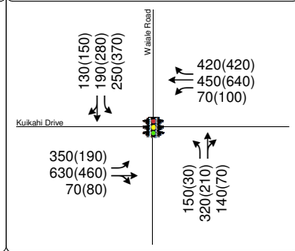
- During the AM peak hour, 210 additional northbound trips and 70 additional southbound trips would traverse Honoapi'ilani Highway.
- Along Kuihelani Highway, it is projected that there would be 110 additional northbound trips and 130 additional southbound trips traversing this portion of the study area in the AM peak hour.
- During the PM peak hour, 50 additional northbound trips and 210 additional southbound trips would traverse Honoapi'ilani Highway.
- Along Kuihelani Highway, it is projected that there would be 130 additional northbound trips and 80 additional southbound trips traversing this portion of the study area in the PM peak hour.

Study Intersection
Turn Lane
AM (PM) Peak Hour Traffic Volume
Traffic Signal
Stop Sign
Waiale Bypass

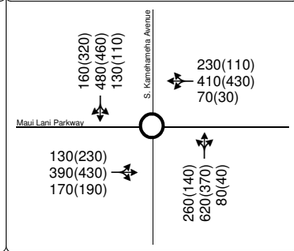
1. Honoapi'ilani Highway/Kuikahi Drive



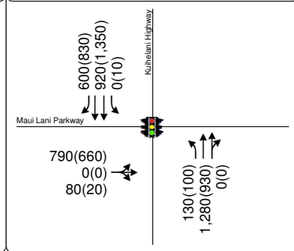
2. Waiale Road/Kuikahi Drive



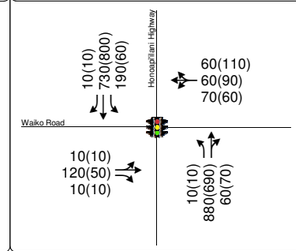
3. S. Kamehameha Avenue/Maui Lani Parkway



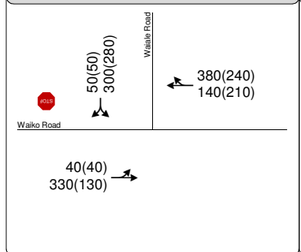
4. Kuihelani Highway/Maui Lani Parkway



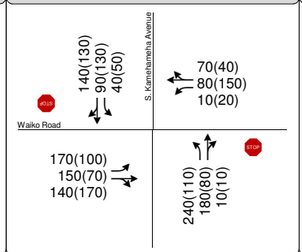
5. Honoapi'ilani Highway/Waiko Road



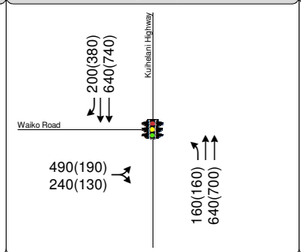
6. Waiale Road/Waiko Road



7. S. Kamehameha Avenue/Waiko Road



8. Kuihelani Highway/Waiko Road



9. Honoapi'ilani Highway/Main Street

Intersection does not exist under No Project Conditions

10. Waiale Road/Main Street

Intersection does not exist without the Waiale Bypass

11. Honoapi'ilani Hwy/E-W Residential Street

Intersection does not exist under No Project Conditions

12. N-S Residential Street/Waiale Road

Intersection does not exist under No Project Conditions

13. Honoapi'ilani Highway/Waiale Road

Intersection does not exist under No Project Conditions

14. Honoapi'ilani Highway/Kuihelani Highway

Figure 1
Peak Hour Traffic Volumes and Lane Configurations
Year 2026 No Project Conditions

PROJECT TRAFFIC PROJECTIONS

Using the same trip generation and overall trip distribution pattern presented in the TIAR, the project trips were assigned to the 2026 roadway network without the bypass. The trip assignment differs from the TIAR as trips to/from land uses on the makai side that were originally using Waiale Road were re-routed to use the site's internal roadways (i.e., Main Street, E-W Residential Road, and N-S Residential Road) and Honoapi'ilani Highway. **Figure 2** illustrates the net new 2026 project generated traffic volumes at full buildout for the AM and PM peak hours at each study intersection.

The project generated traffic volumes **(Figure 2)** were then added to the 2026 base traffic projection **(Figure 1)** to develop 2026 with Project traffic forecasts for the no-bypass scenario shown in **Figure 3**.

KEY STREET SYSTEM CHANGES

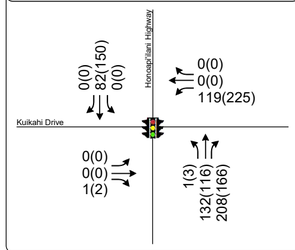
In addition to using the revised traffic projections in the 2026 intersection operations analysis presented in this memorandum, there have been changes to the baseline street system assumptions since the completion of the TIAR, as well as changes to the project street system assumptions due to not constructing that Waiale Bypass that have been applied. Described below are the key changes in study intersection configuration used in this analysis:

- Intersection 1: Honoapi'ilani Highway & Kuikahi Drive – Based on the May 2016 field observations, the eastbound and westbound approaches have been re-striped from one shared through/left-turn lane and one right-turn lane to one left-turn lane, one through lane, and one right-turn lane. Additionally, the eastbound and westbound left-turn phasing has been modified to protected/permitted. These modifications were used in the revised 2026 intersection operations analysis with and without the project in place.
- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway – A roundabout will be replacing the all-way stop-controlled intersection and construction is likely to begin operation sometime in Summer 2017. This intersection control modification was used in the revised 2026 intersection operations analysis with and without the project in place.
- Intersection 6: Waiko Road & Waiale Road – Signalization and construction of the fourth leg of this intersection are associated with the Waiale Bypass. Since this analysis evaluates

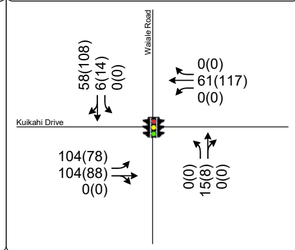
no-bypass scenarios, the existing control and configuration were maintained in the revised 2026 intersection operations analysis with and without the project in place.

- Intersection 9: Honoapi'ilani Highway & Main Street – This future intersection will be constructed as part of the project. Due to the increase in volumes at this location without the Waiale Bypass in place, the intersection configuration has been revised from what was assumed in the TIAR in order to yield acceptable operating conditions (i.e., minimum level of service [LOS] D or better). Thus, this analysis assumes that the intersection is configured with one left-turn lane, one through lane, and one right-turn lane across all approaches. Signal phasing is assumed to be protected/permitted across all approaches, and there would be an overlap phase for the westbound right-turn. These modifications were used in the revised 2026 with project intersection operations analysis.
- Intersection 10: Waiale Bypass & Main Street – This future intersection will not exist without the Waiale Bypass in place.
- Intersection 12: North-South Street Residential & Waiale Bypass– This future intersection will be constructed as part of the project. Without the Waiale Bypass in place this intersection would be a 2-legged, side-street stop-controlled intersection. These modifications were used in the revised 2026 with project intersection operations analysis.
- Intersection 13: Honoapi'ilani Highway & Waiale Bypass – This future intersection will be constructed as part of the project. Without the Waiale Bypass in place, this intersection would be a 4-legged, side-street intersection with stop-control on the minor approach.

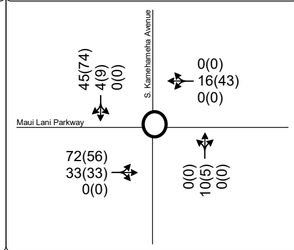
1. Honoapi'ilani Highway/Kuikahi Drive



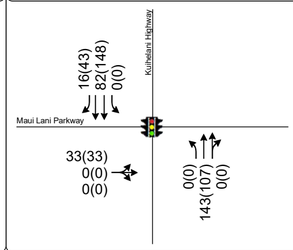
2. Waiale Road/Kuikahi Drive



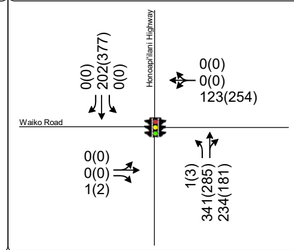
3. S. Kamehameha Avenue/Maui Lani Parkway



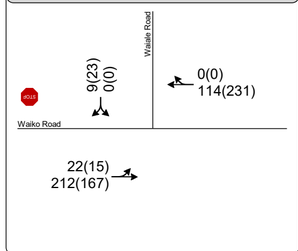
4. Kuihelani Highway/Maui Lani Parkway



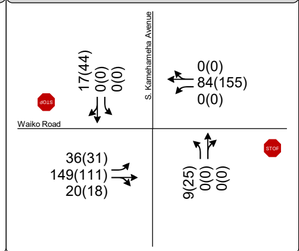
5. Honoapi'ilani Highway/Waiko Road



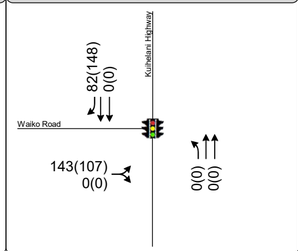
6. Waiale Road/Waiko Road



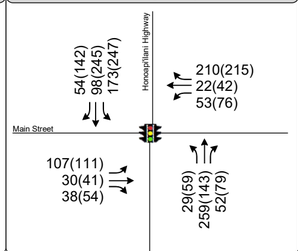
7. S. Kamehameha Avenue/Waiko Road



8. Kuihelani Highway/Waiko Road



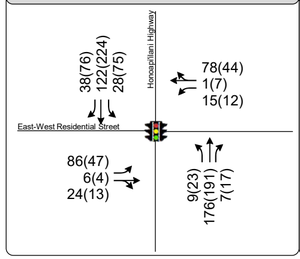
9. Honoapi'ilani Highway/Main Street



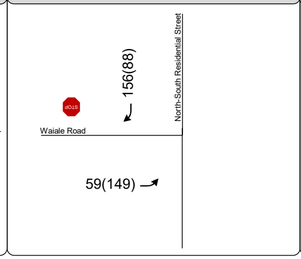
10. Waiale Road/Main Street

Intersection does not exist without the Waiale Bypass

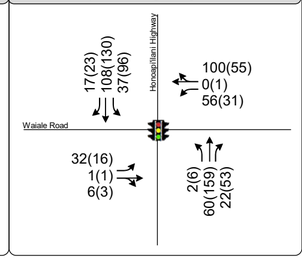
11. Honoapi'ilani Hwy/E-W Residential Street



12. N-S Residential Street/Waiale Road



13. Honoapi'ilani Highway/Waiale Road



14. Honoapi'ilani Highway/Kuihelani Highway

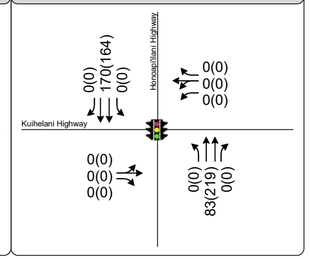
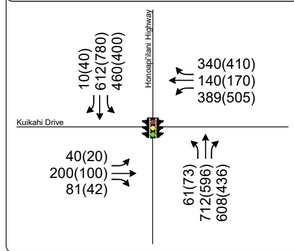


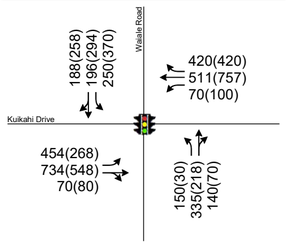
Figure 2
Peak Hour Traffic Volumes and Lane Configurations
Net New Project Only, Phase 1 & 2 (2026)

Study Intersection
Turn Lane
AM (PM) Peak Hour Traffic Volume
* Includes Pass-by Trips
Traffic Signal
Stop Sign
--- Waiale Bypass

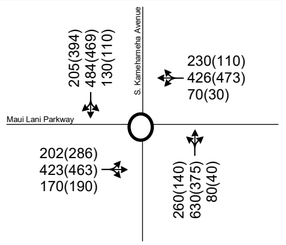
1. Honoapi'ilani Highway/Kuikahi Drive



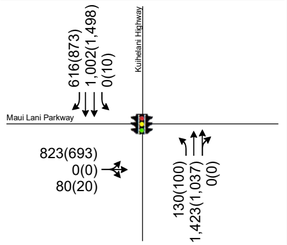
2. Waiale Road/Kuikahi Drive



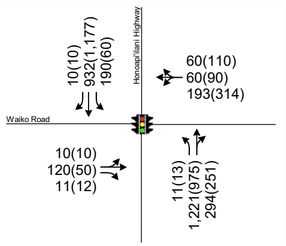
3. S. Kamehameha Avenue/Maui Lani Parkway



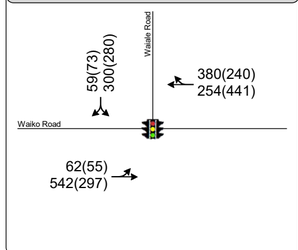
4. Kuihelani Highway/Maui Lani Parkway



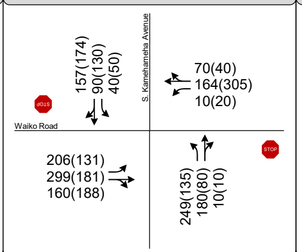
5. Honoapi'ilani Highway/Waiko Road



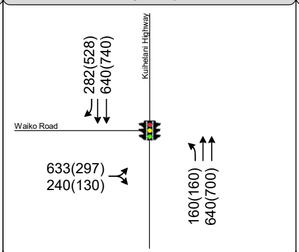
6. Waiale Road/Waiko Road



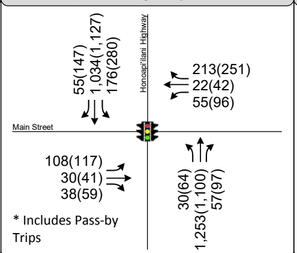
7. S. Kamehameha Avenue/Waiko Road



8. Kuihelani Highway/Waiko Road



9. Honoapi'ilani Highway/Main Street*

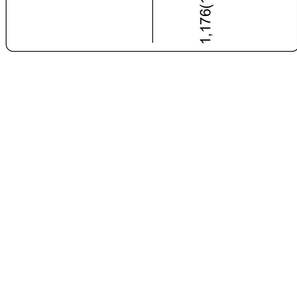


* Includes Pass-by Trips

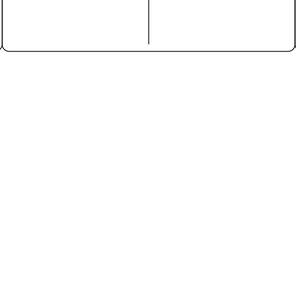
10. Waiale Road/Main Street

Intersection does not exist without the Waiale Bypass

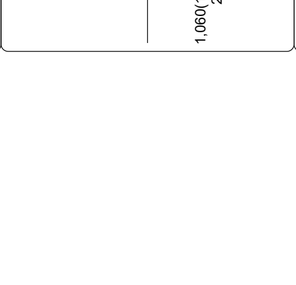
11. Honoapi'ilani Hwy/E-W Residential Street



12. N-S Residential Street/Waiale Road



13. Honoapi'ilani Highway/Waiale Road



14. Honoapi'ilani Highway/Kuihelani Highway

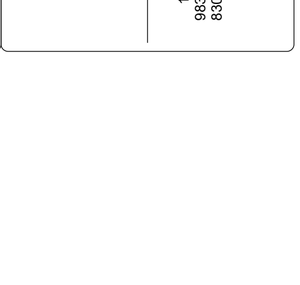


Figure 3
Peak Hour Traffic Volumes and Lane Configurations
2026 with Project (Phase 1 & 2) without Bypass Conditions

INTERSECTION ANALYSIS

The intersection operations analysis compares the projected levels of service at each study intersection under cumulative conditions for 2026 with and without the proposed project and without the Waiale Bypass to determine the potential impacts. Results of this analysis are presented in **Table 1**.

2026 NO PROJECT TRAFFIC CONDITIONS

The results of the LOS calculations indicate that all of the future study intersections operate at an overall desirable LOS (LOS D or better) under 2026 No Project Conditions, with the exception of the following locations:

- Intersection 1: Honoapi'ilani Highway & Kuikahi Drive (LOS F – AM peak hour)
- Intersection 2: Waiale Road & Kuikahi Drive (LOS E – AM peak hour hour)
- Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway (LOS F – AM and PM peak hours)
- Intersection 4: Kuihelani Highway & Maui Lani Parkway (LOS F – AM and PM peak hours)
- Intersection 6: Waiale Road & Waiko Road (LOS F – AM Peak hour and LOS E – PM peak hour)
- Intersection 7: S. Kamehameha Avenue & Waiko Road (LOS F – AM and PM peak hours)
- Intersection 8: Kuihelani Highway & Waiko Road (LOS E – AM peak hour)
- Intersection 13: Honoapi'ilani Highway & Waiale Road (LOS F – AM and PM peak hours)

When compared to the 2026 No Project results presented in the TIAR, Intersection 6: Waiale Road & Waiko Road and Intersection 8: Kuihelani Highway & Waiko Road are new locations that would operate at undesirable LOS if the Waiale Bypass is not in place.

2026 WITH PROJECT TRAFFIC CONDITIONS

The proposed project would contribute to cumulative impacts (LOS E or LOS F conditions) during one or both of the peak hours at the seven study intersection listed in the previous section. In addition, project-specific impacts have been identified at intersections where the addition of

project-generated traffic would cause their overall intersection operations to degrade below LOS D in one or both peak hours. The project-related impacts identified are:

- Intersection 1: Honoapi'ilani Highway & Kuikahi Drive (cumulative and project-specific impact)
- Intersection 2: Waiale Road & Kuikahi Drive (cumulative and project-specific impact)
- Intersection 5: Honoapi'ilani Highway & Waiko Road (LOS F in the AM and PM peak hour)

The results of this no-bypass analysis shows that Intersection 5: Honoapi'ilani Highway & Waiko Road and Intersection 6: Waiale Road & Waiko Road are new impacts not identified in the TIAR. Additionally, when comparing these results to the 2026 intersection operations analysis results presented in the TIAR, the impact type at the following locations change:

- Intersection 2: Waiale Road & Kuikahi Drive would also have a project-specific impact in the PM peak hour.
- Intersection 8: Kuihelani Highway & Waiko Road would be identified as a cumulative impact instead of a project-specific impact under the 2026 with Project without Bypass Condition.
- Intersection 13: Honoapi'ilani Highway & Waiale Road would have a project-specific impact in the AM and PM peak hours.

TABLE 1 – YEAR 2026 LEVELS OF SERVICE - WAIKAPU COUNTRY TOWN FULL DEVELOPMENT (PHASE 1 & 2)

Intersection	Traffic Control	Peak Hour	Year 2026 No Project, No Bypass Conditions		Year 2026 with Project Without Bypass Conditions		Delay Change	Mitigation Required?	Impacted in the DEIS?	Mitigated to: Pre-Project or Better Conditions (≤ LOS D)		Mitigated to: LOS D or Better Conditions	
			Del/Veh[1]	LOS[2,3]	Del/Veh[1]	LOS[2,3]				Del/Veh[1]	LOS[2,3]	Del/Veh[1]	LOS[2,3]
1. Honoapi'ilani Highway & Kuikahi Drive	Signal	AM	85.5	**F**	116.5	**F**	31.0	**YES**	**YES**	51.2	D	Same as Pre-Project Mitigation	
		PM	35.1	D	86.2	**F**	51.1	**YES**	**YES**	37.7	D		
2. Waiale Road & Kuikahi Drive	Signal	AM	62.1	**E**	86.7	**F**	24.6	**YES**	**YES**	46.7	D	Same as Pre-Project Mitigation	
		PM	51.0	D	85.4	**F**	34.4	**YES**	**YES**	36.4	D		
3. S. Kamehameha Avenue & Maui Lani Parkway	Roundabout	AM	> 180	**F**	> 180	**F**	**	**YES**	**YES**	167.4[4]	**F**[4]	23.8	C
		PM	> 180	**F**	> 180	**F**	**	**YES**	**YES**	163.4[4]	**F**[4]	15.7	B
4. Kuihelani Highway & Maui Lani Parkway	Signal	AM	112.0	**F**	125.5	**F**	13.5	**YES**	**YES**	25.8	C	Same as Pre-Project Mitigation	
		PM	86.4	**F**	92.8	**F**	6.4	**YES**	**YES**	33.4	C		
5. Honoapi'ilani Highway & Waiko Road	Signal	AM	40.6	D	> 180	**F**	**	**YES**	NO	33.3	C	Same as Pre-Project Mitigation	
		PM	22.8	C	156.0	**F**	133.2	**YES**	NO	51.3	D		
6. Waiale Road & Waiko Road	SSSC	AM	> 180	**F**	>180	**F**	**	**YES**	NO	23.9	C	Same as Pre-Project Mitigation	
		PM	48.5	**E**	>180	**F**	**	**YES**	NO	16.3	B		
7. S. Kamehameha Avenue & Waiko Road	SSSC	AM	> 180	**F**	**	**F**	**	**YES**	**YES**	10.9	B	Same as Pre-Project Mitigation	
		PM	80.1	**F**	**	**F**	**	**YES**	**YES**	8.3	A		
8. Kuihelani Highway & Waiko Road	Signal	AM	70.5	**E**	113.1	**F**	42.6	**YES**	**YES**	32.3	C	Same as Pre-Project Mitigation	
		PM	21.0	C	26.6	C	5.6	NO	NO	18.6	B		
9. Honoapi'ilani Highway & Main Street	Signal	AM	Only built with project		46.3	D	46.3	NO	NO	No Mitigation Required			
		AM			44.9	D	44.9	NO	NO				
10. Waiale Road & Main Street	Roundabout	AM	Does not exist without the Waiale Bypass										
		PM											
11. Honoapi'ilani Highway & East-West Residential Street	Signal	AM	Only built with project		13.1	B	13.1	NO	NO	No Mitigation Required			
		PM			9.2	A	9.2	NO	NO				
12. North-South Residential Street & Waiale Road	SSSC	AM	Only built with project		8.9	A	8.9	NO	NO	No Mitigation Required			
		PM			8.6	A	8.6	NO	NO				
13. Honoapi'ilani Highway & Waiale Road	SSSC	AM	Only built with project		>180	F	>180	**YES**	NO	14.9	B	Same as Pre-Project Mitigation	
		PM			>180	F	>180	**YES**	NO	9.7	A		
14. Honoapi'ilani Highway & Kuihelani Highway	Signal	AM	21.3	C	22.8	C	1.5	NO	NO	No Mitigation Required			
		PM	23.4	C	26.7	C	3.3	NO	NO				

Source: Fehr & Peers, 2016

Notes:

** Indicated oversaturated conditions. Delay cannot be calculated. AWSC = All-way stop-controlled intersection; SSSC = Side-street stop-controlled intersection.

[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized and all-way stop control intersections. The vehicular delay for the worst movement is reported for side street stop-controlled intersections.

[2] LOS calculations performed using the 2000 Highway Capacity Manual (HCM) method.

[3] Unacceptable LOS highlighted in **bold.**

[4] The mitigation needed to have the intersection operate better than pre-project conditions is installing signal control and having the existing intersection configuration (i.e., a shared left/through/right lane on the eastbound and westbound approaches and a left-turn lane and a shared through/right-turn lane on the northbound and southbound approaches) in place.

POTENTIAL TRAFFIC IMPROVEMENTS

Physical mitigation measures developed in the TIAR were first applied to the impacted locations and others were investigated as necessary. The emphasis was to identify physical and/or operational improvements that could be implemented within the existing or planned roadway rights-of-way. **Table 1** summarizes the projected LOS in 2026 at the impacted locations with these proposed measures in place.

The full range of improvements that address both project-related and/or cumulative traffic impacts are discussed in detail below.

Intersection 1: Honoapi`ilani Highway & Kuikahi Drive – The mitigation presented in the TIAR is not sufficient to mitigate the impact under the no-bypass scenario. Thus, the impact at this intersection could be reduced by widening the northbound approach from a left-turn lane, a through lane, and a right-turn to a left-turn lane, a through lane, and two right-turn lanes, widening the southbound approach from a left-turn lane, a through lane, and a right-turn lane to two left-turn lanes, a through lane, and a right-turn lane, and widening the westbound approach from a left-turn lane, a through lane, and a right-turn lane to two left-turn lanes, a through lane, and two right-turn lanes. Additionally, to complement the addition of a second southbound left-turn lane and a second westbound left-turn lane, the east and south legs of the intersection would each need to be widened to provide a second departure lane. Signal modifications at this intersection would include protected phasing on all approaches and right-turn overlap phasing on the westbound and northbound approaches. Additional right-of-way would be needed on both Honoapiilani Highway and on Kuikahi Drive to fully implement this improvement, which would result in LOS D operations at an overall intersection level.

Intersection 2: Waiale Road & Kuikahi Drive – The impact at this intersection could be mitigated using a reduced version of the improvements proposed in the TIAR for this location. The improvements needed to mitigate the impacts identified under the no-bypass scenario include widening the eastbound and westbound approaches to provide a left-turn lane, two through lanes, and a right-turn lane. To complement the widening of the eastbound and westbound approaches, both the eastbound and westbound departures would also need to be widened to each provide a second receiving lane. This improvement would result in LOS D operations at an overall intersection level.

Intersection 3: S. Kamehameha Avenue & Maui Lani Parkway – The impact at this intersection could be mitigated by implementing the improvements presented in the TIAR, which is signalization of the intersection and maintaining the existing lane configuration (i.e., a shared left/through/right lane on the eastbound and westbound approaches and a left-turn lane and a shared through/right-turn lane on the northbound and southbound approaches). It should be noted, however, that the updated 2026 No Project Condition now assumes that the intersection would be configured as a single-lane roundabout.

As discussed in the TIAR, the pre-project improvement is install a traffic control signal with permitted phasing at all approaches. For LOS D or better operations at an overall intersection level, not only would a traffic signal need to be installed, but the eastbound and northbound approaches would need to provide a left-turn lane and a shared through/right-turn lane and the westbound and southbound approaches to provide a left-turn lane, a through lane, and a right-turn lane.

Intersection 4: Kuihelani Highway & Maui Lani Parkway – The impact at this intersection could be mitigated by implementing the improvements presented in the TIAR, which is to widen the eastbound approach to provide a left-turn lane, a shared through/left-turn lane, and a right-turn lane. In addition to the change in configuration, the eastbound and westbound left-turn phasing would need to be modified to split phasing. This improvement would result in LOS D operations at an overall intersection level.

Intersection 5: Honoapi`ilani Highway & Waiko Road – This intersection is a new impact not previously identified in the TIAR. Thus, the impact at this intersection could be reduced by widening the northbound approach from a left-turn lane and a shared through/right-turn lane to provide a left-turn lane, a through lane, and a shared through/right-turn lane, and widening the eastbound and westbound approaches to provide a left-turn lane and a shared through/right-turn lane. The northbound departure of the highway would require widening for a minimum of approximately 250 feet to provide a second receiving lane, which would transition back into the existing single northbound lane. Additional right-of-way may be needed on both Honoapiilani Drive and Waiko Road to fully implement this improvement, which would result in LOS D operations at an overall intersection level.

Intersection 6: Waiale Road & Waiko Road – The impact at this intersection is a new impact not previously identified in the TIAR. It could be mitigated with the installation of a traffic signal,

which was assumed to be in place in the Cumulative, pre-project condition in the TIAR due to its key location on the planned Waiale Bypass. This improvement would result in LOS D operations at an overall intersection level and the turning movement level.

Intersection 7: S. Kamehameha Avenue & Waiko Road – The impact at this intersection could be mitigated using the improvement presented in the TIAR, which is installing a traffic signal with permitted phasing at all approaches. This improvement would result in LOS D or better operations at both the overall intersection level and the turning movement level.

Intersection 8: Kuihelani Highway & Waiko Road – The impact at this intersection could be mitigated using the improvement presented in the TIAR, which is widening and restriping the eastbound approach to provide a left-turn lane and a right-turn lane. This improvement would result in LOS D or better operations at an overall intersection level.

Intersection 13: Honoapi'ilani Highway & Waiale Road – The impact at this intersection is a new impact not previously identified in the TIAR. It could be mitigated with the installation of a traffic signal, which was assumed to be in place in the Cumulative, pre-project condition in the TIAR due to its key location on the planned Waiale Bypass. This improvement would result in LOS D or better operations at an overall intersection level and the turning movement level.

CONCLUSIONS

This memorandum documents analysis conducted to assess project-related and cumulative impacts upon full build-out of the proposed Waikapu Country Town project if the planned Waiale Bypass were not constructed by 2026. While three more study intersections would be significantly impacted under this scenario than in the "with Bypass" scenario analyzed in the TIAR, LOS D can be achieved at the impacted locations with an expanded program of roadway improvements as mitigation.

2. County of Maui, Department of Water Supply

ALAN M. ARAKAWA
Mayor

DAVID TAYLOR, P.E.
Director

PAUL J. MEYER
Deputy Director

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793-2155
www.mauiwater.org

June 20, 2016

Planning Consultants Hawaii, LLC
Mr. Michael J. Summers, President
2331 West Main Street
Wailuku, Hawaii 96793

Re: TMK: (2) 3-6-002:001 and :003, 3-6-004:003 and :006, 3-6-005:007 and 3-6-006:036
Project Name: Waikapu Country Town
Draft Environmental Impact Statement (DEIS)

Dear Mr. Summers:

Thank you for the opportunity to comment on the Draft Environmental Impact Statement (EIS).

Source Availability

The project overlies the Iao and Waikapu aquifers, the former with a sustainable yield of 20 million gallons per day (gpd) and the latter with 3 mgd, according to the Commission on Water Resource Management (CWRM).

The document states that five wells have been drilled on the site, all located within the Waikapu aquifer. The wells' pump tests requirements (CWRM) and water quality compliance (State DOH) should be addressed in the EIS.

A private water system will be utilized for the entire development. Our department has no jurisdiction to impose requirements on subdivisions served by water systems that are not owned and operated by the County. Please note that any proposal to dedicate this water system to the County should reference compliance with the department's rules and regulations, the Maui County Code, and the Water System Standards for Maui County and stated in the EIS.

Consumption

According to the DEIS, the projected average daily water demand is 655,508 gallons per day (gpd), based on DWS system standards. However, Table 47 of the document contains at least one error: "Rural Residential" is not recognized as a Use in the DWS Water System Standards, 2002. Based on system standards, the average daily water demand is at a minimum approximately 876,746 gpd, not including agricultural uses.

Mr. Michael J. Summers, President
Waikapu Country Town

Pollution Prevention

Best Management Practices (BMPs) protect groundwater resources and should be noted in the EIS and implemented during construction. The mitigation measures below will alleviate adverse impacts on water quality during construction:

- Prevent cement products, oil, fuel and other toxic substances from leaching into the water.
- Properly and promptly dispose of all loosened and excavated soil and debris material from drainage structure work.
- Retain ground cover until the last possible date.
- Stabilize denuded areas by sodding or planting as soon as possible. Replanting should include soil amendments and temporary irrigation. Use high seeding rates to ensure rapid stand establishment.
- Avoid fertilizers and biocides, or apply only during periods of low rainfall to minimize chemical run-off.
- Keep run-off on site.

We also recommend that the following BMPs designed to prevent contamination through and to the wells be included in the EIS:

1. Inspect exposed parts of the well periodically for problems such as: cracked or corroded well casing, broken or missing well cap, damage to protective casing, settling and cracking of surface seals.
2. Ensure that the area around the well is sloped so that surface runoff drains away from the well.
3. Provide a well cap or sanitary seal to prevent unauthorized use of or entry into the well.
4. Provide for sediment removal or well cleaning as necessary.
5. Have the well tested once a year for fecal coliform or other constituents that may be of concern.
6. Keep accurate records of any well maintenance, such as disinfection or sediment removal, that might require use of chemicals in the well.
7. Mixing or using pesticides, fertilizers, herbicides, degreasers, fuels, or other pollutants near the well is to be avoided.
8. Do not locate any type of potentially polluting activity within 1,000' of the well for wellhead protection.

Please note that DWS's Draft WHP Ordinance can be found at the following link:
http://www.mauicounty.gov/DocumentCenter/View/98294

Should you have any questions, please contact Staff Planner Marti Buckner at 463-3104 or marti.buckner@mauicounty.gov.

Sincerely,

David Taylor, P.E. Director

mlb

cc: engineering division

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. David Taylor, P.E.
Director
County of Maui
Department of Water Supply
200 South High Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Taylor:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated June 20, 2016 regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following responses:

1. *Source Availability.* The Applicant understands that the Commission on Water Resource Management (CWRM) has jurisdiction over the pumping of the Iao and Waikapu aquifers. Morover, the Applicant is aware that the Iao Aquifer has a sustainable yield of 20 million gallons per day (mgd) and the Waikapu Aquifer has a sustainable yield of 3 mgd.

   The WCT has six wells drilled. Ten-day pump and water quality tests were conducted on three of these wells in April and May 2016. The test results are summarized in Section V.D.4 of the FEIS and are incorporated in their entirety into the FEIS as Appendix I.

   The Applicant intends to own and operate the potable and non-potable water system it is developing. However, the system is

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

being designed in accordance with all applicable State and County requirements for public water systems so that it might be dedicated to the County at a future date. Section V.D.4 of the FEIS has been updated in response to the Department's question.

2. ***Consumption.*** After consultation with Department of Water Supply engineers, the Project's potable water use was reduced by 33 percent because of the Applicant's proposed use of a dual potable and non-potable water system for irrigation of urban open space, including the irrigation of residential and commercial lots. The 33 percent reduction was based upon consultation with the Department of Water Supply as is documented in the Preliminary Engineering Report (Appendix H of the FEIS). Regarding the proposed "Rural Residential" water use standard, the DWSWSS does not have a value for the potable demand for a Rural Residential designation. The 1,000 gpd/unit used is based on discussion with the Department of Water Supply engineers as an acceptable demand for this designation (See the Preliminary Engineering Report, Appendix H of the FEIS). Section V.D.4 of the FEIS has been updated to address your questions.

3. ***Pollution Prevention.*** The Applicant appreciates the list of construction phase BPM's and well head protection BMP's provided by the Department. The Project's construction and operation phase BMP's to mitigate water quality impacts are explained in Section V.D.3 and 4 of the FEIS. The Applicant is aware of the County's Draft Wellhead Protection Ordinance.

Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

3. County of Maui, Fire Prevention Bureau, Department of Fire and Public Safety

ALAN M. ARAKAWA
MAYOR

JEFFREY A. MURRAY
FIRE CHIEF

ROBERT M. SHIMADA
DEPUTY FIRE CHIEF

COUNTY OF MAUI
DEPARTMENT OF FIRE AND PUBLIC SAFETY
FIRE PREVENTION BUREAU

313 MANEA PLACE . WAILUKU, HAWAII 96793
(808) 876-4690 . FAX (808) 244-1363

February 10, 2016

Planning Consultants Hawaii, LLC
Attn: Michael J. Summers, President
2331 W. Main Street
Wailuku, HI 96793

Re: Waikapu Country Town
Wailuku, Maui, HI
Draft EIS

Dear Michael:

Thank you for the opportunity to provide comment on the referenced subject. At this time, our office provides the following comments:

- Our office reserves the right to provide comment during the subdivision process for this project. At that time, fire apparatus access and water supply for fire protection shall be reviewed and approved.
- Our office also reserves the right to provide comment during the building permit process when access, fire protection, and life safety shall be reviewed and approved for proposed buildings within this project.

If there are any questions or comments, please feel free to contact me at (808) 876-4693.

Sincerely,

Paul Haake
Captain, Fire Prevention Bureau

PLANNING CONSULTANTS HAWAII, LLC

URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Paul Haake
Captain
Fire Prevention Bureau
Department of Fire and Public Safety
313 Manea Place
Wailuku, Maui, Hawaii 96793

Dear Mr. Haake:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated February 10, 2016 regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. The Applicant understands that your office desires to provide detailed comments on the project during the processing of the subdivision and building permits.

Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

4. County of Maui, Department of Housing and Human Concerns, Housing Division

DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
HOUSING DIVISION
COUNTY OF MAUI

ALAN M. ARAKAWA
Mayor
CAROL K. REIMANN
Director
JAN SHISHIDO
Deputy Director

35 LUNALILO STREET, SUITE 102 • WAILUKU, HAWAII 96793 • PHONE (808) 270-7351 • FAX (808) 270-6284

February 11, 2016

Mr. Michael J. Summers, President
Planning Consultants Hawaii LLC
2331 W. Main Street
Wailuku, HI 96793

Dear Mr. Summers:

Subject: **Draft Environmental Impact Statement (DEIS) for Waikapu Country Town of Maui, Hawaii. TMK's (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036**

Thank you for the opportunity to review the Draft Environmental Impact Statement for the subject property. Based on our review, we have determined that the subject project is subject to Chapter 2.96, Maui County Code that a Residential Workforce Housing agreement is required with the Department of Housing and Human Concerns. At the present time, the Department has no additional comments to offer.

Please call Mr. Veranio Tongson Jr. of our Housing Division at 270-1741 if you have any questions.

Sincerely,

BUDDY A. ALMEIDA
Housing Administrator

cc: Director of Housing and Human Concerns
Land Use Commission

PLANNING CONSULTANTS HAWAII, LLC

URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Buddy A. Almeida
Housing Administrator
County of Maui
Department of Housing and Human Concerns
Housing Division
35 Lunalilo Street, Suite 102
Wailuku, Maui, Hawaii 96793

Dear Mr. Almeida:

Re: **Draft Environmental Impact Statement** prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated February 11, 2016 regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. The Applicant is aware that the project must comply with Chapter 2.96, Maui County Code, and that a Residential Workforce Housing Agreement is required with the Department of Housing & Human Concerns.

Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

5. County of Maui, Department of Parks and Recreation

ALAN M. ARAKAWA
Mayor

KA'ALA BUENCONSEJO
Director

BRIANNE L. SAVAGE
Deputy Director

(808) 270-7230
FAX (808) 270-7934

DEPARTMENT OF PARKS & RECREATION

700 Hali'a Nakoa Street, Unit 2, Wailuku, Hawaii 96793

February 29, 2016

Mr. Michael Summers, President
Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Hawaii 96793

Dear Mr. Summers:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) FOR PROPOSED WAIKAPU COUNTRY TOWN,
TMK: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007 AND (2) 3-6-006:036
WAILUKU, MAUI, HAWAII

Thank you for the opportunity to review and comment on the subject project. The Department of Parks & Recreation is interested in continuing discussions with the applicant regarding the proposed 18.5-acre Waikapu River Park, to be dedicated to the County as compliance with the park assessment requirements per MCC 18.16.320. The Department would also like to discuss how the proposed project will tie into and augment the neighboring Waikapu Park and Community Center, and the future County Baseyard and Central Maui Regional Park.

Should you have any questions or concerns, please feel free to contact me, or Robert Halvorson, Chief of Planning and Development, at 270-7931.

Sincerely,

KA'ALA BUENCONSEJO
Director of Parks & Recreation

c: Robert Halvorson, Chief of Planning and Development

KB:RH:csa

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Ka'ala Buenconsejo
Director
Department of Parks and Recreation
700 Hali'a Nakoa Street, Unit 2
Wailuku, Maui, Hawaii 96793

Dear Mr. Buenconsejo:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated February 29, 2016 regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project.

The Applicant understands that the project must comply with MCC 18.16.320 and looks forward to discussing the proposed WCT park lands that are proposed to be dedicated to the County for park use. As described in Sections III.B.4 and V.C.1 of the FEIS, the Project is proposing a mix of active and passive parks in a variety of size configurations. The Applicant looks forward to consulting with your Department to ensure that the proposed park lands address both the Project's and the County's park and recreation facility needs.

As noted in Section V.C.1 of the FEIS the Applicant will consult with the Parks Department to ensure that the Project's park and recreation facilities are accessible to and compliment neighboring facilities including the Waikapu Park and Community Center, the County baseyard and County Regional Park.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's)

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

6. County of Maui, Department of Planning

ALAN M. ARAKAWA
Mayor

WILLIAM R. SPENCE
Director

MICHELE CHOUTEAU McLEAN
Deputy Director

COUNTY OF MAUI
DEPARTMENT OF PLANNING

March 9, 2016

Mr. Michael J. Summers, President
Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Hawaii 96793

Dear Mr. Summers:

SUBJECT: REQUEST FOR COMMENT ON DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) PREPARED FOR A PETITION FOR A STATE LAND USE DISTRICT BOUNDARY AMENDMENT AND ANTICIPATED APPLICATIONS FOR A COMMUNITY PLAN AMENDMENT), CHANGE IN ZONING AND PROJECT DISTRICT FOR THE PROPOSED WAIKAPU COUNTRY TOWN, LOCATED AT WAIKAPU, ISLAND OF MAUI, HAWAII; TMK: (2) 3-6-002:003 (POR), (2) 3-6-004:003 (POR), (2) 3-6-004:006 (POR), AND (2) 3-6-005:007 (POR) (EAC 2016/0001)

The Department of Planning (Department) is in receipt of the above-referenced document for the proposed Waikapu Country Town (Project). On April 29, 2015, the State of Hawaii Land Use Commission agreed to be the Accepting Authority pursuant to Chapter 343, Hawaii Revised Statutes; and determined that the proposed action may have a significant impact upon the environment to warrant proceeding directly to the preparation of an EIS. On June 9, 2015, the Department sent a letter to the Applicant providing comments in reference to an EIS Preparation Notice.

The Department, after a review of the Draft EIS, thanks the Applicant for addressing issues including, but not limited to, Project consistency with County Plans and Zoning, Project impacts and mitigation measures related to roadway infrastructure, utilities, drainage, water supply, wastewater, and viewplanes, and Project connections with adjacent neighborhoods. The visual streetscapes in the Draft EIS help to provide a "sense of place" of the proposed community.

The Department anticipates using the Final EIS as an information document during the review process by the State of Hawaii Land Use Commission, Maui Planning Commission, and Maui County Council. The Department anticipates receiving a copy of the Final EIS for review.

Thank you for the opportunity to comment on this Project of considerable magnitude and impact to the Maui Island community. Should you have any questions about the comments in this letter, please contact Staff Planner Kurt Wollenhaupt by email at kurt.wollenhaupt@mauicounty.gov or by phone at (808) 270-1789.

Sincerely,

WILLIAM SPENCE
Planning Director

xc: Clayton I. Yoshida, AICP, Planning Program Administrator (PDF)
John S. Rapacz, Planning Program Administrator (PDF)
Kurt F. Wollenhaupt, Staff Planner (PDF)
Project File
General File

WRS:CIY:KFW:aj
K:\WP_DOCS\PLANNING\EAC\2016\0001_WaikapuTown\WaikapuDraftEIS_Comments.docm

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. William Spence
Director
Department of Planning
County of Maui
One Main Plaza Building
2200 Main Street, Suite 315
Wailuku, Maui, Hawaii 96793

Dear Mr. Spence:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated March 9, 2016 regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project.

The Applicant is pleased that the Department found our response to your letter dated June 9, 2015 helpful and that the streetscape simulations helped convey a sense of place for the project. The Applicant is aware that the FEIS will serve as an information document in support of the Applicant's request for a District Boundary Amendment, Community Plan Amendment and Change in Zoning. We look forward to working closely with your Department through the entitlement process.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

7. County of Maui, Department of Environmental Management

ALAN M. ARAKAWA
Mayor

STEWART STANT
Director

MICHAEL M. MIYAMOTO
Deputy Director

MICHAEL RATTE
Solid Waste Division

ERIC NAKAGAWA, P.E.
Wastewater Reclamation Division

COUNTY OF MAUI
DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
2050 MAIN STREET, SUITE 2B
WAILUKU, MAUI, HAWAII 96793

April 13, 2016

Mr. Michael Summers
Planning Consultants Hawaii, LLC
2331 W. Main Street
Wailuku, Hawaii 96793

SUBJECT: WAIKAPU COUNTRY TOWN
DRAFT ENVIRONMENTAL IMPACT STATEMENT
TMK (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007, (2) 3-6-006:036, WAILUKU, MAUI

We reviewed the subject application and have the following comments:

1. Solid Waste Division comments:

    a. The contractor must apply to the Central Maui Landfill to dispose of construction waste and obtain a project number. Information is available at www.mauicounty.gov or from the web with the inquiry, "Maui County C&D."

2. Wastewater Reclamation Division (WWRD) comments:

    a. The development will not be allowed to connect to the existing County wastewater collection system and treatment plant.
    b. The Wailuku-Kahului Wastewater Reclamation Facility does not have the capacity to accept flows from outside the current service area.
    c. The existing collection system is inadequate and unable to accept flows from this development without significant upgrades.
    d. Developer shall work with the County of Maui and adjacent developers to complete a master planned treatment solution for the Waikapu area.
    e. Developer shall contribute their fair share to the implementation of the final treatment solution.
    f. The Department of Environmental Management and the Wastewater Reclamation Division will provide additional comments

upon review of the Preliminary Engineering Report prepared for the EIS.

If you have any questions regarding this memorandum, please contact Michael Miyamoto at 270-8230.

Sincerely,

/s/ STEWART STANT
Director of Environmental Management

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Stewart Stant
Director
Department of Environmental Management
County of Maui
2050 Main Street, Suite 2B
Wailuku, Maui, Hawaii 96793

Dear Mr. Stant:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated April 13, 2016 regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following:

Solid Waste Division Comments

1.a The Applicant understands that during the construction phase, the contractor (s) must apply to the Central Maui Landfill to dispose of construction waste and obtain a project number.

Wastewater Division Comments

2.a The Applicant understands that the project will not be allowed to connect to the Wailuku-Kahului Wastewater Treatment Plant and Collection System.

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

2.b The Applicant is aware that the Wailuku-Kahului Wastewater Treatment Plant does not have capacity to accept flows from outside of the service area.

2.c The Applicant is aware that the existing collection system is inadequate and unable to accept flows from the subject development without significant upgrades.

2d. ***Master Planned Treatment Solution for Waikapu.*** The Applicant intends to construct a private wastewater treatment package plant to service the Project's wastewater demand. This plant will also produce R1 and R2 effluent that will be used for agricultural irrigation and irrigation of the Project's parks and open space. The Project's wastewater impacts and proposed private treatment plant are described in detail in Sections III.B.8, V.D.5 and VIII.6 of the FEIS and in Appendices H, J and K of the FEIS.

The Applicant is supportive of the development of a master planned wastewater treatment solution for Waikapu. It would be necessary for such a facility to be available concurrently with the build-out of the Project. While the Applicant intends to pursue it private treatment plant, it welcomes the opportunity to coordinate its plans with the County and adjacent developers.

2.e ***Fair-share Cost Sharing.*** As noted, the Applicant intends to develop a private wastewater treatment package plant to service the Project's wastewater treatment demand. However, should the County be able to assure that a centralized Waikapu wastewater treatment facility, or other treatment option is available concurrently with the buildout of the Project, then the Applicant would consider participating in the development of a regional facility.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions,

please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

8. County of Maui, Police Department

POLICE DEPARTMENT
COUNTY OF MAUI

ALAN M. ARAKAWA
MAYOR

OUR REFERENCE

YOUR REFERENCE

55 MAHALANI STREET
WAILUKU, HAWAII 96793
(808) 244-6400
FAX (808) 244-6411

TIVOLI S. FAAUMU
CHIEF OF POLICE

DEAN M. RICKARD
DEPUTY CHIEF OF POLICE

February 25, 2016

Mr. Michael J. Summers
President
Planning Consultants Hawaii LLC
2331 W. Main Street
Wailuku, HI 96793

Dear Mr. Summers:

SUBJECT: DEA Waikapu Country Town

This is in response to your letter, requesting comments and information on the above project.

We have reviewed the Draft Environmental Impact Statement prepared for the project. Please refer to the enclosed copy of a report submitted by Officer Michael Vaituulala from Wailuku Patrol.

Thank you for giving us the opportunity to comment on this project.

Sincerely,

Assistant Chief Victor K. Ramos
for: Tivoli S. Faaumu
Chief of Police

c: Mr. William Spence, Planning Dept.

Enclosure

THE MAJOR ROADWAYS ARE QUICKLY REACHING THEIR DESIGN LIMITATIONS. UPGRADES/IMPROVEMENTS TO ROADWAYS SHOULD BE COMPLETED FIRST.

TO : **TIVOLI S. FAAUMU, CHIEF OF POLICE, COUNTY OF MAUI**

VIA : **CHANNELS**

Victor K. Ramos
Assistant Chief

FROM : **MICHAEL VAITUULALA, POLICE OFFICER III, COMMUNITY POLICING**

02/26/16

SUBJECT : **RESPONSE FOR DAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) FOR WAIKAPU COUNTRY TOWN**

This communication is submitted as a response to a request for review and comment for Waikapu Country Town from Michael SUMMERS, President of the Planning Consultant Hawaii LLC:

PROJECT	:	WAIKAPU COUNTRY TOWN
TMK #	:	(2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007, and (2) 3-6-006:036
PERMIT NO.	:	CPA 2015/0001, CIZ 2015/0001, and PH1 2015/0001
APPLICANT	:	Mr. Michael ATHERTON, Waikapu Properties LLC.
ADDRESS	:	1670 Honoapiilani Highway, Waikapu, Hawaii 96793
DESCRIPTION	:	A mixed-used residential community proposed for Development on approximately 499 acres within and around the Maui Tropical Plantation, Wailuku Maui Hawaii.

RESPONSE:

In review of the submitted documents, concerns from the police perspective area upon the safety of pedestrian and vehicular movement.

Mr. Michael ATHERTON of Waikapu Properties LLC is the applicant of the Waikapu Country Town. This project is located about 2 miles south of Wailuku and is adjacent to the southern boundary of Waikapu. Four Hundred eighty five (485) of the subject acres are in the State and County Agricultural Districts. Entitlement changes will be sought to bring these lands into appropriate urban and rural designations.

The project includes a diversity of housing types, neighborhood commercial, employment uses, an elementary school, parks and open space. The proposed project will comprise about 1,433 residential units and nearly 200,000 square feet of commercial space. The project includes an approximate 8-mile network of pedestrian and bicycle paths. The applicant desires to establish an agricultural park, farmers market, a limited amount of renewable energy production and other permissible uses on these lands.

There are residences and existing business' in close proximity to this project. During the construction phases, extreme efforts should be made to minimize noise, dust, and debris so not to inhibit those whose health and well being may be affected. Adequate traffic control devices and personnel should also be utilized to minimize the impacts to pedestrian and vehicular movement by the heavy equipment and vehicles traveling in and out of the area. It is the duty of the project manager to examine the impact of vehicular movement within the area while work is conducted on this project.

This project is expected to increase vehicular traffic along Waiale Road, Waiko Road, and Honoapiilani Highway. It is also important to consider proper and adequate lighting during evening, late night, and early morning hours during construction and after the project is completed.

CONCLUSION:

There are no objections to the progression of this project at this time, from the Police standpoint, in regards to pedestrian and vehicular movement.

Addition of nearly 1,500 residential housing units and commercial units poses concerns for the current roadway infrastructure in place. Namely, the intersections closest to the development. Suggest improvements or additions to the already congested nearby intersections, primarily during school hours.
Heather M. GILROY
02/24/16 @ 1530 hours

Respectfully Submitted, 13964

Michael VAITUULALA E#13964
Police Officer III / Community Policing
02/24/16 @ 1200 hrs

Recommend approval;
This residential/commercial/ agricultural project will be on and around the Maui Tropical Plantation. The only traffic problem is entering/exiting Honoapiilani Highway, which should be manned appropriately by flagmen. Police to monitor for additional safety concerns as well.
A/Capt. Wade M. Maeda
02/25/16

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Tivoli S. Faaumu
Chief of Police
Police Department
County of Maui
55 Mahalani Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Faaumu:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated February 25, 2016 regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following:

1. ***Construction Phase Impacts.*** Please note that construction phase Best Management Practices (BMP's) will be implemented to mitigate dust, noise, drainage and traffic impacts that are unique to the construction phase of the development. These BMP's are documented in Sections V.A.2 and 3 and Sections V.D.1 and 3 of the Final Environmental Impact Statement (FEIS).

2. ***Construction Phase Traffic Mitigation.*** Prior to implementation of construction a construction phase traffic control plan will be prepared to discuss staging of construction, hours of construction, anticipated vehicles and equipment, traffic control and dust control. Section V.D.1 of the FEIS documents that a Construction Phase Traffic Mitigation Plan will be prepared prior to construction of the project.

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

3. ***Operation Phase Traffic Impacts.*** Please note that a Traffic Impact Analysis Report (TIAR) was prepared to address the Project's impacts to vehicular and pedestrian traffic. The TIAR is summarized in Section V.D.1 of the FEIS and incorporated in its entirety into the FEIS as Appendix L. In response to agency and public comments received during the review of the DEIS, additional traffic analysis has been conducted and has been incorporated into the Section V.D.1 of the FEIS.

4. ***Project Lighting.*** Note that the project will include lighting designed in accordance with County standards for urban and rural areas.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment

c: Mr. Michael Atherton
Mr. Albert Boyce

9. State of Hawaii, Department of Accounting and General Services

DAVID Y. IGE
GOVERNOR

DOUGLAS MURDOCK
Comptroller

AUDREY HIDANO
Deputy Comptroller

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

FEB - 9 2016

(P)1025.6

Michael Summers, President
Planning Consultants Hawaii LLC
2331 W. Main Street
Wailuku, Hawaii 96793

Dear Mr. Summers:

Subject: Draft Environmental Impact Statement for the
Waikapu Country Town Project
Wailuku, Maui, Hawaii
TMK: (2) 3-6-002:001, 003, (2) 3-6-004:003, 006, (2) 3-6-005:007 and
(2) 3-6-006:036

Thank you for the opportunity to comment on the subject project. We have no comments to offer at this time as the proposed project does not impact any of the Department of Accounting and General Services' projects or existing facilities.

If you have any questions, your staff may please contact Ms. Dora Choy of the Planning Branch at (808) 586-0488.

Sincerely,

JAMES K. KURATA
Public Works Administrator

DC:lnn
c: Mr. Wade Shimabukuro, District Engineer, MDO

PLANNING CONSULTANTS HAWAII, LLC

URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. James K. Kurata
Public Works Administrator
State of Hawaii, Department of Accounting and General Services
P.O. Box 119, Honolulu, Hawaii 96810-0119

Dear Mr. Kurata:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated February 9, 2016, which states that you do not have comments at this time since the Project does not impact any of the Department's projects or facilities.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

10. State of Hawaii, Department of Land and Natural Resources, Land Division

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE
MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 24, 2016

Planning Consultants Hawaii, LLC
Attention: Mr. Michael J. Summers, President
2331 W. Main Street
Wailuku, Hawaii 96793

Dear Mr. Summers:

SUBJECT: Draft Environmental Impact Statement (DEIS) for Waikapu Country Town

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comments.

At this time, enclosed are comments from the (a) Engineering Division and (b) Commission on Water Resource Management on the subject matter. Should you have any questions, please feel free to call Lydia Morikawa at 587-0410. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

RECEIVED
LAND DIVISION
2016 FEB 10 PM 3:01
DEPT OF LAND & NATURAL RESOURCES
STATE OF HAWAII

RECEIVED
16 FEB 05 PM 02:16 ENGINEERING

February 4, 2015

MEMORANDUM

TO: **DLNR Agencies:**
___Div. of Aquatic Resources
___Div. of Boating & Ocean Recreation
X Engineering Division
___Div. of Forestry & Wildlife
___Div. of State Parks
X Commission on Water Resource Management
___ Office of Conservation & Coastal Lands
X Land Division – Maui District
X Historic Preservation

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Draft Environmental Impact Statement (DEIS) for Waikapu Country Town
LOCATION: Wailuku, Island of Maui; TMK Nos: (2) 3-6-002:001,003; 3-6-004:003,006; 3-6-005:007 and 3-6-006:036
APPLICANT: Waikapu Prperties, LLC

Transmitted for your review and comment is information on the above referenced *project.* Please submit any comments by **March 23, 2016.**

Only one (1) copy of the CD is available for your review in Land Division office, Room 220.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Lydia Morikawa at 587-0410. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed: _____

Print Name: Carty S. Chang, Chief Engineer
Date: 2/10/16

cc: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/ Russell Y. Tsuji
REF: DEIS for Waikapu Country Town, Wailuku, Maui
Maui.007

COMMENTS

( ) We confirm that the parcel/project site, according to the Flood Insurance Rate Map (FIRM), is located in Zones X. The National Flood Insurance Program does not regulate developments within Zones X.

(X) Please take note that the majority of project site, according to the data in the Flood Insurance Rate Map (FIRM) is located in Zone X. The National Flood Insurance Program does not regulate developments within Zones X.

(X) Please also note that there are existing streams, ditches and gulches that run through the project per review of the FIRM. These areas are designated as Zone AEF, in which the National Flood Insurance Program regulates developments within a Zone AEF as indicated in bold letters below.

(X) Please note that the project site must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

( ) Mr. Mario Siu Li at (808) 768-8098 of the City and County of Honolulu, Department of Planning and Permitting.

( ) Mr. Carter Romero (Acting) at (808) 961-8943 of the County of Hawaii, Department of Public Works.

(X) Ms. Carolyn Cortez at (808) 270-7253 of the County of Maui, Department of Planning.

( ) Mr. Stanford Iwamoto at (808) 241-4896 of the County of Kauai, Department of Public Works.

( ) The applicant should include project water demands and infrastructure required to meet water demands. Please note that the implementation of State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

( ) Additional Comments: _____

_____

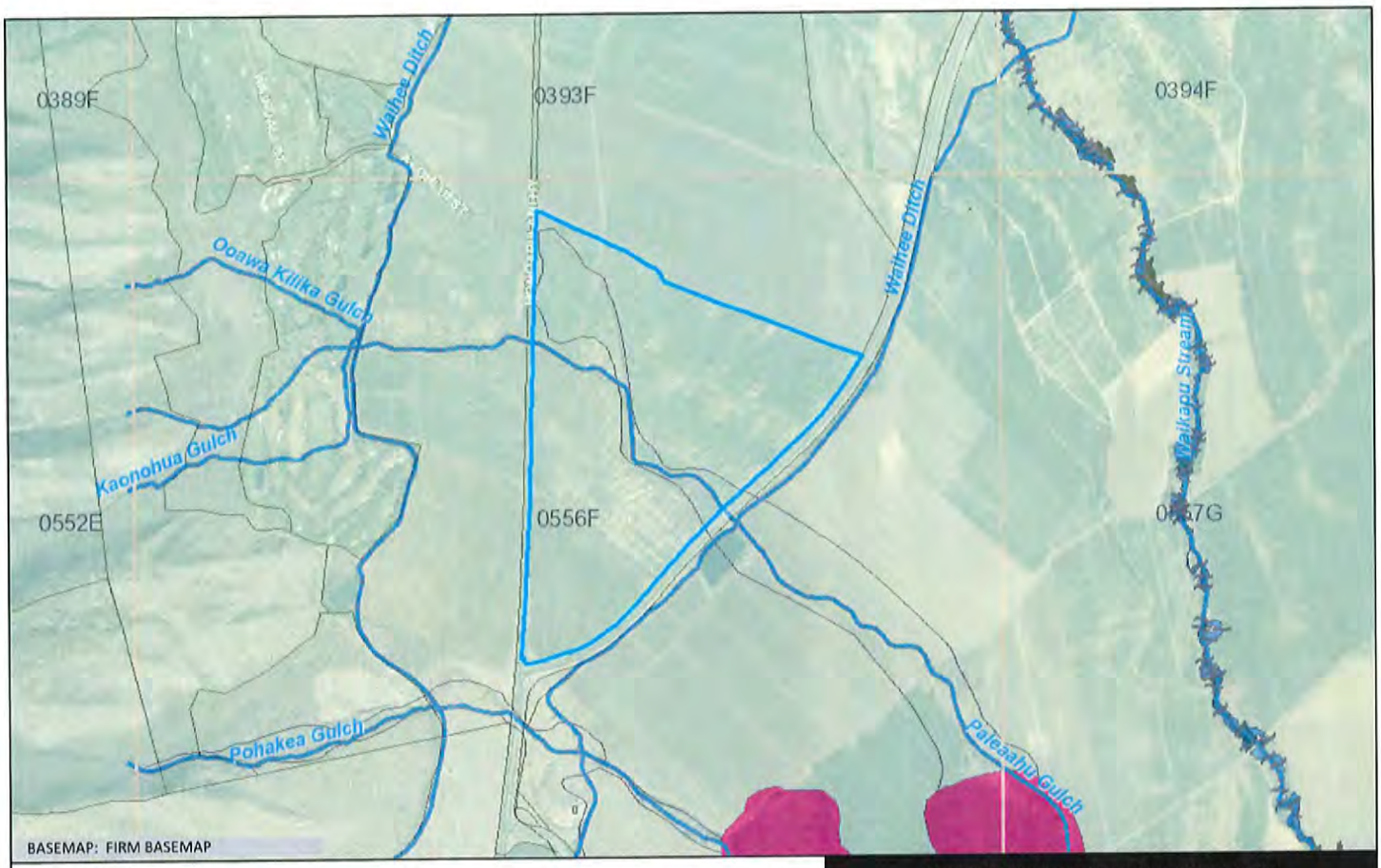
( ) Other: _____

_____

Should you have any questions, please call Mr. Rodney Shiraishi of the Planning Branch at 587-0258.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date: 2/10/16



Flood Hazard Assessment Report

www.hawaiinfip.org

TMK (2) 3-6-002:001

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-002:001
WATERSHED:	POHAKEA; WAIKAPU
PARCEL ADDRESS:	HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030556F
PANEL EFFECTIVE DATE:	SEPTEMBER 25, 2009

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 0.30 0.60 mi

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(Note: legend does not correspond with NFHL)

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

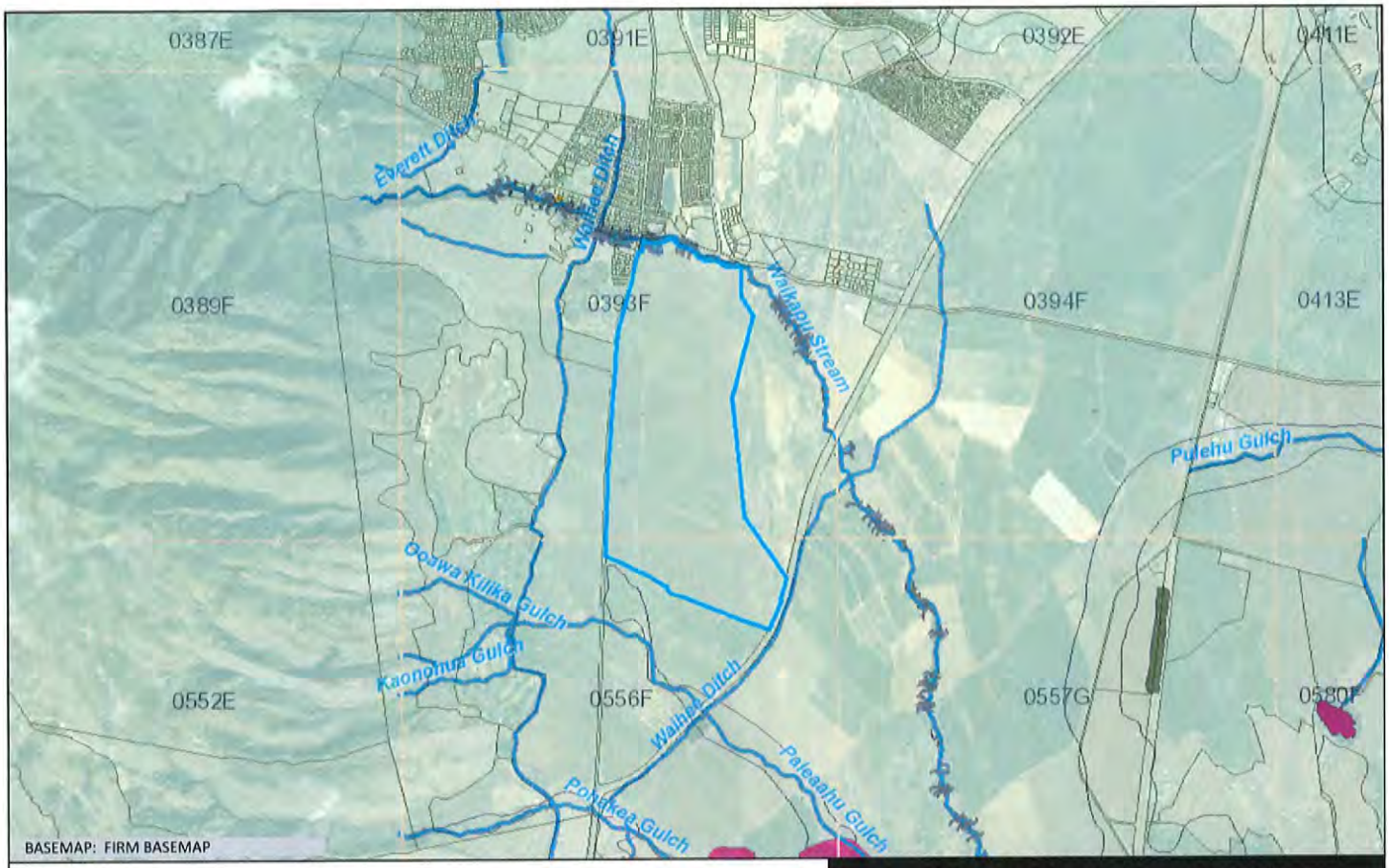
	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.



Flood Hazard Assessment Report

www.hawaiinfip.org

TMK (2) 3-6-002-003

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-002:003
WATERSHED:	IAO; WAIKAPU
PARCEL ADDRESS:	HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL - EFFECTIVE DATE:	1500030393F - NOVEMBER 04, 2015 1500030556F - SEPTEMBER 25, 2009

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 0.60 1.20 mi

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(Note: legend does not correspond with NFHL)

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

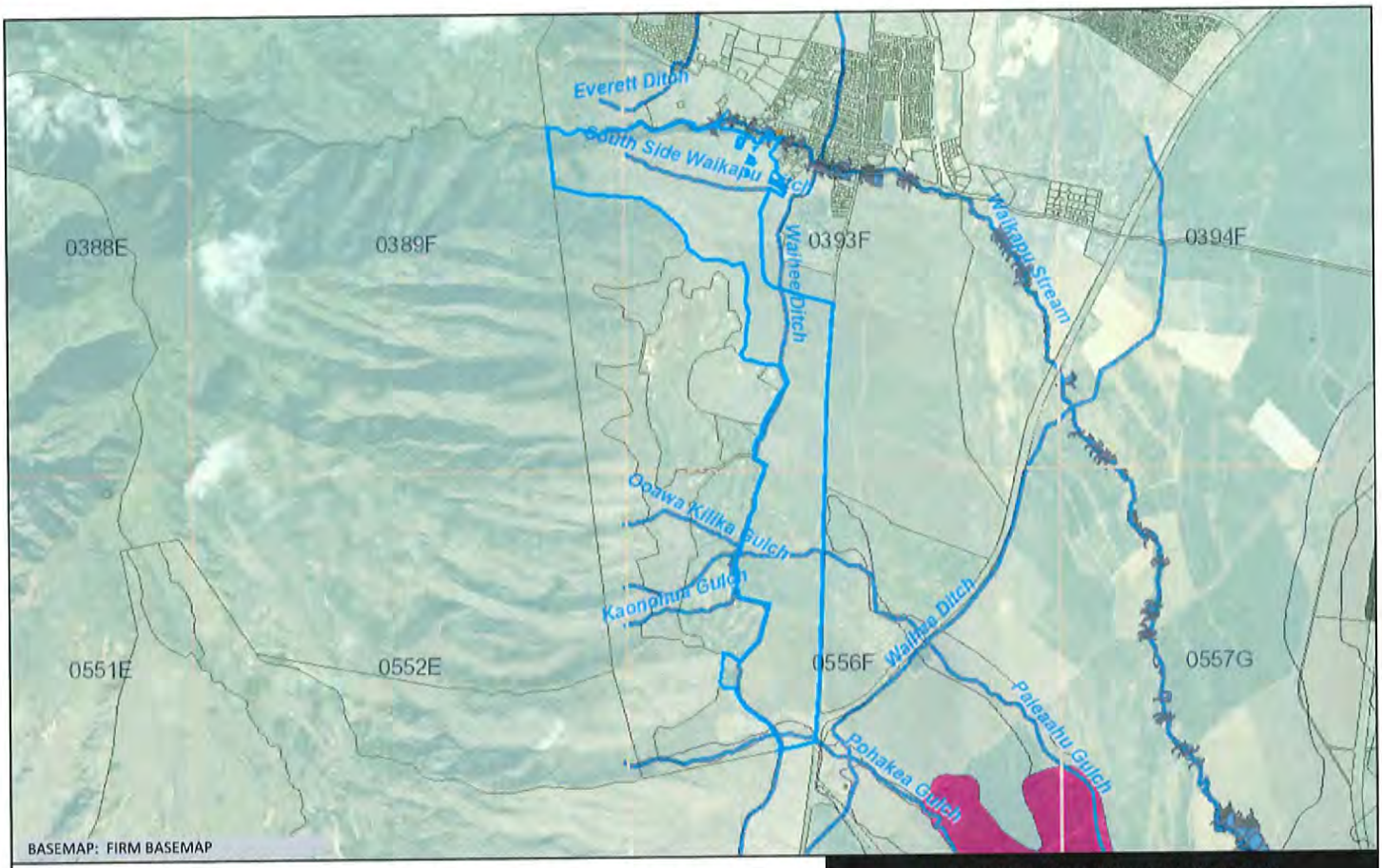
	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.



Flood Hazard Assessment Report

www.hawaiinfip.org

TMK (2) 3-6-004:003

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-004:003
WATERSHED:	POHAKEA; WAIKAPU
PARCEL ADDRESS:	HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL - EFFECTIVE DATE:	1500030389F - NOVEMBER 04, 2015 1500030393F - NOVEMBER 04, 2015 1500030556F - SEPTEMBER 25, 2009

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 0.60 1.20 mi

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(Note: legend does not correspond with NFHL)

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

Flood Hazard Assessment Report

www.hawaiinfip.org

TMK (2) 3-6-004:006

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-004:006
WATERSHED:	WAIKAPU
PARCEL ADDRESS:	2000 HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030393F
PANEL EFFECTIVE DATE:	NOVEMBER 04, 2015

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 600 1,200 ft

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(Note: legend does not correspond with NFHL)

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

Flood Hazard Assessment Report

www.hawaiinfip.org

TMK (2) 3-6-005:007

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-005:007
WATERSHED:	WAIKAPU
PARCEL ADDRESS:	1670 HONOAPIILANI HWY WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030393F
PANEL EFFECTIVE DATE:	NOVEMBER 04, 2015

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 600 1,200 ft

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(Note: legend does not correspond with NFHL)

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

Flood Hazard Assessment Report

www.hawaiinfip.org

TMK (2) 3-6-006:036

Property Information

COUNTY:	MAUI
TMK NO:	(2) 3-6-006:036
WATERSHED:	WAIKAPU
PARCEL ADDRESS:	WAIKAPU WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030393F
PANEL EFFECTIVE DATE:	NOVEMBER 04, 2015

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 100 200 ft

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(Note: legend does not correspond with NFHL)

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

DAVID Y. IGE
GOVERNOR OF HAWAII

RECEIVED
LAND DIVISION
2016 MAR 18 AM 10:49
DEPT OF LAND & NATURAL RESOURCES
STATE OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

February 4, 2015

MEMORANDUM

TO: **DLNR Agencies:**
___Div. of Aquatic Resources
___Div. of Boating & Ocean Recreation
_X_ Engineering Division
___Div. of Forestry & Wildlife
___Div. of State Parks
_X_ Commission on Water Resource Management
___ Office of Conservation & Coastal Lands
_X_ Land Division – Maui District
_X_ Historic Preservation

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Draft Environmental Impact Statement (DEIS) for Waikapu Country Town
LOCATION: Wailuku, Island of Maui; TMK Nos: (2) 3-6-002:001,003; 3-6-004:003,006; 3-6-005:007 and 3-6-006:036
APPLICANT: Waikapu Prperties, LLC

Transmitted for your review and comment is information on the above referenced *project.* Please submit any comments by **March 23, 2016.**

Only one (1) copy of the CD is available for your review in Land Division office, Room 220.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Lydia Morikawa at 587-0410. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(x) Comments are attached.

Signed: /s/ Jeffrey T. Pearson, P.E.

Print Name: Deputy Director
Date: March 14, 2016

RFD 7185.6
13801

cc: Central Files

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

March 14, 2016

REF: RFD.4185.6

TO: Mr. Russell Tsuji, Administrator
Land Division Oahu, DLNR-LD

FROM: Jeffrey T. Pearson, P.E., Deputy Director
Commission on Water Resource Management

SUBJECT: Draft Environmental Impact Statement (DEIS) for Waikapu Country Town

FILE NO.: RFD.4185.6
TMK NO.: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007, (2) 3-6-006:036

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at http://dlnr.hawaii.gov/cwrm.

Our comments related to water resources are checked off below.

[X] 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

[ ] 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

[X] 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

[X] 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EAP as having high water efficiency can be found at http://www.epa.gov/watersense.

[X] 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://hawaii.gov/dbedt/czm/initiative/lid.php.

[X] 6. We recommend the use of alternative water sources, wherever practicable.

[X] 7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at http://energy.hawaii.gov/green-business-program.

[X] 8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at

http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf.

[X] 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

[ ] 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.

[ ] 11. A Well Construction Permit(s) is (are) are required before the commencement of any well construction work.

[ ] 12. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

[ ] 13. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

[ ] 14. Ground-water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

[ ] 15. A Stream Channel Alteration Permit(s) is (are) required before any alteration can be made to the bed and/or banks of a steam channel.

[ ] 16. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is constructed or altered.

[ ] 17. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

[ ] 18. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

[X] OTHER: The report should discuss the projected non-potable water requirements for the project and the calculations for determining non-potable water needs. Potential alternative water sources to meet the non-potable needs should be identified and analyzed, such as the development of an onsite or regional wastewater reclamation facility to serve area non-potable needs.

If you have any questions, please contact Lenore Ohye of the Commission staff at 587-0216.

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Russell Y. Tsuji
Land Administrator
State of Hawaii
Department of Land and Natural Resources
Land Division
Post Office Box 621
Honolulu, Hawaii 96809

Dear Mr. Tsuji:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated March 24, 2016, regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to comments provided by the Engineering Division dated February 10, 2016 and the Commission on Water Resource Management dated March 14, 2016, please find the following:

Engineering Division Comments

- The Applicant understands that the majority of the Project is located with Zone X, according to the data in the Flood Insurance Rate Map (FIRM). The National Flood Insurance Rate Program does not regulate developments within Zone X.

- The Applicant understands that there are portions of the subject site that are located within Zone AEF and that these areas are subject to

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

National Flood Insurance Rate Program regulations.

- The Applicant acknowledges that the rules and regulations of the National Flood Insurance Program (NFIP), presented in Title 44 of the Code of Federal Regulations, will apply when development is proposed within a Special Flood Hazard Area. The Applicant further understands that Maui County's flood hazard ordinance may be more restrictive than the minimum NFIP standards in which case the local standards will apply.

Commission on Water Resource Management (CWRM) Comments

- ***County Water Use and Development Plan.*** Note that the Applicant has been in consultation with the County's Department of Water Supply (DWS) for several years regarding the Project's potable and non-potable water plans. Moreover, the Applicant did receive a letter from the DWS dated March 14, 2016 in response to the DEIS. The Applicant's response letter to the DWS has been incorporated into the FEIS (See Appendix S). Section V.D.4 of the FEIS has been updated to confirm the Project's potable and non-potable water demand and proposed sources of supply.

- ***Agricultural Water Use and Development Plan.*** The Applicant received comment letters from the Department of Agriculture dated June 22, 2015 and March 30, 2016. The DOA requested documentation of the Project's projected irrigation demand, irrigation supply and plans for the Project's irrigation infrastructure. The Applicant's December 12, 2016 response to the DOA documents the project's projected irrigation demand, irrigation supply and plans for the Project's irrigation infrastructure. Section V.D.4 of the FEIS has been updated to confirm the Project's potable and non-potable water demand and proposed sources of supply.

- ***Water Efficient Fixtures.*** The Applicant notes that water efficient fixtures will be installed throughout the development and that water efficient practices, such as using non-potable water for irrigation and utilizing water conserving drip irrigation, will be implemented to conserve potable water resources. Sections III.B.6 and V.D.4 of the FEIS documents the Project's water conservation measures.

- *Stormwater Runoff.* The Applicant notes that BMPs will be implemented to manage stormwater runoff in a manner that minimizes the Project's impact to the natural hydrology and helps to facilitate stormwater recharge of the Waikapu Aquifer. The Project's stormwater management program will also treat runoff through the use of swales, detention basins and filtration systems, where appropriate, to minimize non-point source pollution to inland and coastal waters. Section V.D.3 of the FEIS documents the stormwater BMP's that will be incorporated into the Project.

- *Alternative Water Sources.* The Applicant is proposing to use non-potable water for irrigation of urban landscape planting and irrigation of agricultural lands. A dual water system for non-potable and reclaimed wastewater will be developed for these purposes. Section V.D.4 of the FEIS describes the Project's dual water system.

- *Hawaii Green Business Program.* The Applicant will review and consider its participation in the Hawaii Green Business Program and appreciates having this information made available by the Commission.

- *Landscape Irrigation.* The Applicant will incorporate landscape planting BMPs into the landscape planting and irrigation plan to conserve irrigation water. The Applicant's landscape architect is familiar with the BMP practices that are endorsed by the Landscape Industry Council of Hawaii and the referenced publication. Landscape irrigation BMP's are described in Sections III.B.6 and V.5.4 of the FEIS.

- *Ground Surface Water Degradation/Contamination.* The State Department of Health has reviewed both the EISPN and the DEIS and has provided comments on each. Our responses to the DOH's comments have been incorporated in the FEIS. The State DOH will be consulted as the project proceeds through the land use entitlement and building permit processes.

- *Non-potable water requirements.* Irrigation of the Project's agricultural lands will be from surface water from the Iao Stream via the Iao-Waikapu Ditch and Waikapu Stream via the South Waikapu Ditch and

Waihee Ditch, which are operated by the Wailuku Water Company. This system has historically provided irrigation water to WCT's agricultural lands, which were used to grow kalo and then later sugarcane and pineapple. The Applicant's use of surface water from the Iao and Waikapu streams for irrigation will require the issuance of surface water use permits from the CWRM.

In addition to Ditch water, the Applicant proposes to drill agricultural wells and pump non-potable water that will be stored in agricultural reservoirs and also used for irrigation. The agricultural wells will require the completion of pump and water quality tests and approval of ground water use permits from the CWRM before pumping can occur. An additional source of non-potable irrigation water will be recycled water from WCT's wastewater reclamation facility. At full build-out of the WCT development, the wastewater reclamation facility is expected to be able to generate approximately 650,000 gallons per day of recycled water. Table 1 documents the potential supply of non-potable water versus the Project's potential demand for irrigation of its urban landscape planting areas and agricultural lands.

Table 1: WCT's Potential Supply and Demand for Non-Potable Irrigation Water

Non-Potable Water Source	Estimated Historical Supply in MGD	Estimated Future Supply in MGD	Estimated WCT Demand in MGD	Surplus / Deficit in MGD
Ditch Water[1]	5.82[2]	5.82		
Pumped Well Water	N/A	Unknown		
Reclaimed Wastewater	N/A	.650		

[1] WCT's future use of ground water from the Iao and Waikapu Streams will require the issuance of a Surface Water Use Permit from the Commission on Water Resources Management. These permit requests have been filed but not yet issued.

[2] Based upon a water duty of 5408 gallons per acre per day (GAD). In the Na Wai Eha IIFS proceedings, the Commission on Water Resources Management determined that this was a reasonable daily water use requirement for sugarcane cultivation.

Non-Potable Water Source	Estimated Historical Supply in MGD	Estimated Future Supply in MGD	Estimated WCT Demand in MGD	Surplus / Deficit in MGD
TOTAL	5.82	6.47	3.42[3]	+3.05

As is shown in Table 1, it is expected that sufficient non-potable irrigation water should be available to irrigate the agricultural lands as well as the urban and rural open space lands. Section V.D.4 of the FEIS has been updated to address your questions.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

[3] Assumes a demand for 2.75 mgd to irrigate 1077 acres of agricultural lands based upon a water duty of 3400 GAD for diversified agriculture. This is the application rate used by the State Department of Agriculture for diversified crops. The estimate assumes that 75 percent of the crop land is being irrigated at any given time (1077*.75)*3,400 ≈ 2.75 MGD. Urban open space demand for non-potable irrigation water is estimated to be about 0.67 mgd.

11. State of Hawaii, Department of Land and Natural Resources, State Historic Preservation Division

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

March 24, 2016

MEMORANDUM

Log No: 2016.00248/2015.01944
Doc No: 1603MD35
Archaeology

TO: Russell Y. Tsuji, Land Administrator
DLNR Land Division
Via email to: Russell.Y.Tsuji@hawaii.gov

FROM: Morgan E. Davis, Lead Archaeologist Maui Section

SUBJECT: **Chapter 6E-42 Historic Preservation Review-**
Draft Environmental Impact Statement for the Proposed Waikapu Country Town
Waikapū Ahupua'a, Wailuku District, Island of Maui
TMK (2) 3-6-002:001, 003; 3-6-004:003, 006; 3-6-005:007 and 3-6-006:036

Thank you for the subject memorandum that we received on February 8, 2016. The Waikapu Country Town DEIS has been prepared for associated permit applications for a State Land Use Commission District Boundary Amendment; a County Community Plan Amendment; a County Change in Zoning; a Project District Approval; Subdivision Approval; NPDES Permits; and Building Permits.

The proposed Waikapu Country Town is a mixed-use residential community of approximately 499 acres. The project includes mixed housing totaling 1,433 residential units and 200,000 square feet of commercial space; approximately eight miles of pedestrian and bicycle paths; and 1,077 acres for an agricultural component. An archaeological inventory survey was conducted for this project and a report submitted to SHPD for review and approval in 2013; historic properties are present within the project area. I have just learned that this report was not reviewed; a review is currently in process. We will copy you on the upcoming review correspondence.

Please contact me at (808) 243-4641 or Morgan.E.Davis@hawaii.gov if you have any questions or concerns about this memorandum.

cc: County of Maui
Department of Planning
(Planning@co.maui.hi.us)

County of Maui
Department of Public Works – DSA
(Renee.Segundo@co.maui.hi.us)

County of Maui
Cultural Resources Commission
(Annalise.Kehler@co.maui.hi.us)

Michael J. Summers, President
Planning Consultants Hawaii, LLC
(msummers@planningconsultantshawaii.com)

Lisa Rotunno-Hazuka, Owner
Archaeological Services Hawaii, LLC
(lisa@ashmaui.com)

PLANNING CONSULTANTS HAWAII, LLC

URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Ms. Morgan E. Davis
Lead Archaeologist Maui Section
State of Hawaii, Department of Land and Natural Resources
State Historic Preservation Division
Kakuhihewa Building, 601 Kamokila Blvd., STE 535
Kapaolei, Hawaii 2016

Dear Ms. Davis:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated March 24, 2016, which states that the above-referenced Archaeological Inventory Survey was received by your office in 2013, but has not yet been reviewed. We look forward to receiving your comments at your earliest convenience.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

12. State of Hawaii, Department of Agriculture

DAVID Y. IGE
Governor

SHAN S. TSUTSUI
Lt. Governor

SCOTT E. ENRIGHT
Chairperson, Board of Agriculture

PHYLLIS SHIMABUKURO-GEISER
Deputy to the Chairperson

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 South King Street
Honolulu, Hawaii 96814-2512
Phone: (808) 973-9600 FAX: (808) 973-9613

March 30, 2016

Mr. Michael Summers, President
Planning Consultants Hawaii, LLC
2331 W. Main Street
Wailuku, HI 96793

Dear Mr. Summers:

Subject: Draft Environmental Impact Statement (DEIS) for
Waikapu Country Town
Waikapu Properties
TMK: (2) 3-6-002:001; (2) 3-6-002:003; (2) 3-6-004:003; (2) 3-6-004-006;
(2) 3-6-005:007; (2) 3-6-006:036
Area: 1,576 acres

The Hawaii Department of Agriculture (HDOA) offers the following comments to the DEIS for the Waikapu Country Town development project (project).

BACKGROUND:
The 1,576-acre project site is located on both sides of Honoapi'ilani Highway, two miles south of Wailuku. 1,562 acres is in the State Agricultural District and 14 acres in the Urban District. Approximately 499 acres are planned for residential and commercial development in two phases, of which 485 acres is currently in the State Agricultural District. Currently the majority of the 1,576-acre project site is used for sugarcane cultivation by Hawaiian Commercial & Sugar Company (HC&S), cattle grazing by Michael Atherton, and diversified agriculture including Kumu Farms and Hawaii Taro LLC. The DEIS states that Kumu Farms and Hawaii Taro will relocate their operations to the proposed agricultural park and other lands within the Project area. The cattle herd will likely remain on the mauka agricultural lands even after urbanization occurs.

The DEIS states that the Maui Island Plan (MIP) designates the 499 acres in the project area set aside for residential and commercial development to be within its Small Town Growth Boundary or Rural Growth Boundary and is identified as the "Tropical Plantation Town Planned Growth Area." The MIP allocates 1,433 residential units and supporting commercial and civic uses to the designated growth area. The remaining agricultural lands in the project area does not seem to be in a grown boundary in the MIP.

COMMENTS/RECOMMENDATIONS:

Management of the Proposed Agricultural Park

The DEIS states that 1,077 acres of land will remain in agriculture, with approximately 800 of those acres planned to be permanently dedicated to agricultural use through an agricultural easement. Several hundred acres within the 800-acre agricultural easement is proposed to be developed as an agricultural park. The remaining 277 acres may be subdivided into as many as five large agricultural lots where farm dwellings may be permitted. According to the DEIS, the entity who will manage the park and whether it will be a private or public park is still being considered. Management of the agricultural lands and infrastructure in the project area is critical for establishing and maintaining agriculture, and the Final Environmental Impact Statement (FEIS) should contain any updated information on the management plans for the 800 acres dedicated to agricultural use and the public or private agricultural park.

Impact of the Closure of the Hawaiian Sugar and Commercial Company

As noted above, HC&S currently farms a significant portion of the project site. HC&S has recently stated their intention of shutting down their sugar operations in Maui. The FEIS should discuss whether the discontinuation of sugar cultivation by HC&S affects the planned agricultural component of the project, and if so, provide alternative plans.

The DEIS states that current HC&S operations and diversified agricultural operations receives its agricultural water from the Wailuku Water Company from the Iao-Waikapu Ditch and the Waikapu Stream through the South Waikapu Ditch and the Waihee Ditch. HC&S reportedly uses between 8 and 10 million gallons per day (MGD) of ditch water. For any HC&S lands currently irrigated by the Iao-Waikapu Ditch located in the project area, the FEIS should detail permitting requirements for continued access to irrigation water in quantities sufficient to meet needs throughout the year from the system after HC&S ceases sugarcane cultivation.

Irrigation Water Issues

The DEIS also mentions that five on-site ground water wells have been drilled to be used for potable and irrigation demands of the project. Three of those wells have been designated for potable use and two wells for irrigation. The capacity of the irrigation wells are 500 gallons per minute (gpm) and 650 gpm. The DEIS does not indicate whether the Commission of Water Resource Management (CWRM) has approved an allocation for the irrigation wells. The DEIS states that CWRM designated the sustainable yield of the Waikapu Aquifer at 3 MGD, and that the estimated daily demand for potable water would be around 646,000 gallons per day. The FEIS should include estimated total irrigation demand particularly during the dry periods of the year, proof of adequacy of supply to meet maximum demand, and details of existing and planned irrigation infrastructure including reservoirs. The DEIS should also include information on how the operation and maintenance of the wells, ditches, and reservoirs will be managed. For your information, the HDOA, for planning purposes, uses an

application rate of 3,400 gallons per acre per day which is our standard irrigation water application rate for diversified crops ("Agricultural Water Use and Development Plan", December 2004 revision, page xiv).

Proposed Solar Energy Facilities

From the DEIS, it seems that the Applicant is contemplating installation of two or more 5-acre solar farms in the mauka fields of the project area. HDOA notes that much of the mauka fields are rated "B" by the Land Study Bureau. According to Section 205-4.5(20) & (21), Hawaii Revised Statutes (HRS), solar energy facilities on "B" rated land cannot comprise of more than 10 percent of acreage of the parcel or 20 acres of land without a special use permit. Therefore, if the 5-acre solar farm is located on a parcel of land less than 50 acres in size, a special use permit will be required. HDOA also recommends that compatible agricultural uses such as a goat or sheep operation be considered in conjunction with any solar energy farms.

Protection of Agricultural Activities from Nuisance Complaints

The DEIS acknowledges that agricultural operations can produce nuisance impacts to neighboring residential communities, and that the Applicant is committed to providing assurances to farmers that their operations will be protected from such complaints pursuant to Chapter 165, HRS. Reference should also be made to Section 205-4.6, HRS that prevents agricultural uses or activities from being limited or prohibited through private restrictions.

The HDOA notes that the project includes an elementary school located mauka of Waiale Road. The likelihood of nuisance issues from adjacent agricultural activities should be considered when determining the school's location within the project site.

Thank you for the opportunity to provide our comments. Should you have any questions, please contact Earl Yamamoto at 973-9466 or by email at earl.j.yamamoto@hawaii.gov.

Sincerely,

Scott E. Enright, Chairperson
Board of Agriculture

c: Maui County Planning Department
Office of Planning

PLANNING CONSULTANTS HAWAII, LLC

URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Scott E. Enright, Chairperson
State of Hawaii
Department of Agriculture
1428 South King Street
Honolulu, Hawaii 96814-2512

Dear Mr. Enright:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated March 30, 2016, regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following:

1. ***Management of the Proposed Agricultural Park***. The following WCT property owners, Waikapu Properties, LLC and Waiale 905 Partners, intend to manage the 800-acre Agricultural Preserve. These entities are currently leasing lands in support of the ongoing operations of the following farmers:
    - Kumu Farms;
    - Hoaloa Farms;
    - Makani Olu Ranch; and
    - Beef and Bloom.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

The management, upkeep and maintenance of the agricultural lands, together with the on-site agricultural wells and other WCT owned supporting infrastructure will be the responsibility of the above-referenced property owners. The Wailuku Water Company (WWC) will continue to be responsible for the maintenance of its agricultural reservoirs and ditch systems. Sections III.B.5 and V.A.7 of the FEIS have been updated to address your comments.

2. ***Impact of the Closure of Hawaiian Sugar and Commercial Company.***

- The Closure of HC&S operations within the 800-acre Agricultural Preserve will create new opportunities for diversified agricultural enterprises on Maui. Waikapu Properties, LLC and Waiale 905 Partners are working with the existing farmers that are leasing WCT's agricultural lands to identify the additional lands that will best meet each farmer's needs. It is currently envisioned that the lands farmed by HC&S will be transitioned into "truck" crops (fruits and vegetables), "canoe" crops (banana, sweet potato, coconuts, etc.), Taro and ranching. Moreover, it is anticipated that additional opportunities for producing energy crops, fiber crops, coffee and nursery crops within the Agricultural Preserve, and on the other lands that will remain within the Agricultural District, will arise for the following reasons:
    - High soil productivity;
    - Excellent topography;
    - Reliable and cost effective sources of irrigation water;
    - Proximity to markets, infrastructure and employment;
    - Affordable and long-term agricultural lease rents.

Waikapu Properties LLC has requested to the CWRM that HC&S's surface water use permit requests for an allocation of water from the Na Wai Eha be assigned to Waikapu Properties so that irrigation of the lands once leased by HC&S from Waikapu Properties can continue to be irrigated with ditch water. It should be noted that much of these lands are within the 800-acre Agricultural Preserve. Sections III.B.B, V.A.7 and V.D.4 of the FEIS have been updated to address your comments.

3. ***Irrigation Water Issues***.

Please note that the DEIS stated that five (5) wells had been drilled on-site; however, it is six (6) wells that have been drilled on-site. Three (3) of the six (6) wells have undergone pump and water quality testing and the results of the tests are summarized in Section V.D.4 of the FEI; the complete results of the pump and water quality tests have also been incorporated into the FEIS as Appendix I. The Applicant has not requested an allocation from the CWRM for the irrigation wells. Such a request will be forthcoming once the CWRM has accepted the pump test results for the Project's potable wells.

As noted above, irrigation of the Project's agricultural lands will be from surface water from the Iao Stream via the Iao-Waikapu Ditch and Waikapu Stream via the South Waikapu Ditch and Waihee Ditch, which are operated by the Wailuku Water Company (WWC). These water sources, which are part of the larger surface water system known as the "Na Wai Eha", have been designated by the CWRM as a Surface Water Management Area. Before drawing water from the Na Wai Eha, a surface water use permit will be required from the CWRM, which has regulatory jurisdiction over the aquifer. This system has historically provided irrigation water to WCT's agricultural lands, which were once used to grow Kalo and then later transitioned to sugarcane and pineapple production.

In addition to Ditch water, the Applicant proposes to use its agricultural wells and pump non-potable water that will be stored in agricultural reservoirs and also used for irrigation. The use of the agricultural wells will require a ground water use permit from the CWRM since the water would be drawn from the Waikapu Aquifer, which has been designated by the CWRM as a Ground Water Management Area. An additional source of non-potable irrigation water will be recycled water from the WCT's wastewater reclamation facility. At full build-out of the WCT development, the wastewater reclamation facility is expected to produce approximately 650,000 gallons per day of recycled water. Table 1

documents the potential supply of non-potable water versus the Project's potential demand for irrigation of its urban landscape planting areas and agricultural lands.

Table 1: WCT's Potential Supply and Demand of Non-Potable Irrigation Water

Non-Potable Water Source	Estimated Historical Supply in MGD	Estimated Future Supply in MGD	Estimated WCT Demand in MGD	Surplus / Deficit in MGD
Ditch Water[1]	5.82[2]	5.82		
Pumped Well Water	N/A	Unknown		
Reclaimed Wastewater	N/A	.650		
TOTAL	5.82	6.47	3.42[3]	+3.05

As is shown in Table 1, it is expected that should surface and groundwater permits be issued by the CWRM, sufficient non-potable irrigation water will be available to irrigate the Project's agricultural lands as well as its urban and rural open space lands.

The Applicant intends to establish a private water company to manage, operate, and maintain its water and wastewater systems. The private water company will be responsible for the WCT's on-site agricultural irrigation water sources, storage and distribution

[1] WCT's future use of ground water from the Iao and Waikapu Streams will require the issuance of a Surface Water Use Permit from the Commission on Water Resources Management. These permit requests have been filed but not yet issued.

[2] Based upon a water duty of 5408 gallons per acre per day (GAD). In the Na Wai Eha IIFS proceedings, the Commission on Water Resources Management determined that this was a reasonable daily water use requirement for sugarcane cultivation.

[3] Assumes a demand for 2.75 mgd to irrigate 1077 acres of agricultural lands based upon a water duty of 3400 GAD for diversified agriculture. This is the application rate used by the State Department of Agriculture for diversified crops. The estimate assumes that 75 percent of the crop land is being irrigated at any given time (1077*.75)*3,400 ≈ 2.75 MGD. Urban open space demand for non-potable irrigation water is estimated to be about 0.67 mgd.

systems. Sections III.B.5 and 8 and Section V.D.4 and 5 of the FEIS have been updated to address your comments.

4. ***Proposed Solar Energy Facilities.*** The Applicant understands that Section 205-4.5 (20) & (21), Hawaii Revised Statutes (HRS), solar energy facilities on "B" rated land cannot comprise of more than 10 percent of the acreage of the parcel or 20 acres of land without the issuance of a special use permit. The Applicant will work to incorporate onto agricultural lands that may be used for solar energy facilities crop or livestock types, where practical, that might be compatible with any renewable energy use. Sections III.B.5 and V.A.7 of the FEIS addresses your comments.

5. ***Protection of Agricultural Activities from Nuisance Complaints.*** The Applicant is aware of Hawaii's Right to Farm Act (Chapter 165, HRS) and that the Act provides protections to farmers that their operations will be protected from nuisance complaints. Moreover, pursuant to Section 205-4.6, the Project's agricultural lands will not be subject to restrictions that limit the types of agricultural uses that may be conducted on these lands.

The WCT's elementary school site is mauka of the proposed Waiale Bypass Road. The school will be located in close proximity to the County's future regional park and government facilities complex. The closest agricultural lands are located approximately 3,300 feet to the southeast. With the strong prevalence of northeast tradewinds through the project site and implementation of agricultural land management and chemical application BMPs, the elementary school should not be significantly impacted by agricultural uses. Section V.A.7 of the FEIS addresses your comments.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

13. State of Hawaii, Department of Defense

DAVID Y. IGE
GOVERNOR

ARTHUR J. LOGAN
MAJOR GENERAL
ADJUTANT GENERAL

KENNETH S. HARA
BRIGADIER GENERAL
DEPUTY ADJUTANT GENERAL

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

March 24, 2016

Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Hawaii 'i 96793

Attn.: Mr. Michael Summers, President

Subject: Draft Environmental Impact Statement for Waikapu County Town, Wailuku, Maui, Hawaii, TMK: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007, and (2) 3-6-006:036

Dear Mr. Summers:

Thank you for the opportunity to comment on the above project. The State of Hawaii Department of Defense has no additional comments to offer relative to the project.

Should you have any questions, please contact Mr. Lloyd Maki, Assistant Chief Engineering Officer at (808) 733-4250.

Sincerely,

/Kenneth S. Hara

FOR ARTHUR J. LOGAN
Major General
Hawaii National Guard
Adjutant General

c: Ms. Havinne Okamura, Hawaii Emergency Management Agency

PLANNING CONSULTANTS HAWAII, LLC

URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Arthur J. Logan
Major General, State of Hawaii
Department of Defense
Office of the Adjutant General
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495

Dear Mr. Logan:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated March 24, 2016, which states that you do not have any additional comments at this time regarding the above-referenced project.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

14. State of Hawaii, Department of Education

DAVID Y. IGE
GOVERNOR

KATHRYN S. MATAYOSHI
SUPERINTENDENT

STATE OF HAWAI`I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI`I 96804

OFFICE OF SCHOOL FACILITIES AND SUPPORT SERVICES

March 23, 2016

Mr. Michael J. Summers
Planning Consultants Hawaii LLC
2331 W. Main Street
Wailuku, Hawaii 96793

Re: Draft Environmental Impact Statement for Waikapu Country Town, Wailuku, MauiTMK: 3-6-002:001, 3-6-002:003, 3-6-004:003, 3-6-004:006, 3-6-005:007, and 3-6-006:036

The Department of Education (DOE) has reviewed the Draft Environmental Impact Statement for Waikapu Country Town.

The proposed project is located within the Central Maui School Impact District, which was adopted by the Board of Education on November 18, 2010. As authorized under Hawaii Revised Statutes (HRS) §302A-1601 through 1612 and §46-142.5, the Waikapu Country Town development will be required to pay school impact fees for each and every residential unit developed. Waikapu Properties LLC is requested to meet with the DOE to execute an Educational Contribution Agreement (ECA) prior to any approval by the State Land Use Commission as it will determine the amount of and when school impact fees will become payable. HRS §302A-1606 states in relevant part that:

"Prior to approval of any change of zoning, subdivision, or any other approval for a:

(A) Residential development with fifty or more units; or

(B) Condominium property regime development of fifty or more units, the department shall notify the approving agency of its determination on whether it will require the development to dedicate land, pay a fee in lieu thereof, or a combination of both for the provision of new school facilities. "

It is DOE's standard practice to memorialize this decision in an ECA prior to notifying the approving agency of this determination.

DOE would also like to offer clarity on two statements offered by the applicant. Regarding any affordable housing component of this project, the only exemptions from school impact fee law that shall apply are detailed under HRS §302A-1603. Any other provision of law that involve exemptions from subdivision and zoning standards and run contrary to this authority shall not apply. The State of Hawaii, Office of Planning and Hawaii Housing Financing & Development Corporation have taken a specific position in support of DOE's exclusive authority to exempt.

DOE would also state for the record that any land that is dedicated per its school impact fee program shall be designed, built and operated to provide general public school education to any and all school-aged children within the general vicinity of the school site. Charter and other specialized schools that would exclude and or limit admission to the general population of school-aged children would not satisfy the requirements of DOE's school impact fee program.

Thank you for the opportunity to comment. If you have any questions, please call Heidi Meeker of the Planning Section, Facilities Development Branch at (808) 377-8301.

Sincerely yours,

Duane Y. Kashiwai
Public Works Administrator

DYK:tto

c: Baldwin/King Kekaulike/Maui High Complex Area Superintendent

PLANNING
CONSULTANTS
HAWAII, LLC

URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Duane Y. Kashiwai
Public Works Administrator
State of Hawaii
Department of Education
P.O. Box 2360
Honolulu, Hawaii 96804

Dear Mr. Kashiwai:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated March 23, 2016, regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following responses:

- *School Impact Fees.* The Applicant understands that the Project will be required to pay impact fees pursuant to the requirements of Hawaii Revised Statutes (HRS) §302A-1601 through 1612 and §46-142.5. Section V.C.5 of the FEIS documents the land dedication and impact fees that are required of the Project.

- *Educational Contribution Agreement (ECA).* The Applicant will work with the DOE to finalize an ECA prior to the granting of the subject entitlements.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

- ***Affordable Housing.*** The Applicant understands that County work-force housing and/or housing developed pursuant to HRS 201H does not quality for an exemption to DOE impact fees.

- ***General Public School Education.*** The Applicant acknowledges that lands dedicated per the DOE's impact fee program must be developed to provide general public school education and that Charter and other specialized schools that would exclude and or limit admission to the general population of school-aged children would not satisfy the requirements of DOE's school impact fee program.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

15. State of Hawaii, Department of Health, Environmental Planning Office

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:

EPO 16-038

February 10, 2016

Mr. Michael Summers, President
Planning Consultants Hawaii, LLC
2331 W. Main Sreet
Wailuku, Hawaii 96793
Email: msummers@planningconsultantshawaii.com

Dear Mr. Summers:

SUBJECT: **Draft Environmental Impact Statement (DEIS) for Waikapu Country Town, Wailuku, Maui**
TMK: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 306-006:036

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your DEIS to our office via the OEQC link:
http://oeqc.doh.hawaii.gov/Shared%20Documents/EA_and_EIS_Online_Library/Maui/2010s/2016-02-08-MA-5E-DEIS-Waikapu-Country-Town.pdf

EPO strongly recommends that you review the standard comments and available strategies to support sustainable and healthy design provided at: http://health.hawaii.gov/epo/landuse. Projects are required to adhere to all applicable standard comments. EPO has recently prepared draft Environmental Health Management Maps for each county. They are online at: http://health.hawaii.gov/epo/egis

We suggest you review the requirements for the National Pollutant Discharge Elimination System (NPDES) permit. We recommend contacting the Clean Water Branch at (808) 586-4309 or cleanwaterbranch@doh.hawaii.gov after relevant information is reviewed at:

1. http://health.hawaii.gov/cwb
2. http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/standard-npdes-permit-conditions
3. http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/forms

Please note that all wastewater plans must conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems". We do reserve the right to review the detailed wastewater plans for conformance to applicable rules. Should you have any questions, please review online guidance at: http://health.hawaii.gov/wastewater and contact the Planning and Design Section of the Wastewater Branch at 586-4294.

EPO recommends you review the need and/or requirements for a Clean Air Branch permit. The Clean Air Branch can be consulted via e-mail at: Cab.General@doh.hawaii.gov or via phone: (808) 586-4200.

EPO also suggests that the Hazard Evaluation and Emergency Response (HEER) Office's Site Discovery and Response (SDAR) Section be contacted. The SDAR section protects human health and the environment by identifying, investigating, and remediating sites contaminated with hazardous substances (non-emergency site

investigations and cleanup). The HEER Office's SDAR Section can be contacted at: (808) 586-4249. For historical maps on lands where sugarcane was grown see: http://health.hawaii.gov/epo/egis/sugarcane

EPO encourages you to examine and utilize the Hawaii Environmental Health Portal. The portal provides links to our e-Permitting Portal, Environmental Health Warehouse, Groundwater Contamination Viewer, Hawaii Emergency Response Exchange, Hawaii State and Local Emission Inventory System, Water Pollution Control Viewer, Water Quality Data, Warnings, Advisories and Postings. The Portal is continually updated. Please visit it regularly at: https://eha-cloud.doh.hawaii.gov

You may also wish to review the draft Office of Environmental Quality Control (OEQC) viewer at: http://eha-web.doh.hawaii.gov/oeqc-viewer This viewer geographically shows where previous Hawaii Environmental Policy Act (HEPA) {Hawaii Revised Statutes, Chapter 343} documents have been prepared.

In order to better protect public health and the environment, the U.S. Environmental Protection Agency (EPA) has developed a new environmental justice (EJ) mapping and screening tool called EJSCREEN. It is based on nationally consistent data and combines environmental and demographic indicators in maps and reports. EPO encourages you to explore, launch and utilize this powerful tool in planning your project. The EPA EJSCREEN tool is available at: http://www2.epa.gov/ejscreen

We request that you utilize all of this information on your proposed project to increase sustainable, innovative, inspirational, transparent and healthy design.

Mahalo nui loa,

Laura Leialoha Phillips McIntyre, AICP
Program Manager, Environmental Planning Office

LM:nn

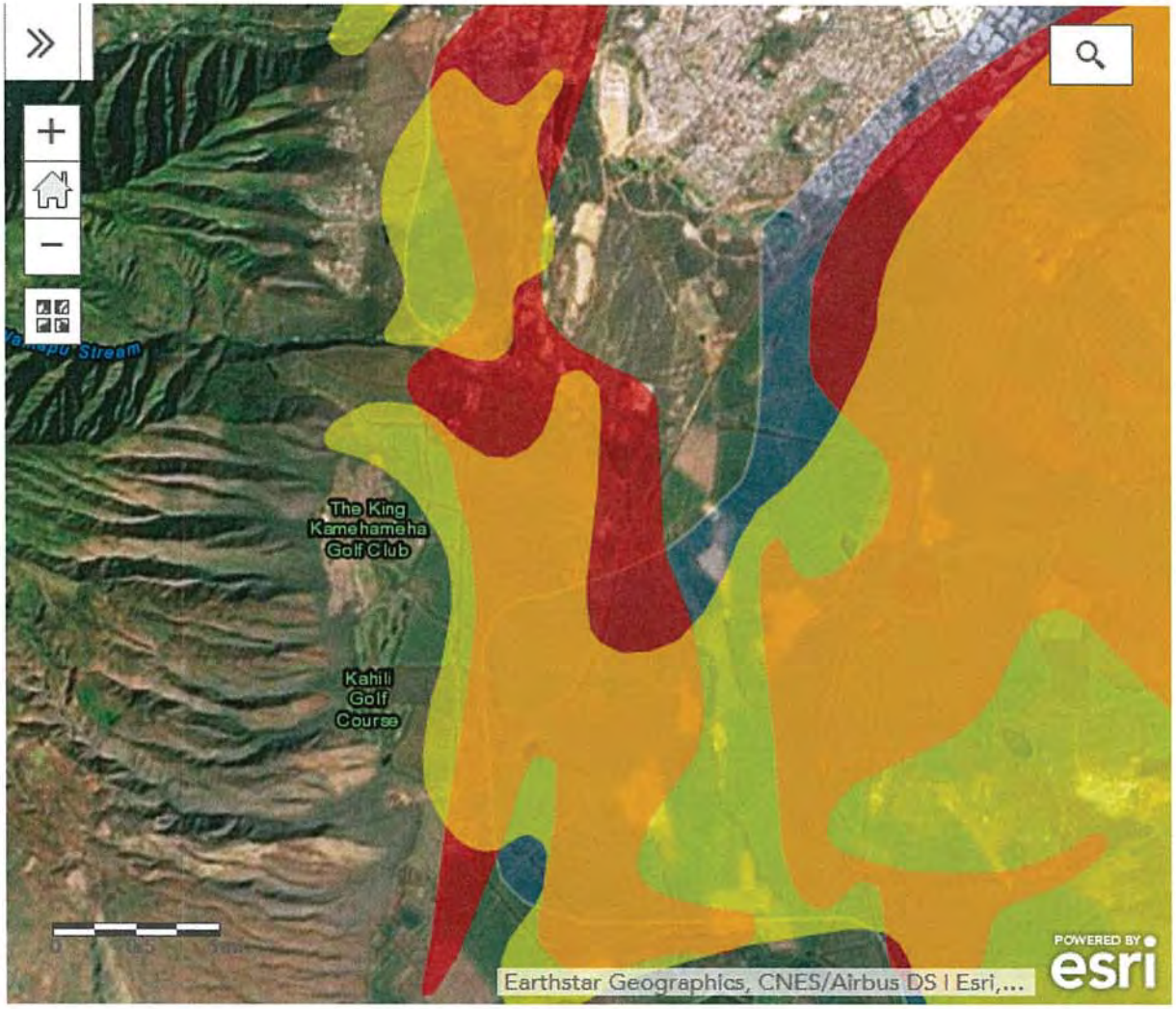
Attachment 1: EPO Draft Environmental Health Management Map
Attachment 2: EPO Historic Sugarcane Map
Attachment 3: OEQC Viewer Map of Area
Attachment 4: U.S. EPA EJSCREEN Report

c: Applicant: Michael Atherton, Waikapu Properties, LLC
Daniel Orodenker, State Land Use Commission, Dept. of Business, Economic Development and Tourism
DOH: DHO Maui, CWB, WWB, SDWB, CAB, HEER {via email only}

ENVIRONMENTAL HEALTH MANAGEMENT ON MAUI

MAP INTENDED FOR ILLUSTRATIVE PURPOSES ONLY. SITE LOCATIONS ARE APPROXIMATE.

HISTORIC SUGARCANE LANDS MAP VIEWER

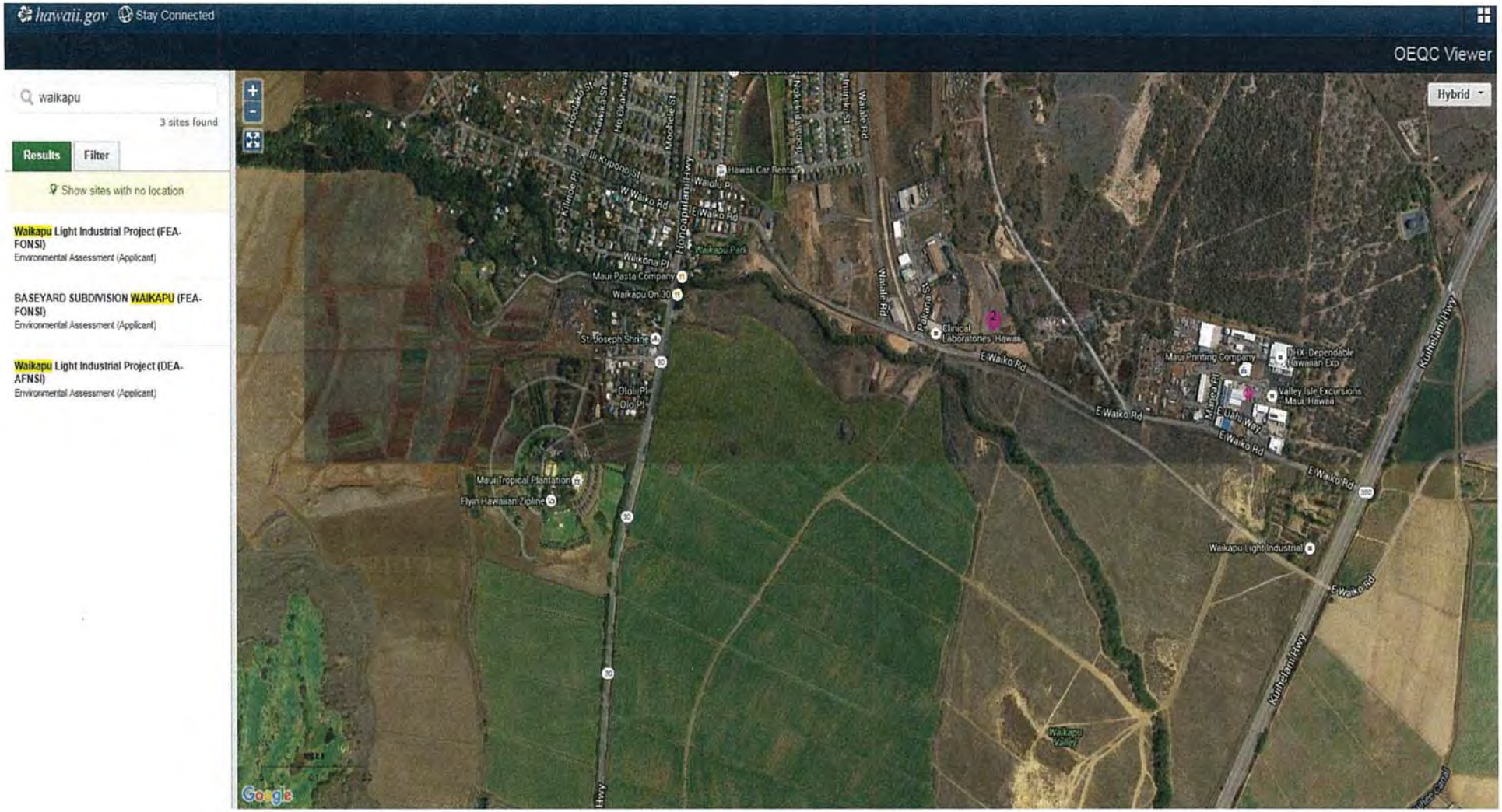


Legend | Details

Sugarcane - Sugarcane_1937

Sugarcane - Sugarcane_1920

Sugarcane - Sugarcane_1900

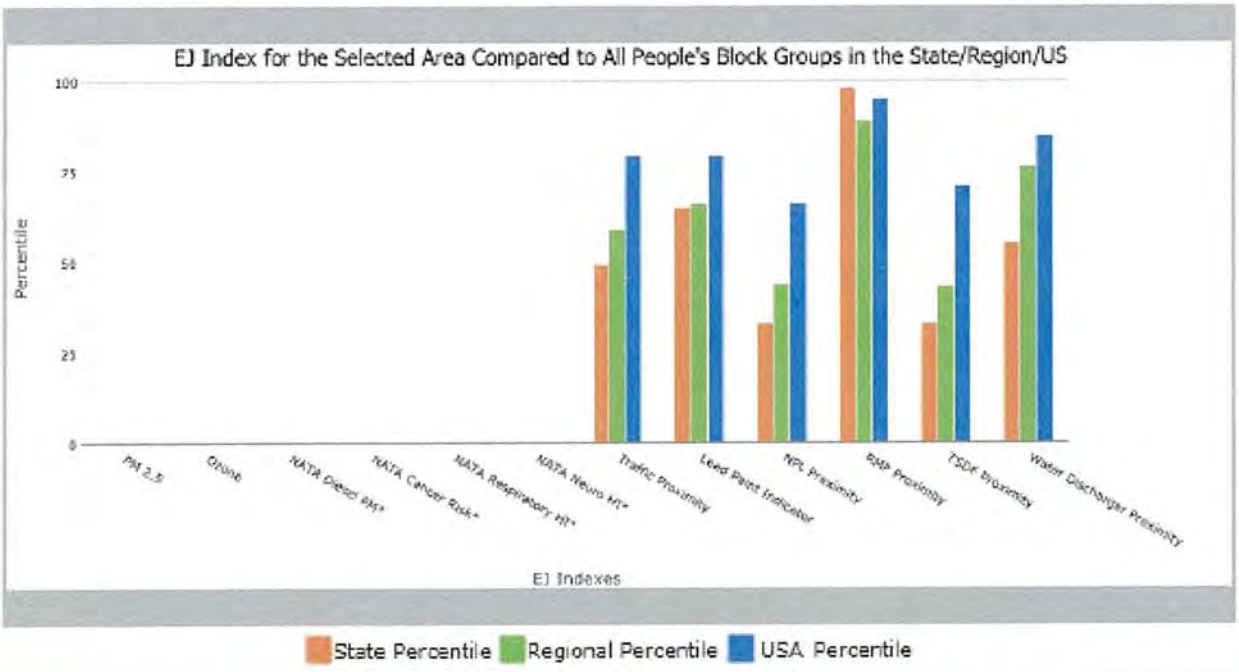

hawaii.gov
Stay Connected
OEQC Viewer
waikapu
3 sites found
Results
Filter
Show sites with no location
Waikapu Light Industrial Project (FEA-FONSI)
Environmental Assessment (Applicant)
BASEYARD SUBDIVISION WAIKAPU (FEA-FONSI)
Environmental Assessment (Applicant)
Waikapu Light Industrial Project (DEA-AFNSI)
Environmental Assessment (Applicant)
Hybrid
Hawaii Car Rental
Maui Pasta Company
Waikapu Park
St. Joseph Shrine
Clinical Laboratories Hawaii
Maui Printing Company
DHX - Dependable Hawaiian Exp
Valley Isle Excursions Maui, Hawaii
Maui Tropical Plantation
Flyin Hawaiian Zipline
Waikapu Light Industrial
Waikapu Valley
E Waiko Rd
Honoapiilani Hwy
Kuihelani Hwy
Waiale Rd
Google

EJSCREEN Report

for 1 mile Ring Centered at 20.846415,-156.505547, HAWAII, EPA Region 9

Approximate Population: 2305

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	N/A	N/A	N/A
EJ Index for Ozone	N/A	N/A	N/A
EJ Index for NATA Diesel PM*	N/A	N/A	N/A
EJ Index for NATA Air Toxics Cancer Risk*	N/A	N/A	N/A
EJ Index for NATA Respiratory Hazard Index*	N/A	N/A	N/A
EJ Index for NATA Neurological Hazard Index*	N/A	N/A	N/A
EJ Index for Traffic Proximity and Volume	49	59	79
EJ Index for Lead Paint Indicator	65	66	79
EJ Index for Proximity to NPL sites	33	44	66
EJ Index for Proximity to RMP sites	98	89	95
EJ Index for Proximity to TSDFs	33	43	71
EJ Index for Proximity to Major Direct Dischargers	55	76	85

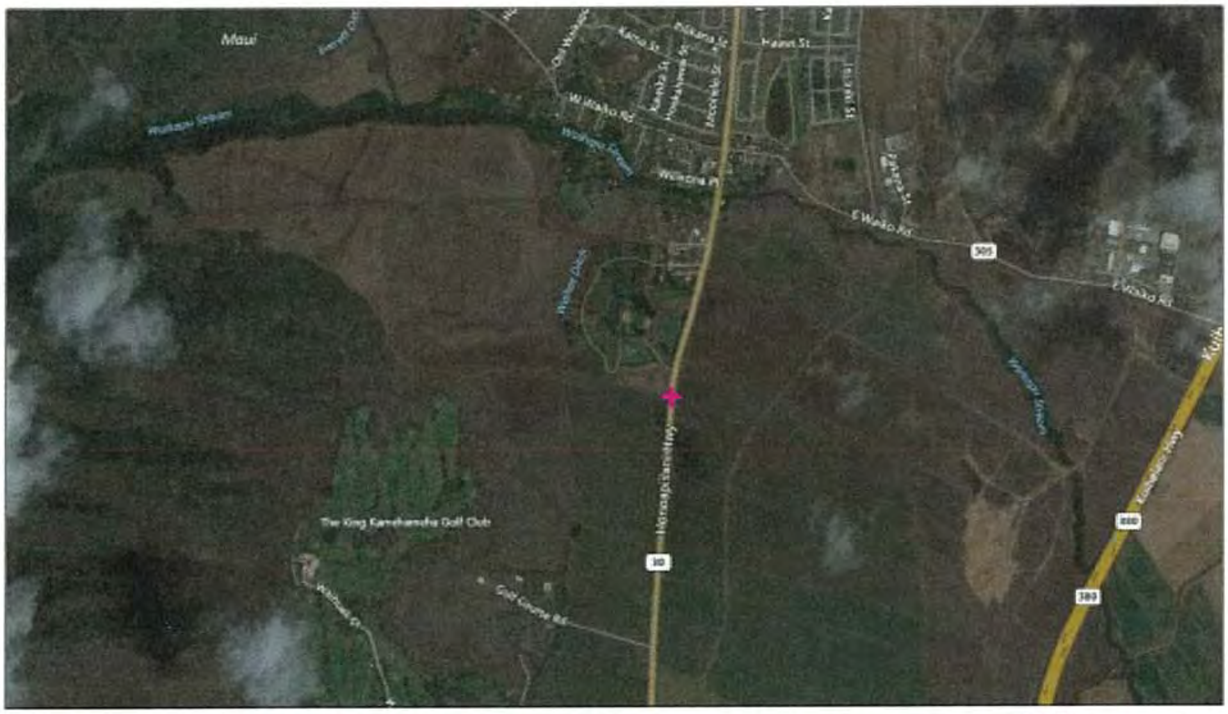


This report shows environmental, demographic, and EJ indicator values. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJSCREEN Report

for 1 mile Ring Centered at 20.846415,-156.505547, HAWAII, EPA Region 9

Approximate Population: 2305



February 9, 2016

Digitized Point

1:18,056

0 0.15 0.3 0.6 mi

0 0.25 0.5 1 km

EJSCREEN Report

for 1 mile Ring Centered at 20.846415,-156.505547, HAWAII, EPA Region 9

Approximate Population: 2305

Selected Variables	Raw Data	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m³)	N/A	N/A	N/A	9.95	N/A	9.78	N/A
Ozone (ppb)	N/A	N/A	N/A	49.7	N/A	46.1	N/A
NATA Diesel PM (µg/m³)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NATA Cancer Risk (lifetime risk per million)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NATA Respiratory Hazard Index*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NATA Neurological Hazard Index*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Traffic Proximity and Volume (daily traffic count/distance to road)	37	280	33	190	32	110	51
Lead Paint Indicator (% Pre-1960 Housing)	0.12	0.17	51	0.25	46	0.3	37
NPL Proximity (site count/km distance)	0.0057	0.092	22	0.11	6	0.096	2
RMP Proximity (facility count/km distance)	0.95	0.18	98	0.41	89	0.31	92
TSDF Proximity (facility count/km distance)	0.0061	0.092	25	0.12	2	0.054	14
Water Discharger Proximity (facility count/km distance)	0.16	0.33	36	0.19	64	0.25	59
Demographic Indicators							
Demographic Index	48%	51%	38	46%	54	35%	72
Minority Population	82%	77%	49	57%	73	36%	86
Low Income Population	13%	25%	27	35%	18	34%	18
Linguistically Isolated Population	2%	6%	35	9%	26	5%	54
Population With Less Than High School Education	5%	10%	32	18%	23	14%	25
Population Under 5 years of age	8%	6%	75	7%	66	7%	71
Population over 64 years of age	10%	14%	30	12%	51	13%	40

* The National-scale Air Toxics Assessment (NATA) environmental indicators and EJ indexes, which include cancer risk, respiratory hazard, neurodevelopment hazard, and diesel particulate matter will be added into EJSCREEN during the first full public update after the soon-to-be-released 2011 dataset is made available. The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: http://www.epa.gov/ttn/atw/natamain/index.html.

For additional information, see: www.epa.gov/environmentaljustice

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Laura Leialoha Phillips McIntyre, AICP
Program Manager
Environmental Planning Office
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Dear Ms. McIntyre:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated February 10, 2016, regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following responses:

- ***Sustainable and Healthy Design.*** The Applicant is committed to developing a community that achieves greater social, economic and environmental sustainability and therefore appreciates the resources made available at health.hawaii.gov/epo/landuse and health.hawaii.gov/epo/egis. Section III.B.6 documents the Project's sustainability goals, objectives and strategies.
- ***National Pollutant Discharge Elimination System (NPDES).*** The Applicant will coordinate with the Clean Water Brach to ensure NPDES requirements are addressed.
- ***Wastewater Plans.*** The Applicant understands that its wastewater treatment plan must conform to the applicable provisions of the Department's Administrative Rules, Chapter 11-62, "Wastewater Systems".

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

- ***Clean Air Branch.*** Please note that the Clean Air Branch has been consulted and the Applicant has received their comments in response to the DEIS, which have been addressed are incorporated into the FEIS.
- ***Hazard Evaluation and Emergency Response Office's Site Recovery and Response (SDAR) Section.*** The Applicant will consult with the SDAR to address any issues that might arise with respect to hazardous substances within the property boundaries.
- ***DOH On-line Resources.*** The Applicant appreciates the on-line resources offered through the Hawaii Environmental Health Portal, the OEQC HEPA viewer, and the EPA EJSCREEN tool.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

16. State of Hawaii, Department of Health, Maui District Health Office

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

LORRIN W. PANG, M.D., M.P.H.
DISTRICT HEALTH OFFICER

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, HAWAII 96793-3378

March 8, 2016

Mr. Michael Summers
President
Planning Consultants Hawaii, LLC
2331 West Main Street
Wailuku, Hawaii 96793

Dear Mr. Summers:

Subject: Waikapu Country Town Draft Environmental Impact Statement (DEIS)

Thank you for the opportunity to review this project. We have the following comments to offer:

1. National Pollutant Discharge Elimination System (NPDES) permit coverage may be required for this project. The Clean Water Branch should be contacted at 808 586-4309.

2. The project is located in the critical wastewater disposal area as determined by the Maui County Wastewater Advisory Committee. The project must connect to the County sewer. In the event that the County sewer is not available for the proposed project to connect to, any new proposed wastewater treatment plant shall be designed and constructed in accordance with applicable provision of Hawaii Administrative Rules (HAR), Chapter 11-62, Wastewater Systems.

   Please be informed that the proposed wastewater system for the subdivision/development may have to include predesign consideration to address any effects associated with the construction of and/or discharges from the wastewater system to any public trust, Native Hawaiian resources or the exercise of traditional cultural practices. If you have any questions, please call Roland Tejano, Environmental Engineer, at 808 984-8232.

3. All lands formerly in the production of sugarcane and/or pineapples should be characterized for arsenic contamination. If arsenic is detected above the US EPA Region Preliminary Remediation Goal (PRG) for non-cancerous effects, then a removal and/or remedial plan must be submitted to the Hazard Evaluation and Emergency Response (HEER) Office of the State Department of Health for approval. Please contact them at 808 586-4249.

4. The noise created during the construction phase of the project may exceed the maximum allowable levels as set forth in Hawaii Administrative Rules, Chapter 11-46, "Community Noise Control." A noise permit may be required and should be obtained before the commencement of work. Please call the Indoor & Radiological Health Branch at 808 586-4700.

It is strongly recommended that the Standard Comments found at the Department's website: http://health.hawaii.gov/epo/home/landuse-planning-review-program/ be reviewed and any comments specifically applicable to this project should be adhered to.

Should you have any questions, please contact me at 808 984-8230.

Sincerely,

Patti Kitkowski

Patti Kitkowski
District Environmental Health Program Chief

c EPO
Daniel Orodenker, DBEDT

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Ms. Patti Kitkowski
District Environmental Health Program Chief
State of Hawaii
Department of Health
Maui District Health Office
54 High Street
Wailuku, Hawaii 96793-3378

Dear Ms. Kitkowski:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated March 8, 2016, regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following:

- ***National Pollutant Discharge Elimination System (NPDES) Permit.*** The Applicant is aware that an NPDES permit will be required for development of the project site. The Clean Water Branch will be consulted as part of this process.
- ***Critical Wastewater Disposal Area.*** The Applicant is aware that a portion of the project site lies within the Critical Wastewater Disposal Area. Moreover, the Applicant understands that the proposed wastewater treatment plant must be designed and constructed in accordance with Hawaii Administrative Rules (HAR), Chapter 11-62, Wastewater Systems. The Applicant further acknowledges that the facility may be subject to a predesign review to address any potential impacts from construction and or

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

discharges to any public trust, Native Hawaiian Resources or the exercise of traditional cultural practices. However, note that the FEIS will address the proposed facilities impacts, if any, upon such resources.

- ***Arsenic Contamination.*** The applicant is aware that former sugarcane and pineapple lands should be assessed for arsenic contamination. Should arsenic be found to be detected above the US EPA Region Preliminary Remediation Goal for non-cancerous effects, a removal plan will be submitted to the Hazard Evaluation and Emergency Response Office of the State Department.

- ***Construction Phase Noise.*** The Applicant will comply with the requirements of Hawaii Administrative Rules, Chapter 11-46, "Community Noise Control" and all required permits will be obtained prior to commencement of work. Section V.A.3 of the FEIS documents the Project's potential noise impacts and mitigation measures.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

17. State of Hawaii, Department of Health, Wastewater Branch

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:

LUD – 2 3 6 002 001 DEIS
Waikapu Country Town-ID2634

February 12, 2016

Mr. Daniel E. Orodenker, Executive Director
State Land Use Commission
Dept. of Business, Economic Development & Tourism
235 South Beretania Street Suite 406
Honolulu, Hawaii 96813

Dear Mr. Orodenker:

Subject: Draft Environmental Impact Statement (DEIS) for the Waikapu Country Town, located within and around the Maui Tropical Plantation, Wailuku, Maui, Hawaii
TMK (2) 3-6-002: 001, (2) 3-6-002: 003, (2) 3-6-004: 006, (2) 3-6-005: 007 and (2) 3-6-006: 036

Thank you for allowing us the opportunity to provide comments on the above subject project.

We have the following comments to offer.

The subject project is located in the critical wastewater disposal area as determined by the Maui County Wastewater Advisory Committee. As a connection to the Kahului Wastewater Reclamation Facility (KWRF) may not be available for the project, any new proposed wastewater treatment plant shall be designed and constructed in accordance with applicable provisions of Hawaii Administrative Rules, Chapter 11-62, "Wastewater Systems".

Please be informed that the proposed wastewater system for the development may have to include design considerations to address any effects associated with the construction of and/or discharges from the wastewater systems to any public trust, Native Hawaiian resources or the exercise of traditional cultural practices.

Mr. Daniel E. Orodenker, Executive Director
State Land Use Commission
February 12, 2016

Should you have any questions, please contact Mark Tomomitsu at 586-4294.

Sincerely,

SINA PRUDER, P.E., CHIEF
Wastewater Branch

LM/MST:lmj

c: Ms. Laura McIntyre, DOH-Environmental Planning Office, via email
Mr. Roland Tejano, DOH-WWB's Maui Staff, via email
Mr. Michael Summers, Planning Consultants Hawaii, LLC
Mr. Michael Atherton, Waikapu Properties, LLC

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Ms. Sina Pruder, P.E.
Chief, Program Manager
Wastewater Branch
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Dear Ms. Pruder:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated February 12, 2016, regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. The Applicant acknowledges that the portion of the Project located mauka (west) of Honoapiilani Highway is located within a critical wastewater disposal area. The portion of the Project that is located makai (east) of Honoapiilani Highway is below the critical wastewater disposal area.

The Applicant's proposed wastewater treatment facility will be designed and constructed in accordance with the provisions of Hawaii Administrative Rules, Chapter 11-62, "Wastewater Systems". The applicant also understands that design changes may be required if the system discharges wastewater that impacts any public trust resource, Native Hawaiian resources or the exercise of traditional cultural practices.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

18. State of Hawaii, Department of Transportation, Airports Division

DAVID Y. IGE
GOVERNOR

FORD N. FUCHIGAMI
DIRECTOR

Deputy Directors
JADE T. BUTAY
ROSS M. HIGASHI
EDWIN H. SNIFFEN
DARRELL T. YOUNG

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
STP 8.1968

May 18, 2016

TO: THE HONORABLE LUIS P. SALAVERIA, DIRECTOR
DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT
AND TOURISM

ATTN: DANIEL ORODENKER, EXECUTIVE OFFICER
LAND USE COMMISSION

FROM: FORD N. FUCHIGAMI
DIRECTOR OF TRANSPORTATION

SUBJECT: WAIKAPU COUNTRY TOWN
DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
WAIKAPU, MAUI, HAWAII
TMK: (2) 3-6-002:001 and 003, 3-6-004:003 and 006, 3-6-005:007
and 3-6 006:036

Our Department of Transportation's (DOT) comments on the subject project are as follows:

Airports Division (DOT-AIR)

1. Federal Aviation Administration (FAA) Advisory Circular 150/5200-33B, Hazardous Wildlife Attractants On or Near Airports (copy attached), recommends a distance of five (5) statute miles between the farthest edge of the airfield's Air Operations Area and land use activities that could attract hazardous wildlife movement into or across aircraft approach or departure space. The subject project is of concern because it is within five (5) statute miles from Kahului Airport (OGG).

2. According to an earlier illustration of the Waikapu County Town Master Plan, several existing plantation reservoirs were identified as detention basins. To prevent the attraction of hazard wildlife, the FAA recommends that stormwater detention ponds be designed, engineered, constructed, and maintained for a maximum 48-hour detention period after the design storm and remain completely dry between storms.

3. According to the DEIS, solar farms/photovoltaic (PV) systems may be installed. PV systems can create a hazardous condition for a pilot due to possible glint and glare reflected from the PV array. If glint or glare from the PV array creates a hazard condition for pilots, the applicant must be prepared to immediately mitigate the hazard, upon notification by the DOT Airports Division or the FAA. The following website may assist the applicant with preparation of a glint and glare analysis in order to minimize any potential hazard: www.sandia.gov/glare.

4. The project lies within the approach surface to the Kahului Airport and will be subject to aircraft overflights and noise.

Highways Division (DOT-HWY)

HWY is still reviewing the subject project. Supplemental comments will be sent as soon as the review is completed.

If there are any questions, please contact Mr. Norren Kato of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

Attachment: FAA Advisory Circular 150/5200-33B

c: Michael J. Summers, Planning Consultants Hawaii, LLC

U.S. Department
of Transportation

**Federal Aviation
Administration**

Advisory Circular

Subject: HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS	**Date:** 8/28/2007	**AC No:** 150/5200-33B
	Initiated by: AAS-300	**Change:**

1. PURPOSE. This Advisory Circular (AC) provides guidance on certain land uses that have the potential to attract hazardous wildlife on or near public-use airports. It also discusses airport development projects (including airport construction, expansion, and renovation) affecting aircraft movement near hazardous wildlife attractants. Appendix 1 provides definitions of terms used in this AC.

2. APPLICABILITY. The Federal Aviation Administration (FAA) recommends that public-use airport operators implement the standards and practices contained in this AC. The holders of Airport Operating Certificates issued under Title 14, Code of Federal Regulations (CFR), Part 139, Certification of Airports, Subpart D (Part 139), may use the standards, practices, and recommendations contained in this AC to comply with the wildlife hazard management requirements of Part 139. Airports that have received Federal grant-in-aid assistance must use these standards. The FAA also recommends the guidance in this AC for land-use planners, operators of non-certificated airports, and developers of projects, facilities, and activities on or near airports.

3. CANCELLATION. This AC cancels AC 150/5200-33A, *Hazardous Wildlife Attractants on or near Airports*, dated July 27, 2004.

4. PRINCIPAL CHANGES. This AC contains the following major changes, which are marked with vertical bars in the margin:

a. Technical changes to paragraph references.

b. Wording on storm water detention ponds.

c. Deleted paragraph 4-3.b, *Additional Coordination.*

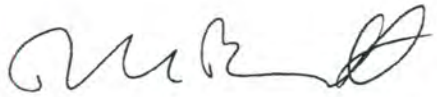
5. BACKGROUND. Information about the risks posed to aircraft by certain wildlife species has increased a great deal in recent years. Improved reporting, studies, documentation, and statistics clearly show that aircraft collisions with birds and other wildlife are a serious economic and public safety problem. While many species of wildlife can pose a threat to aircraft safety, they are not equally hazardous. Table 1

ranks the wildlife groups commonly involved in damaging strikes in the United States according to their relative hazard to aircraft. The ranking is based on the 47,212 records in the FAA National Wildlife Strike Database for the years 1990 through 2003. These hazard rankings, in conjunction with site-specific Wildlife Hazards Assessments (WHA), will help airport operators determine the relative abundance and use patterns of wildlife species and help focus hazardous wildlife management efforts on those species most likely to cause problems at an airport.

Most public-use airports have large tracts of open, undeveloped land that provide added margins of safety and noise mitigation. These areas can also present potential hazards to aviation if they encourage wildlife to enter an airport's approach or departure airspace or air operations area (AOA). Constructed or natural areas—such as poorly drained locations, detention/retention ponds, roosting habitats on buildings, landscaping, odor-causing rotting organic matter (putrescible waste) disposal operations, wastewater treatment plants, agricultural or aquaculture activities, surface mining, or wetlands—can provide wildlife with ideal locations for feeding, loafing, reproduction, and escape. Even small facilities, such as fast food restaurants, taxicab staging areas, rental car facilities, aircraft viewing areas, and public parks, can produce substantial attractions for hazardous wildlife.

During the past century, wildlife-aircraft strikes have resulted in the loss of hundreds of lives worldwide, as well as billions of dollars in aircraft damage. Hazardous wildlife attractants on and near airports can jeopardize future airport expansion, making proper community land-use planning essential. This AC provides airport operators and those parties with whom they cooperate with the guidance they need to assess and address potentially hazardous wildlife attractants when locating new facilities and implementing certain land-use practices on or near public-use airports.

6. MEMORANDUM OF AGREEMENT BETWEEN FEDERAL RESOURCE AGENCIES. The FAA, the U.S. Air Force, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the U.S. Department of Agriculture - Wildlife Services signed a Memorandum of Agreement (MOA) in July 2003 to acknowledge their respective missions in protecting aviation from wildlife hazards. Through the MOA, the agencies established procedures necessary to coordinate their missions to address more effectively existing and future environmental conditions contributing to collisions between wildlife and aircraft (wildlife strikes) throughout the United States. These efforts are intended to minimize wildlife risks to aviation and human safety while protecting the Nation's valuable environmental resources.



DAVID L. BENNETT
Director, Office of Airport Safety
and Standards

Table 1. Ranking of 25 species groups as to relative hazard to aircraft (1=most hazardous) based on three criteria (damage, major damage, and effect-on-flight), a composite ranking based on all three rankings, and a relative hazard score. Data were derived from the FAA National Wildlife Strike Database, January 1990–April 2003.[1]

Species group	Ranking by criteria			Composite ranking[2]	Relative hazard score[3]
	Damage[4]	Major damage[5]	Effect on flight[6]		
Deer	1	1	1	1	100
Vultures	2	2	2	2	64
Geese	3	3	6	3	55
Cormorants/pelicans	4	5	3	4	54
Cranes	7	6	4	5	47
Eagles	6	9	7	6	41
Ducks	5	8	10	7	39
Osprey	8	4	8	8	39
Turkey/pheasants	9	7	11	9	33
Herons	11	14	9	10	27
Hawks (buteos)	10	12	12	11	25
Gulls	12	11	13	12	24
Rock pigeon	13	10	14	13	23
Owls	14	13	20	14	23
H. lark/s. bunting	18	15	15	15	17
Crows/ravens	15	16	16	16	16
Coyote	16	19	5	17	14
Mourning dove	17	17	17	18	14
Shorebirds	19	21	18	19	10
Blackbirds/starling	20	22	19	20	10
American kestrel	21	18	21	21	9
Meadowlarks	22	20	22	22	7
Swallows	24	23	24	23	4
Sparrows	25	24	23	24	4
Nighthawks	23	25	25	25	1

[1] Excerpted from the *Special Report for the FAA, "Ranking the Hazard Level of Wildlife Species to Civil Aviation in the USA: Update #1, July 2, 2003".* Refer to this report for additional explanations of criteria and method of ranking.

[2] Relative rank of each species group was compared with every other group for the three variables, placing the species group with the greatest hazard rank for ≥ 2 of the 3 variables above the next highest ranked group, then proceeding down the list.

[3] Percentage values, from Tables 3 and 4 in Footnote 1 of the *Special Report*, for the three criteria were summed and scaled down from 100, with 100 as the score for the species group with the maximum summed values and the greatest potential hazard to aircraft.

[4] Aircraft incurred at least some damage (destroyed, substantial, minor, or unknown) from strike.

[5] Aircraft incurred damage or structural failure, which adversely affected the structure strength, performance, or flight characteristics, and which would normally require major repair or replacement of the affected component, or the damage sustained makes it inadvisable to restore aircraft to airworthy condition.

[6] Aborted takeoff, engine shutdown, precautionary landing, or other.

This page intentionally left blank.

Table of Contents

SECTION 1. GENERAL SEPARATION CRITERIA FOR HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS. 1
1-1. INTRODUCTION 1
1-2. AIRPORTS SERVING PISTON-POWERED AIRCRAFT 1
1-3. AIRPORTS SERVING TURBINE-POWERED AIRCRAFT 1
1-4. PROTECTION OF APPROACH, DEPARTURE, AND CIRCLING AIRSPACE 1
SECTION 2. LAND-USE PRACTICES ON OR NEAR AIRPORTS THAT POTENTIALLY ATTRACT HAZARDOUS WILDLIFE 3
2-1. GENERAL 3
2-2. WASTE DISPOSAL OPERATIONS 3
2-3. WATER MANAGEMENT FACILITIES 5
2-4. WETLANDS 8
2-5. DREDGE SPOIL CONTAINMENT AREAS 9
2-6. AGRICULTURAL ACTIVITIES 9
2-7. GOLF COURSES, LANDSCAPING AND OTHER LAND-USE CONSIDERATIONS 10
2-8. SYNERGISTIC EFFECTS OF SURROUNDING LAND USES 11
SECTION 3. PROCEDURES FOR WILDLIFE HAZARD MANAGEMENT BY OPERATORS OF PUBLIC-USE AIRPORTS 13
3.1. INTRODUCTION 13
3.2. COORDINATION WITH USDA WILDLIFE SERVICES OR OTHER QUALIFIED WILDLIFE DAMAGE MANAGEMENT BIOLOGISTS 13
3-3. WILDLIFE HAZARD MANAGEMENT AT AIRPORTS: A MANUAL FOR AIRPORT PERSONNEL 13
3-4. WILDLIFE HAZARD ASSESSMENTS, TITLE 14, CODE OF FEDERAL REGULATIONS, PART 139 13
3-5. WILDLIFE HAZARD MANAGEMENT PLAN (WHMP) 14
3-6. LOCAL COORDINATION 14
3-7. COORDINATION/NOTIFICATION OF AIRMEN OF WILDLIFE HAZARDS 14
SECTION 4. FAA NOTIFICATION AND REVIEW OF PROPOSED LAND-USE PRACTICE CHANGES IN THE VICINITY OF PUBLIC-USE AIRPORTS 15
4-1. FAA REVIEW OF PROPOSED LAND-USE PRACTICE CHANGES IN THE VICINITY OF PUBLIC-USE AIRPORTS 15
4-2. WASTE MANAGEMENT FACILITIES 15
4-3. OTHER LAND-USE PRACTICE CHANGES 16
APPENDIX 1. DEFINITIONS OF TERMS USED IN THIS ADVISORY CIRCULAR 19

This page intentionally left blank.

SECTION 1.

GENERAL SEPARATION CRITERIA FOR HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS.

1-1. INTRODUCTION. When considering proposed land uses, airport operators, local planners, and developers must take into account whether the proposed land uses, including new development projects, will increase wildlife hazards. Land-use practices that attract or sustain hazardous wildlife populations on or near airports can significantly increase the potential for wildlife strikes.

The FAA recommends the minimum separation criteria outlined below for land-use practices that attract hazardous wildlife to the vicinity of airports. Please note that FAA criteria include land uses that cause movement of hazardous wildlife onto, into, or across the airport's approach or departure airspace or air operations area (AOA). (See the discussion of the synergistic effects of surrounding land uses in Section 2-8 of this AC.)

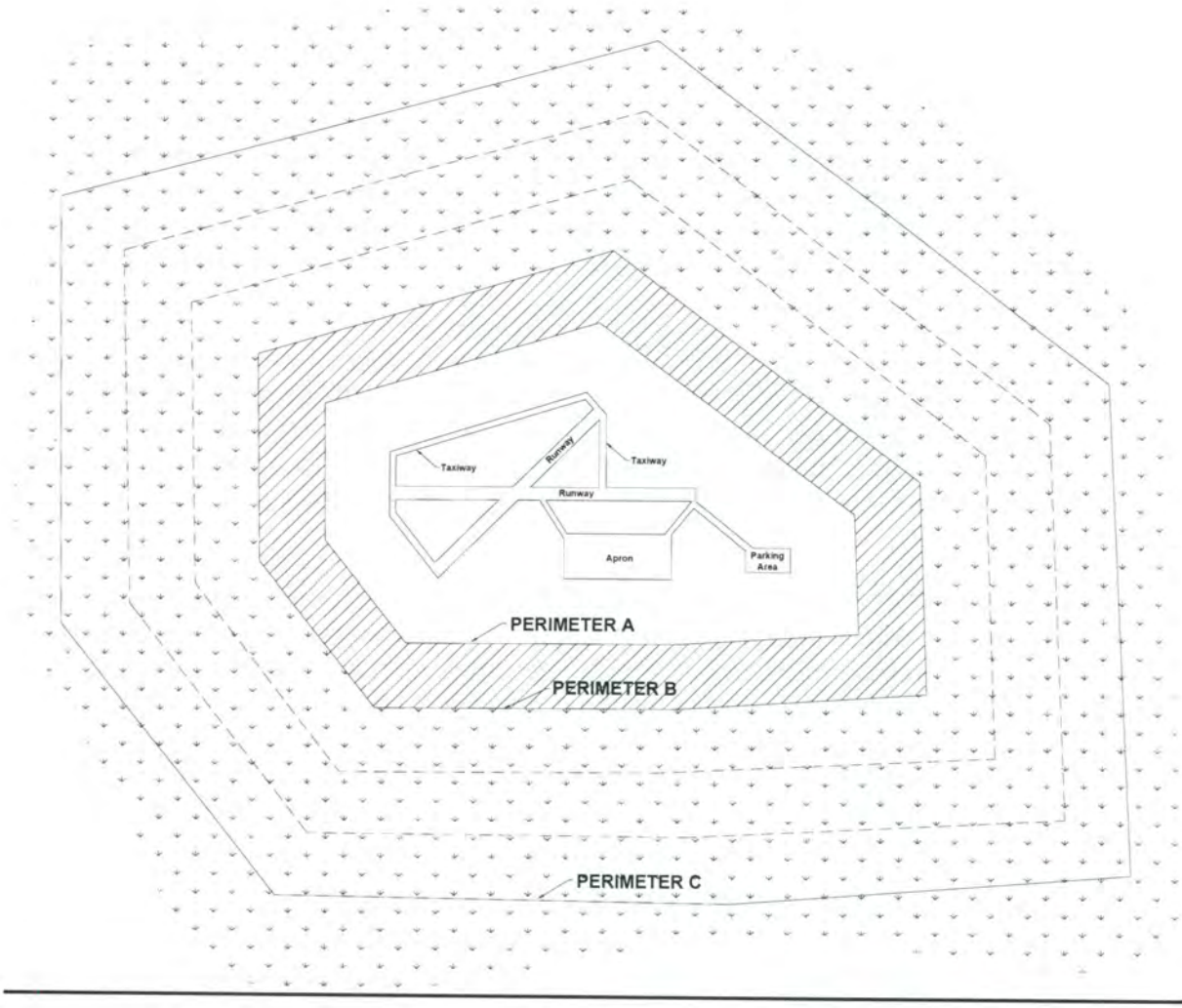
The basis for the separation criteria contained in this section can be found in existing FAA regulations. The separation distances are based on (1) flight patterns of piston-powered aircraft and turbine-powered aircraft, (2) the altitude at which most strikes happen (78 percent occur under 1,000 feet and 90 percent occur under 3,000 feet above ground level), and (3) National Transportation Safety Board (NTSB) recommendations.

1-2. AIRPORTS SERVING PISTON-POWERED AIRCRAFT. Airports that do not sell Jet-A fuel normally serve piston-powered aircraft. Notwithstanding more stringent requirements for specific land uses, the FAA recommends a separation distance of 5,000 feet at these airports for any of the hazardous wildlife attractants mentioned in Section 2 or for new airport development projects meant to accommodate aircraft movement. This distance is to be maintained between an airport's AOA and the hazardous wildlife attractant. Figure 1 depicts this separation distance measured from the nearest aircraft operations areas.

1-3. AIRPORTS SERVING TURBINE-POWERED AIRCRAFT. Airports selling Jet-A fuel normally serve turbine-powered aircraft. Notwithstanding more stringent requirements for specific land uses, the FAA recommends a separation distance of 10,000 feet at these airports for any of the hazardous wildlife attractants mentioned in Section 2 or for new airport development projects meant to accommodate aircraft movement. This distance is to be maintained between an airport's AOA and the hazardous wildlife attractant. Figure 1 depicts this separation distance from the nearest aircraft movement areas.

1-4. PROTECTION OF APPROACH, DEPARTURE, AND CIRCLING AIRSPACE. For all airports, the FAA recommends a distance of 5 statute miles between the farthest edge of the airport's AOA and the hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace.

Figure 1. Separation distances within which hazardous wildlife attractants should be avoided, eliminated, or mitigated.



PERIMETER A: For airports serving piston-powered aircraft, hazardous wildlife attractants must be 5,000 feet from the nearest air operations area.

PERIMETER B: For airports serving turbine-powered aircraft, hazardous wildlife attractants must be 10,000 feet from the nearest air operations area.

PERIMETER C: 5-mile range to protect approach, departure and circling airspace.

SECTION 2.

LAND-USE PRACTICES ON OR NEAR AIRPORTS THAT POTENTIALLY ATTRACT HAZARDOUS WILDLIFE.

2-1. GENERAL. The wildlife species and the size of the populations attracted to the airport environment vary considerably, depending on several factors, including land-use practices on or near the airport. This section discusses land-use practices having the potential to attract hazardous wildlife and threaten aviation safety. In addition to the specific considerations outlined below, airport operators should refer to *Wildlife Hazard Management at Airports,* prepared by FAA and U.S. Department of Agriculture (USDA) staff. (This manual is available in English, Spanish, and French. It can be viewed and downloaded free of charge from the FAA's wildlife hazard mitigation web site: http://wildlife-mitigation.tc.FAA.gov.). And, *Prevention and Control of Wildlife Damage,* compiled by the University of Nebraska Cooperative Extension Division. (This manual is available online in a periodically updated version at: ianrwww.unl.edu/wildlife/solutions/handbook/.)

2-2. WASTE DISPOSAL OPERATIONS. Municipal solid waste landfills (MSWLF) are known to attract large numbers of hazardous wildlife, particularly birds. Because of this, these operations, when located within the separations identified in the siting criteria in Sections 1-2 through 1-4, are considered incompatible with safe airport operations.

a. **Siting for new municipal solid waste landfills subject to AIR 21.** Section 503 of the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (Public Law 106-181) (AIR 21) prohibits the construction or establishment of a new MSWLF within 6 statute miles of certain public-use airports. Before these prohibitions apply, both the airport and the landfill must meet the very specific conditions described below. These restrictions do not apply to airports or landfills located within the state of Alaska.

   The airport must (1) have received a Federal grant(s) under 49 U.S.C. § 47101, et. seq.; (2) be under control of a public agency; (3) serve some scheduled air carrier operations conducted in aircraft with less than 60 seats; and (4) have total annual enplanements consisting of at least 51 percent of scheduled air carrier enplanements conducted in aircraft with less than 60 passenger seats.

   The proposed MSWLF must (1) be within 6 miles of the airport, as measured from airport property line to MSWLF property line, and (2) have started construction or establishment on or after April 5, 2001. Public Law 106-181 only limits the construction or establishment of some new MSWLF. It does not limit the expansion, either vertical or horizontal, of existing landfills.

   NOTE: Consult the most recent version of AC 150/5200-34, *Construction or Establishment of Landfills Near Public Airports,* for a more detailed discussion of these restrictions.

b. **Siting for new MSWLF not subject to AIR 21.** If an airport and MSWLF do not meet the restrictions of Public Law 106-181, the FAA recommends against locating MSWLF within the separation distances identified in Sections 1-2 through 1-4. The separation distances should be measured from the closest point of the airport's AOA to the closest planned MSWLF cell.

c. **Considerations for existing waste disposal facilities within the limits of separation criteria.** The FAA recommends against airport development projects that would increase the number of aircraft operations or accommodate larger or faster aircraft near MSWLF operations located within the separations identified in Sections 1-2 through 1-4. In addition, in accordance with 40 CFR 258.10, owners or operators of existing MSWLF units that are located within the separations listed in Sections 1-2 through 1-4 must demonstrate that the unit is designed and operated so it does not pose a bird hazard to aircraft. (See Section 4-2(b) of this AC for a discussion of this demonstration requirement.)

d. **Enclosed trash transfer stations.** Enclosed waste-handling facilities that receive garbage behind closed doors; process it via compaction, incineration, or similar manner; and remove all residue by enclosed vehicles generally are compatible with safe airport operations, provided they are not located on airport property or within the Runway Protection Zone (RPZ). These facilities should not handle or store putrescible waste outside or in a partially enclosed structure accessible to hazardous wildlife. Trash transfer facilities that are open on one or more sides; that store uncovered quantities of municipal solid waste outside, even if only for a short time; that use semi-trailers that leak or have trash clinging to the outside; or that do not control odors by ventilation and filtration systems (odor masking is not acceptable) do not meet the FAA's definition of fully enclosed trash transfer stations. The FAA considers these facilities incompatible with safe airport operations if they are located closer than the separation distances specified in Sections 1-2 through 1-4.

e. **Composting operations on or near airport property.** Composting operations that accept only yard waste (e.g., leaves, lawn clippings, or branches) generally do not attract hazardous wildlife. Sewage sludge, woodchips, and similar material are not municipal solid wastes and may be used as compost bulking agents. The compost, however, must never include food or other municipal solid waste. Composting operations should not be located on airport property. Off-airport property composting operations should be located no closer than the greater of the following distances: 1,200 feet from any AOA or the distance called for by airport design requirements (see AC 150/5300-13, *Airport Design*). This spacing should prevent material, personnel, or equipment from penetrating any Object Free Area (OFA), Obstacle Free Zone (OFZ), Threshold Siting Surface (TSS), or Clearway. Airport operators should monitor composting operations located in proximity to the airport to ensure that steam or thermal rise does not adversely affect air traffic. On-airport disposal of compost by-products should not be conducted for the reasons stated in 2-3f.

f. **Underwater waste discharges.** The FAA recommends against the underwater discharge of any food waste (e.g., fish processing offal) within the separations identified in Sections 1-2 through 1-4 because it could attract scavenging hazardous wildlife.

g. **Recycling centers.** Recycling centers that accept previously sorted non-food items, such as glass, newspaper, cardboard, or aluminum, are, in most cases, not attractive to hazardous wildlife and are acceptable.

h. **Construction and demolition (C&D) debris facilities.** C&D landfills do not generally attract hazardous wildlife and are acceptable if maintained in an orderly manner, admit no putrescible waste, and are not co-located with other waste disposal operations. However, C&D landfills have similar visual and operational characteristics to putrescible waste disposal sites. When co-located with putrescible waste disposal operations, C&D landfills are more likely to attract hazardous wildlife because of the similarities between these disposal facilities. Therefore, a C&D landfill co-located with another waste disposal operation should be located outside of the separations identified in Sections 1-2 through 1-4.

i. **Fly ash disposal.** The incinerated residue from resource recovery power/heat-generating facilities that are fired by municipal solid waste, coal, or wood is generally not a wildlife attractant because it no longer contains putrescible matter. Landfills accepting only fly ash are generally not considered to be wildlife attractants and are acceptable as long as they are maintained in an orderly manner, admit no putrescible waste of any kind, and are not co-located with other disposal operations that attract hazardous wildlife.

   Since varying degrees of waste consumption are associated with general incineration (not resource recovery power/heat-generating facilities), the FAA considers the ash from general incinerators a regular waste disposal by-product and, therefore, a hazardous wildlife attractant if disposed of within the separation criteria outlined in Sections 1-2 through 1-4.

2-3. WATER MANAGEMENT FACILITIES. Drinking water intake and treatment facilities, storm water and wastewater treatment facilities, associated retention and settling ponds, ponds built for recreational use, and ponds that result from mining activities often attract large numbers of potentially hazardous wildlife. To prevent wildlife hazards, land-use developers and airport operators may need to develop management plans, in compliance with local and state regulations, to support the operation of storm water management facilities on or near all public-use airports to ensure a safe airport environment.

a. **Existing storm water management facilities.** On-airport storm water management facilities allow the quick removal of surface water, including discharges related to aircraft deicing, from impervious surfaces, such as pavement and terminal/hangar building roofs. Existing on-airport detention ponds collect storm water, protect water quality, and control runoff. Because they slowly release water

after storms, they create standing bodies of water that can attract hazardous wildlife. Where the airport has developed a Wildlife Hazard Management Plan (WHMP) in accordance with Part 139, the FAA requires immediate correction of any wildlife hazards arising from existing storm water facilities located on or near airports, using appropriate wildlife hazard mitigation techniques. Airport operators should develop measures to minimize hazardous wildlife attraction in consultation with a wildlife damage management biologist.

Where possible, airport operators should modify storm water detention ponds to allow a maximum 48-hour detention period for the design storm. The FAA recommends that airport operators avoid or remove retention ponds and detention ponds featuring dead storage to eliminate standing water. Detention basins should remain totally dry between rainfalls. Where constant flow of water is anticipated through the basin, or where any portion of the basin bottom may remain wet, the detention facility should include a concrete or paved pad and/or ditch/swale in the bottom to prevent vegetation that may provide nesting habitat.

When it is not possible to drain a large detention pond completely, airport operators may use physical barriers, such as bird balls, wires grids, pillows, or netting, to deter birds and other hazardous wildlife. When physical barriers are used, airport operators must evaluate their use and ensure they will not adversely affect water rescue. Before installing any physical barriers over detention ponds on Part 139 airports, airport operators must get approval from the appropriate FAA Regional Airports Division Office.

The FAA recommends that airport operators encourage off-airport storm water treatment facility operators to incorporate appropriate wildlife hazard mitigation techniques into storm water treatment facility operating practices when their facility is located within the separation criteria specified in Sections 1-2 through 1-4.

b. **New storm water management facilities.** The FAA strongly recommends that off-airport storm water management systems located within the separations identified in Sections 1-2 through 1-4 be designed and operated so as not to create above-ground standing water. Stormwater detention ponds should be designed, engineered, constructed, and maintained for a maximum 48–hour detention period after the design storm and remain completely dry between storms. To facilitate the control of hazardous wildlife, the FAA recommends the use of steep-sided, rip-rap lined, narrow, linearly shaped water detention basins. When it is not possible to place these ponds away from an airport's AOA, airport operators should use physical barriers, such as bird balls, wires grids, pillows, or netting, to prevent access of hazardous wildlife to open water and minimize aircraft-wildlife interactions. When physical barriers are used, airport operators must evaluate their use and ensure they will not adversely affect water rescue. Before installing any physical barriers over detention ponds on Part 139 airports, airport operators must get approval from the appropriate FAA Regional Airports Division Office. All vegetation in or around detention basins that provide food or cover for hazardous wildlife should be eliminated. If soil conditions and other requirements allow, the FAA encourages

the use of underground storm water infiltration systems, such as French drains or buried rock fields, because they are less attractive to wildlife.

c. **Existing wastewater treatment facilities.** The FAA strongly recommends that airport operators immediately correct any wildlife hazards arising from existing wastewater treatment facilities located on or near the airport. Where required, a WHMP developed in accordance with Part 139 will outline appropriate wildlife hazard mitigation techniques. Accordingly, airport operators should encourage wastewater treatment facility operators to incorporate measures, developed in consultation with a wildlife damage management biologist, to minimize hazardous wildlife attractants. Airport operators should also encourage those wastewater treatment facility operators to incorporate these mitigation techniques into their standard operating practices. In addition, airport operators should consider the existence of wastewater treatment facilities when evaluating proposed sites for new airport development projects and avoid such sites when practicable.

d. **New wastewater treatment facilities.** The FAA strongly recommends against the construction of new wastewater treatment facilities or associated settling ponds within the separations identified in Sections 1-2 through 1-4. Appendix 1 defines wastewater treatment facility as "any devices and/or systems used to store, treat, recycle, or reclaim municipal sewage or liquid industrial wastes." The definition includes any pretreatment involving the reduction of the amount of pollutants or the elimination of pollutants prior to introducing such pollutants into a publicly owned treatment works (wastewater treatment facility). During the site-location analysis for wastewater treatment facilities, developers should consider the potential to attract hazardous wildlife if an airport is in the vicinity of the proposed site, and airport operators should voice their opposition to such facilities if they are in proximity to the airport.

e. **Artificial marshes.** In warmer climates, wastewater treatment facilities sometimes employ artificial marshes and use submergent and emergent aquatic vegetation as natural filters. These artificial marshes may be used by some species of flocking birds, such as blackbirds and waterfowl, for breeding or roosting activities. The FAA strongly recommends against establishing artificial marshes within the separations identified in Sections 1-2 through 1-4.

f. **Wastewater discharge and sludge disposal.** The FAA recommends against the discharge of wastewater or sludge on airport property because it may improve soil moisture and quality on unpaved areas and lead to improved turf growth that can be an attractive food source for many species of animals. Also, the turf requires more frequent mowing, which in turn may mutilate or flush insects or small animals and produce straw, both of which can attract hazardous wildlife. In addition, the improved turf may attract grazing wildlife, such as deer and geese. Problems may also occur when discharges saturate unpaved airport areas. The resultant soft, muddy conditions can severely restrict or prevent emergency vehicles from reaching accident sites in a timely manner.

2-4. WETLANDS. Wetlands provide a variety of functions and can be regulated by local, state, and Federal laws. Normally, wetlands are attractive to many types of wildlife, including many which rank high on the list of hazardous wildlife species (Table 1).

NOTE: If questions exist as to whether an area qualifies as a wetland, contact the local division of the U.S. Army Corps of Engineers, the Natural Resources Conservation Service, or a wetland consultant qualified to delineate wetlands.

a. **Existing wetlands on or near airport property.** If wetlands are located on or near airport property, airport operators should be alert to any wildlife use or habitat changes in these areas that could affect safe aircraft operations. At public-use airports, the FAA recommends immediately correcting, in cooperation with local, state, and Federal regulatory agencies, any wildlife hazards arising from existing wetlands located on or near airports. Where required, a WHMP will outline appropriate wildlife hazard mitigation techniques. Accordingly, airport operators should develop measures to minimize hazardous wildlife attraction in consultation with a wildlife damage management biologist.

b. **New airport development.** Whenever possible, the FAA recommends locating new airports using the separations from wetlands identified in Sections 1-2 through 1-4. Where alternative sites are not practicable, or when airport operators are expanding an existing airport into or near wetlands, a wildlife damage management biologist, in consultation with the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, and the state wildlife management agency should evaluate the wildlife hazards and prepare a WHMP that indicates methods of minimizing the hazards.

c. **Mitigation for wetland impacts from airport projects.** Wetland mitigation may be necessary when unavoidable wetland disturbances result from new airport development projects or projects required to correct wildlife hazards from wetlands. Wetland mitigation must be designed so it does not create a wildlife hazard. The FAA recommends that wetland mitigation projects that may attract hazardous wildlife be sited outside of the separations identified in Sections 1-2 through 1-4.

   (1) Onsite mitigation of wetland functions. The FAA may consider exceptions to locating mitigation activities outside the separations identified in Sections 1-2 through 1-4 if the affected wetlands provide unique ecological functions, such as critical habitat for threatened or endangered species or ground water recharge, which cannot be replicated when moved to a different location. Using existing airport property is sometimes the only feasible way to achieve the mitigation ratios mandated in regulatory orders and/or settlement agreements with the resource agencies. Conservation easements are an additional means of providing mitigation for project impacts. Typically the airport operator continues to own the property, and an easement is created stipulating that the property will be maintained as habitat for state or Federally listed species.

Mitigation must not inhibit the airport operator's ability to effectively control hazardous wildlife on or near the mitigation site or effectively maintain other aspects of safe airport operations. Enhancing such mitigation areas to attract hazardous wildlife must be avoided. The FAA will review any onsite mitigation proposals to determine compatibility with safe airport operations. A wildlife damage management biologist should evaluate any wetland mitigation projects that are needed to protect unique wetland functions and that must be located in the separation criteria in Sections 1-2 through 1-4 before the mitigation is implemented. A WHMP should be developed to reduce the wildlife hazards.

(2) Offsite mitigation of wetland functions. The FAA recommends that wetland mitigation projects that may attract hazardous wildlife be sited outside of the separations identified in Sections 1-2 through 1-4 unless they provide unique functions that must remain onsite (see 2-4c(1)). Agencies that regulate impacts to or around wetlands recognize that it may be necessary to split wetland functions in mitigation schemes. Therefore, regulatory agencies may, under certain circumstances, allow portions of mitigation to take place in different locations.

(3) Mitigation banking. Wetland mitigation banking is the creation or restoration of wetlands in order to provide mitigation credits that can be used to offset permitted wetland losses. Mitigation banking benefits wetland resources by providing advance replacement for permitted wetland losses; consolidating small projects into larger, better-designed and managed units; and encouraging integration of wetland mitigation projects with watershed planning. This last benefit is most helpful for airport projects, as wetland impacts mitigated outside of the separations identified in Sections 1-2 through 1-4 can still be located within the same watershed. Wetland mitigation banks meeting the separation criteria offer an ecologically sound approach to mitigation in these situations. Airport operators should work with local watershed management agencies or organizations to develop mitigation banking for wetland impacts on airport property.

2-5. DREDGE SPOIL CONTAINMENT AREAS. The FAA recommends against locating dredge spoil containment areas (also known as Confined Disposal Facilities) within the separations identified in Sections 1-2 through 1-4 if the containment area or the spoils contain material that would attract hazardous wildlife.

2-6. AGRICULTURAL ACTIVITIES. Because most, if not all, agricultural crops can attract hazardous wildlife during some phase of production, the FAA recommends against the used of airport property for agricultural production, including hay crops, within the separations identified in Sections 1-2 through 1-4. . If the airport has no financial alternative to agricultural crops to produce income necessary to maintain the viability of the airport, then the airport shall follow the crop distance guidelines listed in the table titled "Minimum Distances between Certain Airport Features and Any On-Airport Agricultural Crops" found in AC 150/5300-13, *Airport Design*, Appendix 17. The cost of wildlife control and potential accidents should be weighed against the income produced by the on-airport crops when deciding whether to allow crops on the airport.

a. **Livestock production.** Confined livestock operations (i.e., feedlots, dairy operations, hog or chicken production facilities, or egg laying operations) often attract flocking birds, such as starlings, that pose a hazard to aviation. Therefore, The FAA recommends against such facilities within the separations identified in Sections 1-2 through 1-4. Any livestock operation within these separations should have a program developed to reduce the attractiveness of the site to species that are hazardous to aviation safety. Free-ranging livestock must not be grazed on airport property because the animals may wander onto the AOA. Furthermore, livestock feed, water, and manure may attract birds.

b. **Aquaculture.** Aquaculture activities (i.e. catfish or trout production) conducted outside of fully enclosed buildings are inherently attractive to a wide variety of birds. Existing aquaculture facilities/activities within the separations listed in Sections 1-2 through 1-4 must have a program developed to reduce the attractiveness of the sites to species that are hazardous to aviation safety. Airport operators should also oppose the establishment of new aquaculture facilities/activities within the separations listed in Sections 1-2 through 1-4.

c. **Alternative uses of agricultural land.** Some airports are surrounded by vast areas of farmed land within the distances specified in Sections 1-2 through 1-4. Seasonal uses of agricultural land for activities such as hunting can create a hazardous wildlife situation. In some areas, farmers will rent their land for hunting purposes. Rice farmers, for example, flood their land during waterfowl hunting season and obtain additional revenue by renting out duck blinds. The duck hunters then use decoys and call in hundreds, if not thousands, of birds, creating a tremendous threat to aircraft safety. A wildlife damage management biologist should review, in coordination with local farmers and producers, these types of seasonal land uses and incorporate them into the WHMP.

2-7. GOLF COURSES, LANDSCAPING AND OTHER LAND-USE CONSIDERATIONS.

a. **Golf courses.** The large grassy areas and open water found on most golf courses are attractive to hazardous wildlife, particularly Canada geese and some species of gulls. These species can pose a threat to aviation safety. The FAA recommends against construction of new golf courses within the separations identified in Sections 1-2 through 1-4. Existing golf courses located within these separations must develop a program to reduce the attractiveness of the sites to species that are hazardous to aviation safety. Airport operators should ensure these golf courses are monitored on a continuing basis for the presence of hazardous wildlife. If hazardous wildlife is detected, corrective actions should be immediately implemented.

b. **Landscaping and landscape maintenance.** Depending on its geographic location, landscaping can attract hazardous wildlife. The FAA recommends that airport operators approach landscaping with caution and confine it to airport areas not associated with aircraft movements. A wildlife damage management biologist should review all landscaping plans. Airport operators should also monitor all landscaped areas on a continuing basis for the presence of hazardous wildlife. If

hazardous wildlife is detected, corrective actions should be immediately implemented.

Turf grass areas can be highly attractive to a variety of hazardous wildlife species. Research conducted by the USDA Wildlife Services' National Wildlife Research Center has shown that no one grass management regime will deter all species of hazardous wildlife in all situations. In cooperation with wildlife damage management biologist, airport operators should develop airport turf grass management plans on a prescription basis, depending on the airport's geographic locations and the type of hazardous wildlife likely to frequent the airport

Airport operators should ensure that plant varieties attractive to hazardous wildlife are not used on the airport. Disturbed areas or areas in need of re-vegetating should not be planted with seed mixtures containing millet or any other large-seed producing grass. For airport property already planted with seed mixtures containing millet, rye grass, or other large-seed producing grasses, the FAA recommends disking, plowing, or another suitable agricultural practice to prevent plant maturation and seed head production. Plantings should follow the specific recommendations for grass management and seed and plant selection made by the State University Cooperative Extension Service, the local office of Wildlife Services, or a qualified wildlife damage management biologist. Airport operators should also consider developing and implementing a preferred/prohibited plant species list, reviewed by a wildlife damage management biologist, which has been designed for the geographic location to reduce the attractiveness to hazardous wildlife for landscaping airport property.

c. **Airports surrounded by wildlife habitat.** The FAA recommends that operators of airports surrounded by woodlands, water, or wetlands refer to Section 2.4 of this AC. Operators of such airports should provide for a Wildlife Hazard Assessment (WHA) conducted by a wildlife damage management biologist. This WHA is the first step in preparing a WHMP, where required.

d. **Other hazardous wildlife attractants.** Other specific land uses or activities (e.g., sport or commercial fishing, shellfish harvesting, etc.), perhaps unique to certain regions of the country, have the potential to attract hazardous wildlife. Regardless of the source of the attraction, when hazardous wildlife is noted on a public-use airport, airport operators must take prompt remedial action(s) to protect aviation safety.

2-8. SYNERGISTIC EFFECTS OF SURROUNDING LAND USES. There may be circumstances where two (or more) different land uses that would not, by themselves, be considered hazardous wildlife attractants or that are located outside of the separations identified in Sections 1-2 through 1-4 that are in such an alignment with the airport as to create a wildlife corridor directly through the airport and/or surrounding airspace. An example of this situation may involve a lake located outside of the separation criteria on the east side of an airport and a large hayfield on the west side of an airport, land uses that together could create a flyway for Canada geese directly across the airspace of the airport. There are numerous examples of such situations;

therefore, airport operators and the wildlife damage management biologist must consider the entire surrounding landscape and community when developing the WHMP.

SECTION 3.

PROCEDURES FOR WILDLIFE HAZARD MANAGEMENT BY OPERATORS OF PUBLIC-USE AIRPORTS.

3.1. INTRODUCTION. In recognition of the increased risk of serious aircraft damage or the loss of human life that can result from a wildlife strike, the FAA may require the development of a Wildlife Hazard Management Plan (WHMP) when specific triggering events occur on or near the airport. Part 139.337 discusses the specific events that trigger a Wildlife Hazard Assessment (WHA) and the specific issues that a WHMP must address for FAA approval and inclusion in an Airport Certification Manual.

3.2. COORDINATION WITH USDA WILDLIFE SERVICES OR OTHER QUALIFIED WILDLIFE DAMAGE MANAGEMENT BIOLOGISTS. The FAA will use the Wildlife Hazard Assessment (WHA) conducted in accordance with Part 139 to determine if the airport needs a WHMP. Therefore, persons having the education, training, and expertise necessary to assess wildlife hazards must conduct the WHA. The airport operator may look to Wildlife Services or to qualified private consultants to conduct the WHA. When the services of a wildlife damage management biologist are required, the FAA recommends that land-use developers or airport operators contact a consultant specializing in wildlife damage management or the appropriate state director of Wildlife Services.

NOTE: Telephone numbers for the respective USDA Wildlife Services state offices can be obtained by contacting USDA Wildlife Services Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD, 20737-1234, Telephone (301) 734-7921, Fax (301) 734-5157 *(http://www.aphis.usda.gov/ws/)*.

3-3. WILDLIFE HAZARD MANAGEMENT AT AIRPORTS: A MANUAL FOR AIRPORT PERSONNEL. This manual, prepared by FAA and USDA Wildlife Services staff, contains a compilation of information to assist airport personnel in the development, implementation, and evaluation of WHMPs at airports. The manual includes specific information on the nature of wildlife strikes, legal authority, regulations, wildlife management techniques, WHAs, WHMPs, and sources of help and information. The manual is available in three languages: English, Spanish, and French. It can be viewed and downloaded free of charge from the FAA's wildlife hazard mitigation web site: http://wildlife-mitigation.tc.FAA.gov/. This manual only provides a starting point for addressing wildlife hazard issues at airports. Hazardous wildlife management is a complex discipline and conditions vary widely across the United States. Therefore, qualified wildlife damage management biologists must direct the development of a WHMP and the implementation of management actions by airport personnel.

There are many other resources complementary to this manual for use in developing and implementing WHMPs. Several are listed in the manual's bibliography.

3-4. WILDLIFE HAZARD ASSESSMENTS, TITLE 14, CODE OF FEDERAL REGULATIONS, PART 139. Part 139.337(b) requires airport operators to conduct a Wildlife Hazard Assessment (WHA) when certain events occur on or near the airport.

Part 139.337 (c) provides specific guidance as to what facts must be addressed in a WHA.

3-5. WILDLIFE HAZARD MANAGEMENT PLAN (WHMP). The FAA will consider the results of the WHA, along with the aeronautical activity at the airport and the views of the airport operator and airport users, in determining whether a formal WHMP is needed, in accordance with Part 139.337. If the FAA determines that a WHMP is needed, the airport operator must formulate and implement a WHMP, using the WHA as the basis for the plan.

The goal of an airport's Wildlife Hazard Management Plan is to minimize the risk to aviation safety, airport structures or equipment, or human health posed by populations of hazardous wildlife on and around the airport.

The WHMP must identify hazardous wildlife attractants on or near the airport and the appropriate wildlife damage management techniques to minimize the wildlife hazard. It must also prioritize the management measures.

3-6. LOCAL COORDINATION. The establishment of a Wildlife Hazards Working Group (WHWG) will facilitate the communication, cooperation, and coordination of the airport and its surrounding community necessary to ensure the effectiveness of the WHMP. The cooperation of the airport community is also necessary when new projects are considered. Whether on or off the airport, the input from all involved parties must be considered when a potentially hazardous wildlife attractant is being proposed. Airport operators should also incorporate public education activities with the local coordination efforts because some activities in the vicinity of your airport, while harmless under normal leisure conditions, can attract wildlife and present a danger to aircraft. For example, if public trails are planned near wetlands or in parks adjoining airport property, the public should know that feeding birds and other wildlife in the area may pose a risk to aircraft.

Airport operators should work with local and regional planning and zoning boards so as to be aware of proposed land-use changes, or modification of existing land uses, that could create hazardous wildlife attractants within the separations identified in Sections 1-2 through 1-4. Pay particular attention to proposed land uses involving creation or expansion of waste water treatment facilities, development of wetland mitigation sites, or development or expansion of dredge spoil containment areas. At the very least, airport operators must ensure they are on the notification list of the local planning board or equivalent review entity for all communities located within 5 miles of the airport, so they will receive notification of any proposed project and have the opportunity to review it for attractiveness to hazardous wildlife.

3-7 COORDINATION/NOTIFICATION OF AIRMEN OF WILDLIFE HAZARDS. If an existing land-use practice creates a wildlife hazard and the land-use practice or wildlife hazard cannot be immediately eliminated, airport operators must issue a Notice to Airmen (NOTAM) and encourage the land–owner or manager to take steps to control the wildlife hazard and minimize further attraction.

SECTION 4.

FAA NOTIFICATION AND REVIEW OF PROPOSED LAND-USE PRACTICE CHANGES IN THE VICINITY OF PUBLIC-USE AIRPORTS

4-1. FAA REVIEW OF PROPOSED LAND-USE PRACTICE CHANGES IN THE VICINITY OF PUBLIC-USE AIRPORTS.

a. The FAA discourages the development of waste disposal and other facilities, discussed in Section 2, located within the 5,000/10,000-foot criteria specified in Sections 1-2 through 1-4.

b. For projects that are located outside the 5,000/10,000-foot criteria but within 5 statute miles of the airport's AOA, the FAA may review development plans, proposed land-use changes, operational changes, or wetland mitigation plans to determine if such changes present potential wildlife hazards to aircraft operations. The FAA considers sensitive airport areas as those that lie under or next to approach or departure airspace. This brief examination should indicate if further investigation is warranted.

c. Where a wildlife damage management biologist has conducted a further study to evaluate a site's compatibility with airport operations, the FAA may use the study results to make a determination.

4-2. WASTE MANAGEMENT FACILITIES.

a. Notification of new/expanded project proposal. Section 503 of the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (Public Law 106-181) limits the construction or establishment of new MSWLF within 6 statute miles of certain public-use airports, when both the airport and the landfill meet very specific conditions. See Section 2-2 of this AC and AC 150/5200-34 for a more detailed discussion of these restrictions.

The Environmental Protection Agency (EPA) requires any MSWLF operator proposing a new or expanded waste disposal operation within 5 statute miles of a runway end to notify the appropriate FAA Regional Airports Division Office and the airport operator of the proposal (40 CFR 258, *Criteria for Municipal Solid Waste Landfills*, Section 258.10, *Airport Safety*). The EPA also requires owners or operators of new MSWLF units, or lateral expansions of existing MSWLF units, that are located within 10,000 feet of any airport runway end used by turbojet aircraft, or within 5,000 feet of any airport runway end used only by piston-type aircraft, to demonstrate successfully that such units are not hazards to aircraft. (See 4-2.b below.)

When new or expanded MSWLF are being proposed near airports, MSWLF operators must notify the airport operator and the FAA of the proposal as early as possible pursuant to 40 CFR 258.

b. **Waste handling facilities within separations identified in Sections 1-2 through 1-4.** To claim successfully that a waste-handling facility sited within the separations identified in Sections 1-2 through 1-4 does not attract hazardous wildlife and does not threaten aviation, the developer must establish convincingly that the facility will not handle putrescible material other than that as outlined in 2-2.d. The FAA strongly recommends against any facility other than that as outlined in 2-2.d (enclosed transfer stations). The FAA will use this information to determine if the facility will be a hazard to aviation.

c. **Putrescible-Waste Facilities.** In their effort to satisfy the EPA requirement, some putrescible-waste facility proponents may offer to undertake experimental measures to demonstrate that their proposed facility will not be a hazard to aircraft. To date, no such facility has been able to demonstrate an ability to reduce and sustain hazardous wildlife to levels that existed before the putrescible-waste landfill began operating. For this reason, demonstrations of experimental wildlife control measures may not be conducted within the separation identified in Sections 1-2 through 1-4.

4-3. OTHER LAND-USE PRACTICE CHANGES. As a matter of policy, the FAA encourages operators of public-use airports who become aware of proposed land use practice changes that may attract hazardous wildlife within 5 statute miles of their airports to promptly notify the FAA. The FAA also encourages proponents of such land use changes to notify the FAA as early in the planning process as possible. Advanced notice affords the FAA an opportunity (1) to evaluate the effect of a particular land-use change on aviation safety and (2) to support efforts by the airport sponsor to restrict the use of land next to or near the airport to uses that are compatible with the airport.

The airport operator, project proponent, or land-use operator may use FAA Form 7460-1, *Notice of Proposed Construction or Alteration*, or other suitable documents similar to FAA Form 7460-1 to notify the appropriate FAA Regional Airports Division Office. Project proponents can contact the appropriate FAA Regional Airports Division Office for assistance with the notification process.

It is helpful if the notification includes a 15-minute quadrangle map of the area identifying the location of the proposed activity. The land-use operator or project proponent should also forward specific details of the proposed land-use change or operational change or expansion. In the case of solid waste landfills, the information should include the type of waste to be handled, how the waste will be processed, and final disposal methods.

a. **Airports that have received Federal grant-in-aid assistance.** Airports that have received Federal grant-in-aid assistance are required by their grant assurances to take appropriate actions to restrict the use of land next to or near the airport to uses that are compatible with normal airport operations. The FAA recommends that airport operators to the extent practicable oppose off-airport land-use changes or practices within the separations identified in Sections 1-2 through 1-4 that may attract hazardous wildlife. Failure to do so may lead to noncompliance with applicable grant assurances. The FAA will not approve the placement of airport

development projects pertaining to aircraft movement in the vicinity of hazardous wildlife attractants without appropriate mitigating measures. Increasing the intensity of wildlife control efforts is not a substitute for eliminating or reducing a proposed wildlife hazard. Airport operators should identify hazardous wildlife attractants and any associated wildlife hazards during any planning process for new airport development projects.

This page intentionally left blank.

APPENDIX 1. DEFINITIONS OF TERMS USED IN THIS ADVISORY CIRCULAR.

1. **GENERAL.** This appendix provides definitions of terms used throughout this AC.

    1. **Air operations area.** Any area of an airport used or intended to be used for landing, takeoff, or surface maneuvering of aircraft. An air operations area includes such paved areas or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiways, or apron.

    2. **Airport operator.** The operator (private or public) or sponsor of a public-use airport.

    3. **Approach or departure airspace.** The airspace, within 5 statute miles of an airport, through which aircraft move during landing or takeoff.

    4. **Bird balls.** High-density plastic floating balls that can be used to cover ponds and prevent birds from using the sites.

    5. **Certificate holder.** The holder of an Airport Operating Certificate issued under Title 14, Code of Federal Regulations, Part 139.

    6. **Construct a new MSWLF.** To begin to excavate, grade land, or raise structures to prepare a municipal solid waste landfill as permitted by the appropriate regulatory or permitting agency.

    7. **Detention ponds.** Storm water management ponds that hold storm water for short periods of time, a few hours to a few days.

    8. **Establish a new MSWLF.** When the first load of putrescible waste is received on-site for placement in a prepared municipal solid waste landfill.

    9. **Fly ash.** The fine, sand-like residue resulting from the complete incineration of an organic fuel source. Fly ash typically results from the combustion of coal or waste used to operate a power generating plant.

    10. **General aviation aircraft.** Any civil aviation aircraft not operating under 14 CFR Part 119, Certification: Air Carriers and Commercial Operators.

    11. **Hazardous wildlife.** Species of wildlife (birds, mammals, reptiles), including feral animals and domesticated animals not under control, that are associated with aircraft strike problems, are capable of causing structural damage to airport facilities, or act as attractants to other wildlife that pose a strike hazard

    12. **Municipal Solid Waste Landfill (MSWLF).** A publicly or privately owned discrete area of land or an excavation that receives household waste and that is not a land application unit, surface impoundment, injection well, or waste pile, as those terms are defined under 40 CFR § 257.2. An MSWLF may receive

30. **Wildlife.** Any wild animal, including without limitation any wild mammal, bird, reptile, fish, amphibian, mollusk, crustacean, arthropod, coelenterate, or other invertebrate, including any part, product, egg, or offspring thereof (50 CFR 10.12, *Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants*). As used in this AC, wildlife includes feral animals and domestic animals out of the control of their owners (14 CFR Part 139, Certification of Airports).

31. **Wildlife attractants.** Any human-made structure, land-use practice, or human-made or natural geographic feature that can attract or sustain hazardous wildlife within the landing or departure airspace or the airport's AOA. These attractants can include architectural features, landscaping, waste disposal sites, wastewater treatment facilities, agricultural or aquaculture activities, surface mining, or wetlands.

32. **Wildlife hazard.** A potential for a damaging aircraft collision with wildlife on or near an airport.

33. **Wildlife strike.** A wildlife strike is deemed to have occurred when:

    a. A pilot reports striking 1 or more birds or other wildlife;

    b. Aircraft maintenance personnel identify aircraft damage as having been caused by a wildlife strike;

    c. Personnel on the ground report seeing an aircraft strike 1 or more birds or other wildlife;

    d. Bird or other wildlife remains, whether in whole or in part, are found within 200 feet of a runway centerline, unless another reason for the animal's death is identified;

    e. The animal's presence on the airport had a significant negative effect on a flight (i.e., aborted takeoff, aborted landing, high-speed emergency stop, aircraft left pavement area to avoid collision with animal) (Transport Canada, Airports Group, *Wildlife Control Procedures Manual*, Technical Publication 11500E, 1994).

2. RESERVED.

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Ford N. Fuchigami
Director of Transportation
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Mr. Fuchigami:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated May 18, 2016, which provides the Airport Division's comments regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following responses:

- ***Federal Aviation Administration (FAA) Advisory Circular 150/5200-33B, Hazardous Wildlife Attractants.*** The Applicant understands that the WCT is within five (5) statute miles between the furthest edge of the airfield's Air Operations Area and the WCT's urban and rural land use and agricultural activities. The Applicant will work with the FAA and the Airports Division to identify BMPs that will help to mitigate hazardous wildlife movement into and from the Project's proposed urban and agricultural infrastructure systems.

- ***WCT Detention Basins.*** The Applicant understands that in order to help prevent the attraction of birds to and from the project area, the FAA recommends that stormwater detention ponds be

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

designed, engineered, constructed, and maintained for a maximum 48-hour detention period after the design storm and remain completely dry between storms. The design of the detention basins will include an overflow pipe which will allow a minimal discharge during a storm event and fully drain the basin within 48 hours after each storm event.

- ***PVC Photovoltaic Farms.*** The Applicant acknowledges your concerns regarding potential glint or glare from PV arrays that might be installed within the subject property. The applicant will refer to the suggested website (www.sandia.gov/glare) to prepare a glint and glare analysis and will also consult with the Airports Division prior to installation of any large-scale PV system within the WCT.

  Section V.D.6 of the FEIS documents measures that will be taken to address DOT's concerns regarding hazardous wildlife attractants and photovoltaic farms potential impacts to air operations.

- ***Aircraft Nosie.*** The Applicant understands that the subject property is within the approach surface of the Kahului Airport and overflight noise may be apparent to residents.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.comThank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

19. State of Hawaii, Department of Transportation, Highways Division

DAVID Y. IGE
GOVERNOR

FORD N. FUCHIGAMI
DIRECTOR

Deputy Directors
JADE T. BUTAY
ROSS M. HIGASHI
EDWIN H. SNIFFEN
DARRELL T. YOUNG

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
STP 8.1985

July 6, 2016

TO: THE HONORABLE LUIS P. SALAVERIA
DIRECTOR OF BUSINESS, ECONOMIC DEVELOPMENT
AND TOURISM

ATTN: DANIEL ORODENKER, EXECUTIVE OFFICER
LAND USE COMMISSION

FROM: FORD N. FUCHIGAMI
DIRECTOR OF TRANSPORTATION

SUBJECT: WAIKAPU COUNTRY TOWN
DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
WAIKAPU, MAUI, HAWAII
TMK: (2) 3-6-002:001 and 003, 3-6-004:003 and 006, 3-6-005:007
and 3-6 006:036

Our State Department of Transportation (DOT) previously commented on the subject project in our letter STP 8.1968 dated May 18, 2016 (copy attached) and now offers the following supplemental comments:

Highways Division

1. Acknowledge and appreciate the planned elementary school has moved away from a location abutting Honoapiilani Highway, as discussed in a January 17, 2014, pre-consultation meeting.

2. Honoapiilani Highway will be impacted by the proposed development. The Applicant will be responsible for its fair share of transportation improvements to mitigate the developments transportation impacts to the State Highway system.

3. The proposed intersections of Honoapiilani Highway with the development's Main Street and East/West Street appear to be less than a half mile apart. Federal guidelines for preserving functional classification of principal arterials include limiting the number of access points and sufficient distance between intersections. Internal roadway intersections appear close to Honoapiilani Highway and could affect highway operations. The Applicant should continue to work with us on intersection spacing.

4. Assure consistency and integration of the Hawaii Department of Transportation's (HDOT) bicycle and pedestrian policies and plans.

5. This section of Honoapiilani Highway is planned for widening in the HDOT's 2035 Transportation Plans for the Maui District. The Final EIS should include a discussion that the project will include a road widening setback along Honoapiilani Highway for future widening of this State facility.

6. Suggest meeting with the Highways Division, Planning Branch to further refine transportation improvements, and update the Traffic Impact Analysis Report if needed, prior to County zoning application.

If there are any questions, please contact Mr. Norren Kato of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

Attachment: Ltr. STP 8.1968 dtd. 5/18/16

c: Michael J. Summers, Planning Consultants Hawaii, LLC

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Ford N. Fuchigami
Director of Transportation
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Mr. Fuchigami:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated July 6, 2016, which provides the Highway Division's comments regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following responses:

1. *Elementary School Siting.* The Applicant understands that the Division is comfortable with the current siting of the proposed elementary school.

2. *Fair share Improvements.* The Applicant understands that the WCT will be responsible for its fair share improvements to mitigate the Project's transportation impacts to the State Highway system.

3. *Intersection Spacing.* In response to your comments regarding the spacing of the Project's intersections along Honoapiilani Highway, the Applicant's traffic consultant, Fehr & Peers, provided the following response:

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

"The comment indicates that the proposed project intersections along Honoapiilani Highway are spaced at less than one-half mile intervals and expresses a concern that internal intersections close to the Highway could affect traffic operations along the highway.

For the study intersections along Honoapiilani, the distance from Waiko Road to the future Main Street is approximately 2,400 feet, from the future Main Street to the future East-West Road is approximately 1,600 feet, and from the future East-West Road to the southern terminus of the future Waiale Bypass is approximately 2,400 feet. The spacing is less than ½ a mile between these intersections; however, since the project lies within the urbanized area of Maui, which will become more urbanized as other projects in the area are developed, rather than in the country or a rural area, more closely spaced intersections are reasonable and typical, including along a major arterial. It should be noted that similar intersection spacing along Honoapiilani Highway exists today in Wailuku just north of the WCT study area. For example, the spacing between the signalized intersections at Kehalani Makai Parkway and Kuikahi Drive is approximately 1,300 feet. Similarly, the distance between the signalized intersections of Waiko Road and Pilikana Street is also approximately 1,300 feet. Thus, it is possible to have functional intersections with spacing less than the distance desired by HDOT."

Regarding the spacing of the Project's internal intersections and the Honoapiilani Highway, the Applicant's traffic consultant, Fehr and Peers provided the following response:

"The comment suggests that some of the internal intersections near Honoapiilani Highway appear close to the highway and could affect intersection operations. The detailed intersection level of service analysis conducted as part of the TIAR and as part of the analysis of a future scenario without the Waile Bypass in place was reviewed in response to this comment. Data on the estimated 50th percentile and 95th percentile queues extending away from Honoapiilani Highway was reviewed for

the study intersections where the future Main Street and the future East-West Road are planned to cross the highway (Study Intersections #9 and #11). It was found that the planned roadways will provide more than sufficient storage space in the eastbound and westbound (makai-bound and mauka-bound) directions in all scenarios.

Additional review of the project site plan was conducted in response to this comment. The minor intersection lying east of Study Intersection 11 (Honoapiilani Highway & East-West Road) will be approximately 100 feet east of the highway. This proximity is such that it raises concern about potential vehicular conflicts with drivers turning east onto the East-West Road from the highway. In response it is recommended that turning movements at this intersection be limited to right-turns in to the minor street and right-turns out from the minor street. The most appropriate type of traffic control for internal intersections will be determined by the County as project development proceeds."

4. ***State DOT Bicycle and Pedestrian Plans and Policies.*** The Applicant is aware of the State DOT's bicycle and pedestrian plans and policies. The WCT's proposed pedestrian and bicycle facilities are consistent with the State's plans.

5. ***Honoapiilani Highway Widening.*** The Applicant is aware that HDOT's 2035 Transportation Plan for the Maui District shows Honapiilani Highway being widened fronting the project site to potentially accommodate two additional travel lanes. The WCT site plan should be able to accommodate the additional highway widening if required in the future.

6. ***Future Consultation.*** The Applicant appreciates the opportunity to continue working with HDOT to further refine the proposed transportation improvements and TIAR as the Project proceeds through the land use entitlement process.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

20. State of Hawaii, Department of Health, Office of Environmental Quality Control

OFFICE OF ENVIRONMENTAL QUALITY CONTROL

DAVID Y. IGE
GOVERNOR

SCOTT GLENN
INTERIM DIRECTOR

DEPARTMENT OF HEALTH, STATE OF HAWAI'I
235 South Beretania Street, Suite 702, Honolulu, HI 96813

Phone: (808) 586-4185
Email: oeqchawaii@doh.hawaii.gov

March 24, 2016

Daniel Orodenker, Executive Officer
Department of Business, Economic Development and Tourism
Land Use Commission
P.O. Box 2359
Honolulu, HI 96804

Dear Mr. Orodenker,

SUBJECT: Draft Environmental Impact Statement (EIS) for the Waikapū Country Town (WCT)

The Office of Environmental Quality Control (OEQC) reviewed the Draft EIS prepared for the subject project and offers the following comments for your consideration.

1) Agriculture Land

The Draft EIS proposes permanently converting prime agricultural land into residential development. This increase in land use intensity may also have an effect on the aquifer and its capacity. The project plans to use non-potable water and recycled water for crop irrigation. However, the total demand on the Waikapū aquifer will likely be increased, especially with other housing developments going into the area.

Additionally, the proximity of farming to homes and schools is of public concern, as there is potential for people to be exposed to chemicals. While the prevailing winds blow North to South, and will mostly keep particulates and other volatiles downwind of the residential area, Kona winds and other future wind conditions may blow the material in other directions. Also, there will be biking and jogging trails around the agricultural areas, and residents using these amenities could come in contact with farming chemicals and airborne particulates. Mitigation measures for these issues should be discussed.

2. Development Mitigation Measures

OEQC commends the recommendation of using low flow shower heads and toilets, LED lighting, other various Low Impact Development initiatives, and a community composting facility. While the stormwater mitigation measures are substantial, using pervious pavement or pavers would decrease stormwater run-off in general and lead to increased groundwater recharging.

Cc: Michael Summers, Planning Consultants Hawai'i, LLC

16-235

3. Infrastructure Improvements

Since WCT promotes non-vehicular transportation, it would be expected that many residents would want to walk or ride bikes with their children to school. In the community scoping phase, Waikapū citizens identified a pedestrian bridge or culvert as ways for residents to cross the highway, even with traffic lights. Many roadway and traffic mitigations measures were identified, but pedestrian and bicycle highway crossing was not addressed. Pedestrian travel across the highway should be discussed in more detail and mitigation measures proposed.

OEQC recommends expanding upon the discussion of long term impacts within the context of anticipated climate change. Lastly, please ensure thorough editing of the document and organizing the Agency Letters Section to enhance readability.

Thank you for the opportunity to comment on the Draft EIS. We look forward to a response that also will be included within the project's Final EIS. If you have questions about these comments, please contact our office at oeqchawaii@doh.hawaii.com or (808) 586-4185.

Sincerely,

Scott Glenn, Interim Director

Cc: Michael Summers, Planning Consultants Hawai'i, LLC

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Scott Glenn
Interim Director
State of Hawaii
Department of Health
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Mr. Glenn:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated March 24, 2016, regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following:

1. *Agricultural Land and Water Use.* The agricultural land that is being urbanized is within the Maui Island Plan's (MIP's) Small Town and Rural Growth Boundaries. These lands are needed to accommodate projected population growth through 2030 and are an integral part of the MIP's directed growth strategy.

   Potable water for the Project will be from on-site wells drawing water from the Waikapu Aquifer. The potable water demand for the Project, not including irrigation of urban open space, is estimated to be 968,000 gallons per day (gpd), whereas the Waikapu Aquifer has a sustainable yield of 3 million gpd. Before drawing water from the Aquifer, a permit will be required from the Commission on Water Resource

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

Management (CWRM) which has regulatory jurisdiction over the aquifer.

Irrigation of the Project's proposed urban and rural open spaces and irrigation of the Project's agricultural lands is proposed from the following sources:

- Surface water from the Iao Stream via the Iao-Waikapu Ditch and Waikapu Stream via the South Waikapu Ditch and Waihee Ditch. These water sources, which are part of the larger surface water system known as the "Na Wai Eha", have been designated by the CWRM as a Surface Water Management Area. Before drawing water from the Na Wai Eha, a surface water use permit will be required from the CWRM, which has regulatory jurisdiction over the aquifer.
- Agricultural wells that will pump non-potable water to be stored in agricultural reservoirs and used for irrigation. The use of the agricultural wells will require a ground water use permit from the CWRM since the water would be drawn from the Waikapu Aquifer, which has been designated by the CWRM as a Ground Water Management Area.
- Recycled wastewater from WCT's wastewater reclamation facility.

As is shown in Table 1, it is expected that should surface and groundwater permits be issued by the CWRM, sufficient non-potable irrigation water will be available to irrigate the agricultural lands as well as the urban and rural open space lands.

Table 1: WCT's Potential Non-Potable Water Supply Versus its Projected Demand for Non-Potable Irrigation

Non-Potable Water Source	Estimated Historical Supply in MGD	Estimated Future Supply in MGD	Estimated WCT Demand in MGD	Surplus / Deficit in MGD

Non-Potable Water Source	Estimated Historical Supply in MGD	Estimated Future Supply in MGD	Estimated WCT Demand in MGD	Surplus / Deficit in MGD
Ditch Water[1]	5.82[2]	5.82		
Pumped Well Water	N/A	Unknown		
Reclaimed Wastewater	N/A	.650		
TOTAL	5.82	6.47	3.42[3]	+3.05

Section 4.D.4 of the FEIS has been updated to address your comments.

2. The proposed urban and rural development will be bound by agricultural lands along the Project's southern and western boundaries. This is a common pattern of development in Hawaii. Historically, villages and small towns were established throughout Hawaii to support the pineapple, sugar and livestock industries. These agricultural land uses invariably came into close proximity of agricultural operations. In comparison to sugarcane, it is expected that air pollution emissions will be significantly reduced. Unlike sugarcane, there will be no burning of the sugarcane fields every two years, and there would be no large sugarcane haul trucks generating significant amounts of fugitive dust. Moreover, it is expected that much of the agricultural areas are expected to engage in and promote organic farming, which may reduce or prohibit pesticide use.

---

[1] WCT's future use of ground water from the Iao and Waikapu Streams will require the issuance of a Surface Water Use Permit from the Commission on Water Resources Management. These permit requests have been filed but not yet issued.

[2] Based upon a water duty of 5408 gallons per acre per day (GAD). In the Na Wai Eha IIFS proceedings, the Commission on Water Resources Management determined that this was a reasonable daily water use requirement for sugarcane cultivation.

[3] Assumes a demand for 2.75 mgd to irrigate 1077 acres of agricultural lands based upon a water duty of 3400 GAD for diversified agriculture. This is the application rate used by the State Department of Agriculture for diversified crops. The estimate assumes that 75 percent of the crop land is being irrigated at any given time (1077*.75)*3,400 ≈ 2.75 MGD. Urban open space demand for non-potable irrigation water is estimated to be about 0.67 mgd.

In addition, the bulk of the WCT's agricultural preserve is located to the south of the WCT's urban development. This allows for the predominant northeast trade winds to carry dust and any agricultural chemicals or pesticides away from the proposed development. However, during Kona or southwest winds, agricultural dust and chemical emissions could be carried over the Project's residential areas. The proposed elementary school is located approximately one-mile to the northeast of the agricultural fields. The closest residential and rural residences are located in close proximity to WCT's agricultural lands.

Airborne dust generated by agricultural activities can cause nuisance and health impacts to neighboring residences if not property mitigated through BMPs. Likewise, the improper application of pesticides may cause drift that could negatively impact environmental and human health. The Applicant will work closely with its farmers to develop appropriate BMPs to help mitigate airborne dust and chemical drift from potentially impacting neighboring land uses. BMPs that are often implemented by farmers to mitigate dust and pesticide drift include:

- Instituting a dust and chemical drift education and management program to ensure that farmers are properly trained in BMP's that can reduce airborne emissions from their activities.
- Establishing suitable buffer zones between agricultural lands where pesticides might be applied and sensitive environments that could be negatively impacted.
- Establishing windbreaks to capture windblown emissions and to slow the movement of wind.
- Conducting spraying and other nuisance related activities when winds are blowing away from sensitive environments and limiting spraying to periods of low wind speeds to reduce drift distance.
- Ensuring that nozzles used in the application of pesticides and/or herbicides produce the largest or coarsest size droplets possible.
- Encouraging the use of the lowest end of the pressure range when spraying pesticides.
- Following all pesticide application procedures as directed on the product labels.

- Using drift control additives, when needed, to increase the size of droplets in order to reduce drift.
- Limiting vehicle speeds on unpaved access roads within the agricultural area.
- Directing recreation uses, such as off-road biking, hiking and jogging, to the perimeter of agricultural areas where chemical drift would not be a concern.

The Applicant is committed to establishing an agricultural preserve that is farmed in a manner that reduces potential impacts to human health and sensitive environmental resources through the implementation of strong education and management programs focused upon implementing BMPs to reduce potential agricultural nuisances. Section V.A.7 of the FEIS has been updated to address your comments.

3. ***Development Mitigation Measures.*** The Applicant is implementing Low Impact Development initiatives in the areas of water conservation, energy use, stormwater management and recycling. The Applicant will also consider developing a composting facility within the development, which might significantly benefit the farmers operating within the Project's Agricultural Preserve. Sections III.B.6 and Sections V.C.6 and V.D.3, 4, and 5 have been updated to address your comments.

4. ***Infrastructure Improvements.*** The WCT site and urban design plan facilitates multi-modal transportation and it is anticipated that many residents will walk and bicycle throughout the development. The Honoapiilani Highway traverses through the center of the development. While the Highway facilitates vehicular ingress and egress into the project, the scale of this facility could create a barrier for pedestrians and bicyclists that desire to travel between the mauka and makai neighborhoods. Section III.B.3.e of the FEIS addresses pedestrian and bicycle crossings of the Honoapiilani Highway.

5. ***Anticipated Climate Change.*** As noted in the DEIS, the Project will not have a significant impact upon climatic conditions. However, in order

to contribute to a cleaner environment and to mitigate greenhouse gas emissions, the Applicant is committed to designing a community that relies less upon vehicular modes of transportation and incorporates energy efficient building design, materials and fixtures into the development. The Applicant also intends to develop on-site renewable energy to help off-set the Project's demand for fossil fuels, diversify Project revenues, and reduce electricity costs for WCT businesses and residents.

The Applicant understands that climatic change may produce unforeseen impacts, such as an increase in tropical storm intensity, rising temperatures, and greater fluctuations in rainfall, which could lead to more intense flooding and drought conditions. In response, all housing will be constructed in compliance with building codes and the County's flood hazard ordinance. Section IV.A.I of the FEIS has been updated to address your comments.

The FEIS will include all agency comment letters and Applicant responses within the Appendix. Changes to the written text of the FEIS will be properly identified. The document will be organized to enhance readability.

Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

21. State of Hawaii, Office of Hawaiian Affairs

PHONE (808) 594-1888

FAX (808) 594-1938

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
560 N. NIMITZ HWY., SUITE 200
HONOLULU, HAWAI'I 96817

HRD16-7503B

March 24, 2016

Michael J. Summers, President
Planning Consultants Hawai'i, LLC
2331 W. Main Street
Wailuku, HI 96793

Re: Request for Comments on the Draft Environmental Impact Statement for the District Boundary Amendment for the Waikapū Country Town
Waikapū Ahupua'a, Pū'ali Komohana Moku, Maui Mokupuni
Tax map key (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-004:003, (2) 3-6-004:006, (2) 3-6-005:007, and (2) 3-4-006:036

Aloha Mr. Summers:

The Office of Hawaiian Affairs (OHA) is responding to the open comment period for the draft environmental impact statement (DEIS) for the district boundary amendment (DBA) for the Waikapū Country Town (WCT). The applicant is Planning Consultants Hawai'i, LLC on behalf of Waikapū Properties, LLC (Applicant).

OHA did not receive any correspondence notifying us that the DEIS was available for review despite our past response to the environmental impact statement preparation notice for this project, by letter dated June 25, 2015. In the future, we ask to be notified that documents are available for review.

OHA is the constitutionally established body responsible for protecting and promoting the rights of Native Hawaiians. Hawai'i law mandates OHA to "[s]erve as the principal public agency in the State of Hawai'i responsible for the performance, development, and coordination of programs and activities relating to native Hawaiians and Hawaiians; . . . and [t]o assess the policies and practices of other agencies impacting on native Hawaiians and Hawaiians, and

conducting advocacy efforts for native Hawaiians and Hawaiians." Hawai'i Revised Statutes (HRS) § 10-3.

The following comments reflect OHA's responsibility to better the conditions of Native Hawaiians and are specifically intended to maximize the benefits to our beneficiaries.

Project Description

The WCT is a mixed-use residential community project on approximately 1,576 acres, of which 499 acres will encompass the WCT project and the remaining 1,077 will remain agricultural. The project site will include commercial space, an elementary school, park and open space areas, agricultural lands, and 1,433 residential units plus 146 'Ohana units. The residential units are divided among 970 single-family, 256 multi-family/town-home, 80 rural, and 127 country town mixed-use.

The project site is currently designated as an agricultural district by the State of Hawai'i Land use Commission (LUC), zoned by the Maui County as agricultural, and designated as a planned growth area in the Maui Island Plan. In order to comply with state and county laws, the applicant is requesting a district boundary amendment to the LUC.

Agricultural Lands

The Applicant is requesting a change in classification for 485 of the 499 acres that are in the State of Hawai'i agricultural district and Maui County agricultural zoning. The remaining 14 acres are designated urban. The entire 499-acre area is designated as a planned growth area in the Maui Island Plan, published in December 2012.

OHA previously commented on the EIS preparation notice by letter dated June 25, 2015, expressing concerns over the Applicant's request to reclassify 485 acres of agricultural lands as urban without proposing mitigation efforts. In reviewing the DEIS, the Applicant identified several mitigation efforts proposed for the loss of agricultural lands: (1) 800 acres of agricultural land will be permanently dedicated to agricultural use; (2) a reduction in the number of large agricultural farm lots to five from nine; (3) allowing current commercial farmer leaseholders to continue their activities on the agricultural lands; and (4) readjusting the development plans allowing the two Mahi 'Ohana kuleana parcels to be placed within the agricultural lands.

OHA appreciates these mitigation efforts, as all agriculturally designated lands play an important role in supporting the State of Hawai'i's food self-sufficiency goals, including the Aloha+ Challenge target of doubling local food production by 2030.

The project site is categorized as Agricultural Lands Important to the State of Hawai'i, and designated as having soil classifications of "A" or "B" by the University of Hawai'i Land Study Bureau. The WCT agricultural lands are of very high quality and an important resource to the State of Hawai'i. OHA remains concerned that urbanization of high quality agricultural lands reduces the state's ability to meet its own self-sufficiency goals, and may also run counter

OHA's strategic goals to increase sustainable land management practices. At the same time, OHA understands that 485 acres of the 1,576 overall agricultural acres are proposed to be reclassified as urban, and that approximately 1,077 acres will remain in agricultural use. The 1,077 are further split with 800 acres permanently dedicated to agricultural use with no residential structures permitted, and 277 acres subdivided into five large agricultural lots where farm dwellings will be permitted.

The agriculture-designated lands will be used by commercial farmers, and developed as a public and private agricultural park. Currently there are three commercial farms on the land, Kumu Farms, Hawai'i Taro, LLC, and Hawaiian Commercial & Sugar Company.[1] The companies will be relocated to the agricultural district within WCT, where they can continue their business.

Walking Community

OHA appreciates the Plan's emphasis on supporting non-automotive travel such as pedestrian and bike use within the community, and transit use for trips both within and outside the community.

One of OHA's strategic priorities is Mauli Ola (Health), which represents our commitment to improve the conditions of Native Hawaiians and quality of life by reducing the onset of chronic diseases. In furtherance of this priority, and in line with Act 155 (Reg. Sess. 2014) and HRS § 226-20, we particularly support a public health approach that takes a holistic and systemic view in addressing obesity in Hawai'i's communities, *e.g.*, through the social determinants of health. Community design, including complete streets designed for pedestrians, bicyclists, transit users, motorists, and persons of all ages and abilities, is one of the social determinants of health. Conversely, improper community design is well-documented as a major contributing factor to disproportionate chronic and co-morbid disease rates of a community's residents.

OHA notes that HRS §226-20 requires all state agencies to strive for the elimination of the health disparities of Native Hawaiians and other communities, by identifying and addressing social determinants of health. This includes prioritizing interventions, such as walkable communities, that address the social determinants of health.

Affordable Housing

OHA appreciates that WCT will include workforce affordable homes in the project. We understand the need for affordable housing, as one of OHA's strategic priorities focuses on improving Native Hawaiians' economic self-sufficiency, centering its efforts on two critical goals: increasing homeownership and increasing family income in Native Hawaiians.

---

[1] Alexander & Baldwin announced in January 2016 that Hawaiian Commercial & Sugar Company (HC&S) will be transitioning into a new model over a multi-year period. The DEIS was completed prior to this announcement, therefore it is not clear whether HC&S will continue their presence in WTC.

Water

The DEIS states that five ground water wells have been drilled by the Applicant. Three wells will be used for potable water, while the remaining two are for non-potable water to service the agricultural parcels. It is not clear from the information provided how these wells will affect the Waikapū aquifer and surface water stream flows. Concerns were expressed by community members during the cultural impact assessment (CIA) as to the effect upon Waikapū aquifer and stream as more nearing developments continue to use the two water resources.

OHA asks that Applicant adhere to the guidelines set forth by the State Commission on Water Resource Management, and that any effect on Waikapū Stream not affect the flow and habitat enhancing characteristic in accordance with the Nā Wai ʻĒha settlement agreement.[2]

Archaeological and Historical Resources

An archaeological inventory survey (AIS) of the proposed project site was completed by Archaeological Services Hawaiʻi, LLC in September 2013. The land survey consisted of a pedestrian survey and subsurface exploration through 150 backhoe trenches. No cultural remains were found through the subsurface testing, but the pedestrian survey found four historic sites,[3] significant under Criterion D.

OHA does request assurances that should iwi kūpuna or Native Hawaiian cultural deposits be identified during any ground altering activities, all work in the area will immediately cease and the appropriate agencies, including OHA, will be contacted pursuant to applicable law.

Mahi Kuleana Parcels

The CIA was prepared by Hana Pono, LLC in January 2014. During interviews with community members, two kuleana parcels were identified. The parcels are situated within tax map key (TMK) (2) 3-6-004:003, and each lot is identified as TMK (2) 3-6-005:009 and (2) 3-6-005:010. Applicant has modified their development plan to go around the two parcels and assure that they are situated within the agricultural designated lands. OHA appreciates and encourages future collaboration between the Mahi ʻOhana and Applicant to assure the protection of the kuleana parcels.

---

[2] On June 25, 2004, Hui O Nā Wai ʻĒha (Hui) and Maui Tomorrow Foundation, Inc. (MTF) filed a Petition to Amend the Interim Instream Flow Standards (IIFS) for the Waiheʻe River and the Waiehu, ʻĪao, and Waikapū Streams. The State of Hawaiʻi Commission on Water Resource Management (CWRM) released its final Findings of Fact, Conclusions of Law, and Decision and Order on June 10, 2010. OHA joined the Hui and MTF in appealing the CWRM decision in 2010. In August 2012, the Hawaiʻi Supreme Court vacated the CWRM decision and remanded the case to CWRM for further proceedings. A settlement agreement between the parties was finalized on April 17, 2014.

[3] State Inventory of Historic Places Site 5197 Waiheʻe Ditch; Site 7881 concrete lined ditches, sluice gates, and culverts; Site 7882 L-shaped retaining wall; Site 7883 World War II bunker; and Site 7884 trash pit.

Mahalo for the opportunity to comment. Should you have any questions, please contact Jeannin Jeremiah at 594-1790 or by email at jeanninj@oha.org.

'O wau iho nō me ka 'oia 'i'o,

Kamana'opono M. Crabbe, Ph.D.
Ka Pouhana, Chief Executive Officer

KC:jj

C: Carmen Hulu Lindsey – OHA Trustee, Maui Island
Thelma Shimaoka - OHA Community Outreach Coordinator, Maui Island

**Please address replies and similar, future correspondence to our agency:*
Dr. Kamana'opono Crabbe
Attn: OHA Compliance Enforcement
560 N. Nimitz Hwy, Ste. 200
Honolulu, HI 96817

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Kamana`opono M. Crabbe, Ph.D.
Ka Pouhana, Chief Executive Officer
State of Hawaii
Office of Hawaiian Affairs
560 N. Nimitz Hwy., Suite 200
Honolulu, Hawaii 96817

Dear Mr. Crabbe:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated March 24, 2016, regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. We understands that you did not receive correspondence notifying your office that the DEIS was available for review. Please note that our records indicate that the document was mailed to 711 Kapiolani Blvd., Ste. 500, which we understand is a dated address. We are sorry for any inconvenience this may have caused, and are pleased that you were able to review the DEIS and provide comments is a very timely manner. In response to your comments, please find the following responses:

- *Agricultural Lands.* The Applicant understands your office's sensitivity to the protection of productive agricultural lands and acknowledges your appreciation of the mitigation measures proposed by the Applicant. We are confident that by deeding these highly productive and strategically located lands for long-term agricultural production, providing access to reliable irrigation water, and facilitating the on-going activities of the WCT's

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

experienced professional farmers that the WCT will contribute to the State's self-sufficiency goals and OHA's strategic goals to increase sustainable land management practices.

- ***Walking Community***. Developing a multi-modal community is an important design objective for the Applicant. The Applicant appreciates your acknowledgement that community design is one of the social determinants of health, while poor community design contributes to poor community health.

- ***Water***. It is anticipated that the Project will be serviced by at least three (3) potable wells and non-potable irrigation wells. The irrigation wells will be used for agricultural uses and to irrigate the Project's open spaces and park lands. Other sources of non-potable irrigation water will include reclaimed R-1 and R-2 quality water from the Project's wastewater treatment facility. The Applicant is also in the process of requesting an allocation of surface water from the Iao Stream via the Iao-Waikapu Ditch and Waikapu Stream via the South Waikapu Ditch and Waihee Ditch. The use of this ground water will require the issuance of a permit from the CWRM before the surface water can be used for non-potable irrigation. Likewise, before water can be drawn from the Waikapu Aquifer and used for the WCT's urban development, permits must be issued by the CWRM since the aquifer is within a Special Ground Water Management Area.

  The Applicant will work with the CWRM to ensure that the Applicant's use of the Waikapu Aquifer and the Iao and Waikapu streams is in accordance with State water policy and regulatory requirements. The WCT is also working closely with neighboring Kuleana farmers, and with State agencies including the CWRM, to ensure that riparian rights are adequately addressed and that the aquatic habitat of the Waikapu Stream is protected from overuse. Section V.D.4 has of the FEIS has been updated to address your comments.

- ***Archaeological and Historical Resources.*** The Applicant understands that should iwi kūpuna or Native Hawaiian cultural

deposits be identified during any ground altering activities, all work in the area will immediately cease and the appropriate agencies, including OHA, will be contacted pursuant to State law.

- ***Mahi Kuleana Parcels.*** As documented in the DEIS and in the Cultural Impact Assessment (CIA), the Mahi kuleana parcels are located outside of the area proposed for urban and rural development. These parcels will remain within the State Agricultural District. The Applicant intends to engage in future collaboration with the Mahi 'Ohana to assure protection of the Kuleana parcels.

Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

22. State of Hawaii, Department of Business Economic Development and Tourism, Office of Planning

OFFICE OF PLANNING
STATE OF HAWAII

DAVID Y. IGE
GOVERNOR

LEO R. ASUNCION
DIRECTOR
OFFICE OF PLANNING

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: http://planning.hawaii.gov/

Ref. No. P-15087

March 28, 2016

Mr. Michael J. Summers, President
Planning Consultants Hawaii LLC
2331 W. Main Street
Wailuku, Hawaii 96793

Dear Mr. Summers:

Subject: Draft Environmental Impact Statement, Waikapu Country Town
LUC Docket No. A15-798, Waikapu Properties, LLC et al
TMK: (2) 3-6-002:001, 003; (2) 3-6-004:003, 006;
(2) 3-6-005:007, and (2) 3-6-006:036
Wailuku, Maui, Hawaii

Thank you for the opportunity to review the subject Draft Environmental Impact Statement (EIS) for Waikapu Country Town.

The project area encompasses approximately 1,576 acres, of which approximately 485 acres would be reclassified from the State Agricultural District to the State Urban and Rural Districts for a mixed-use residential community. Approximately 1,077 acres of the project area would remain in the State Agricultural District, and of those lands, approximately 800 acres would be permanently protected through a conservation easement, as an Agricultural Preserve. The remaining 14 acres of the project are already classified as State Urban and are utilized by the Maui Tropical Plantation. The Urban and Rural components of the project will include 1,433 residential units, in addition to 146 ohana units, neighborhood retail, commercial, an elementary school, parks, and open space.

The Office of Planning (OP) offers the following comments on the subject Draft EIS.

1. **Proposed District Reclassification Boundaries.** The description of the project in Chapter I does not clearly identify which lands are proposed for reclassification to the State Urban District and which lands are proposed for reclassification to the State Rural District. Please clarify in text and graphics the proposed district reclassification boundaries in the Final EIS.

2. **Housing.** We understand that the project will comply with the County's workforce housing ordinance, which is enumerated in Chapter 2.96, MCC. We also note that

Hawaii Administrative Rules, § 15-15-50 (c)(8) provides that a petition for district boundary amendment shall include a "statement of projected number of lots, lot size, number of units, densities, selling, price, intended market, and development timetables." Accordingly in the Final EA, please describe how the proposed project will comply with the ordinance and LUC rules, particularly how the project's proposed residential product types will be allocated among the market and various affordable housing target populations (income groups), the number of each housing type, the expected price ranges for the different product types, and the assumed household sizes of the housing types.

3. **Water Resources.** It is unclear whether there is sufficient potable and non-potable water available to meet the projected average daily water demand for Phases I and II. Please clarify in the Final EA relative to applicable water sources, surface water and aquifer sustainable yields and current withdrawals. Please also state whether the proposed project is within a designated Water Management Area; the permits or other approvals required for proposed water source use; and the consistency of the project and impact of the project in terms of proposed water use and system improvements and priorities contained in the county water use and development plan, prepared pursuant to the State Water Code, HRS Chapter 174C.

4. **Agricultural Lands.**
   - We understand that the specific details of the agricultural conservation easement are still being considered, however, we expect that the Final EA or district boundary amendment petition submittal will include a discussion of how the easement will be implemented and managed.
   - Page III-34 of the Draft EA states that the conservation easement will only allow agricultural subdivisions which serve the purpose of creating agricultural enterprises. In order to prevent the occurrence of non-agricultural uses within the proposed Agricultural Preserve, please provide a definition of "agricultural enterprises" in the Final EIS.
   - The Conceptual Agricultural Master Plan on page III-37 indicates that renewable energy facilities (or solar farms, according to page III-36) may be located within the Agricultural Preserve. OP notes that the proposed location of the solar farms appears to be on soils rated "A" and "B" by the Land Study Bureau Detailed Land Classification system. We further note that solar energy facilities are allowed on "B" rated lands with conditions and restrictions, and are allowed under very narrowly-defined circumstances on "A" rated agricultural lands. Please discuss the applicable restrictions on solar energy facilities in the Agricultural District and required permitting and/or consider modifying the Agricultural Master Plan accordingly.
   - Additionally, we encourage the Petitioner to require in the conservation easement agreement that the proposed solar farms be accessory to agricultural activities.

5. **Wastewater Treatment and Disposal.** Page V-92 states that the [Petitioner] will need to construct a stand-alone private wastewater treatment facility, or partner with other projects in the Waikapu area, such as A&B's Waiale project or the County of Maui to construct a regional wastewater treatment facility. The Draft EA further states that the [Petitioner] is analyzing several package wastewater treatment options. If this becomes known before preparation of the Final EA, please provide information about the wastewater system selected, specifically the type of plant to be used, permitting requirements, plans for reuse and/or disposal of treated effluent and waste solids, and how the private system will be operated and maintained.

6. **Schools.**
   - In a letter from the Department of Education (DOE) dated June 5, 2015, the DOE states that [the Petitioner] is strongly encouraged to meet with the DOE, Facilities Development Branch to negotiate and execute an Educational Contribution Agreement (ECA) before county entitlements are sought. The Draft EA, however, does not include mention of an ECA with the DOE. In the Final EA, please include a discussion regarding the status of the ECA with the DOE.
   - The table on page V-62 indicates that the Petitioner will pay to the DOE approximately $2,600,000 in impact fees for construction costs. This value, however, is based only on the development of the single family and multi-family units, totaling 1,433 units, and does not include the 146 ohana units proposed.
   - The Maui Island Plan states that the [Waikapu Country Town] planned growth area...will have a mix of single-family and multifamily rural residences, park land, open space, commercial uses, and an elementary or intermediate school developed in coordination with the Waiale project (page 8-9). In the Final EA, please describe how the Petitioner is coordinating the development of the proposed elementary school with the Waiale project.
   - We recommend that school facilities be added to the unresolved issues list in Chapter I.

7. **Waiale Bypass Road.** Pursuant to page VI-13 of the Draft EA, the Waiale Bypass Road is identified in the County's FY2016 CIP for funding between 2017 and 2021, but the precise schedule for funding and development of this roadway is uncertain at this time. Pursuant to page 4 of the TIAR, primary access to the proposed development would be provided via Honoapiilani Highway and the Waiale Bypass Road. Given the significance of the bypass road for efficient circulation in the area, the Final EA should identify when the bypass road will be completed to ensure that mitigation coincides with the development of the proposed project.

8. **Other Comments:**
    - A map showing the proposed State Land Use District Boundary Amendments and acreage reclassifications should be provided in the Final EIS.
    - All maps should include a legible scale, a north arrow, and a legend. Maps should also be in color whenever possible. The Land Study Bureau Map on page V-39, in particular, should be in color in order to accurately determine soil ratings within the project area.
    - The Table of Contents indicates that the ALISH Map is included as Figure 37 on page V-40, however there is no ALISH Map in the Draft EA; it appears that the Land Study Bureau Map was accidentally added in its place. Please reconcile this in the Final EIS.
    - The digital version of the Final EIS document should be PDF-bookmarked in its entirety. All chapters, subchapters, appendices and comment letters should be bookmarked for easier access.

The responsiveness of the project and proposed petition to concerns identified in the environmental review process will influence OP's evaluation of the acceptability of the Final EIS and development of the State's position on the proposed petition.

Thank you for the opportunity to review this project. If you have any questions please call Katie Mineo of our Land Use Division at (808) 587-2883.

Sincerely,

Leo R. Asuncion
Director

c: Land Use Commission

PLANNING
CONSULTANTS
HAWAII, LLC

URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Leo R. Asuncion
Director
Office of Planning
State of Hawaii
Department of Business Economic Development
and Tourism
P.O. Box 2359, Honolulu, HI 96804

Dear Mr. Asuncion:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated March 28, 2016, regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following:

1. ***Project District Reclassification Boundaries.*** Section I.C.9 of the FEIS has been incorporated into the report to include a clear description in text and exhibits of the lands proposed for reclassification to the State Urban and Rural Districts.

2. ***Housing.*** Sections III.B.1, 7 and V.B.2 of the FEIS document the Project's compliance with MCC, Chapter 2.96, "Residential Workforce Housing Policy" and Hawaii Administrative Rules § 15-15-50 (C) (8), which requires that a District Boundary Amendment Application document the number of lots, lot size, number of units, densities, selling price, intended market and development timetables.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

3. ***Water Resources.*** Potable water for the Project will be from on-site wells drawing water from the Waikapu Aquifer. The potable water demand for the Project, not including irrigation of urban open space, is estimated to be 968,000 gallons per day, whereas the Waikapu Aquifer has a sustainable yield of 3 million gallons per day. The Waikapu Aquifer has been designated by the Commission on Water Resource Management as a Ground Water Management Area. Before drawing water from the Aquifer, a ground water use permit will be required from the Commission on Water Resource Management (CWRM), which has regulatory jurisdiction over the aquifer.

   Irrigation of the Project's proposed urban and rural open spaces and irrigation of the Project's agricultural lands is proposed from the following sources:

   - Surface water from the Iao Stream via the Iao-Waikapu Ditch and Waikapu Stream via the South Waikapu Ditch and Wäihee Ditch. These water sources, which are part of the larger surface water system known as the "Na Wai Eha", have been designated by the CWRM as a Surface Water Management Area. Before drawing water from the Na Wai Eha, a surface water use permit will be required from the CWRM, which has regulatory jurisdiction over the Na Wai Eha.

   - Agricultural wells that will pump non-potable water to be stored in agricultural reservoirs and used for irrigation. The use of the agricultural wells will require a ground water use permit from the CWRM since the water would be drawn from the Waikapu Aquifer, which has been designated by the CWRM as a Ground Water Management Area.

   - Recycled wastewater from WCT's wastewater reclamation facility.

As is shown in Table 1, it is expected that should surface and groundwater permits be issued by the CWRM, sufficient non-potable irrigation water supply will be available to irrigate the Project's urban and rural open spaces as well as the Project's 1,077 acres of agricultural lands.

Table 1: WCT's Potential Non-Potable Water Supply Versus Its Projected Non-Potable Irrigation Demand

Non-Potable Water Source	Estimated Historical Supply in MGD	Estimated Future Supply in MGD	Estimated WCT Non-Potable Demand in MGD	Surplus / Deficit in MGD
Ditch Water[1]	5.82[2]	5.82		
Pumped Well Water	N/A	Unknown		
Reclaimed Wastewater	N/A	.650		
TOTAL	5.82	6.47	3.42[3]	+3.05

Section V.D.4 of the FEIS has been updated to address your comments.

4. *Agricultural Lands.* As noted in the DEIS, the WCT's agricultural lands will comprise approximately 1,077 acres. Eight hundred of these acres will be set aside to create an Agricultural Preserve. The Agricultural Preserve will be dedicated in perpetuity to

[1] WCT's future use of ground water from the Iao and Waikapu Streams will require the issuance of a Surface Water Use Permit from the Commission on Water Resources Management. These permit requests have been filed but not yet issued.

[2] Based upon a water duty of 5408 gallons per acre per day (GAD). In the Na Wai Eha IIFS proceedings, the Commission on Water Resources Management determined that this was a reasonable daily water use requirement for sugarcane cultivation.

[3] Assumes a demand for 2.75 mgd to irrigate 1077 acres of agricultural lands based upon a water duty of 3400 GAD for diversified agriculture. This is the application rate used by the State Department of Agriculture for diversified crops. The estimate assumes that 75 percent of the crop land is being irrigated at any given time (1077*.75)*3,400 ≈ 2.75 MGD. Urban open space demand for non-potable irrigation water is estimated to be about 0.67 mgd.

agricultural conservation once all of the entitlements for the WCT's proposed urban and rural lands are granted in accordance with the WCT Master Plan development as described in Section III.B of the FEIS.

The agricultural conservation easement will prohibit the development of farm dwellings and/or residential dwellings of any kind, including farm labor dwellings, within the Preserve. However, it is planned that any other agricultural use, agricultural accessory uses or special uses as permitted by Hawaii Revised Statutes (HRS), Chapter 205 and Maui County Code (MCC), Chapter 19.30A will be permitted within the Agricultural Preserve. The underlying State Land Use Designation and County Zoning of the property will not be changed by the conservation easement, except that dwellings units will be prohibited.

Once established, the Agricultural Preserve will be managed by the existing ownership entities; or it will be managed by a separate entity with the specific responsibility for the management and operations of the Preserve. Agricultural enterprises would be any business or non-profit entity engaged in any permitted agricultural and/or special use approved pursuant to HRS, Chapter 205 and/or Maui County Code Chapter 19.30A, except that "farm dwellings", as defined in HRS Chapter 205, or any other type of residential dwellings including "farm labor dwellings", would not be permitted within the Agricultural Preserve.

The Applicant is aware that HRS Chapter 205 contains conditions and restrictions on the use of solar energy facilities within the State Agricultural District. The Applicant acknowledges that the Agricultural Preserve, as well as the WCT's other agricultural lands, will be subject to these restrictions. As such, any development of solar energy facilities will be done in accordance with these restrictions. As is documented in the DEIS, the Applicant desires to offset some of the Project's energy demand by developing on-site renewables. Developing a limited amount of on-site renewable energy within the Agricultural Preserve, as well as on the Project's other agricultural lands, will help to protect the

environment by mitigating carbon emissions and will contribute to Hawaii's energy self-sufficiency. On-site renewables will also create an additional revenue source that can be derived from the use of the Project's agricultural lands. It is important to note that a considerable amount of the Applicant's agricultural land is designated "A" by the Land Study Bureau and that these lands will not be impacted solar facilities. Any solar facilities developed would be limited to "B" lands and the acreages developed will likely be significantly less that what would be permitted pursuant to HRS Chapter 205. Sections III.B.5 and I.A.7 of the FEIS have been updated to address your comments.

- ***Private Wastewater Treatment Plant.*** Section V.D.5 of the FEIS has been updated to include a thorough description of the WCT's preferred wastewater treatment plant design, alternatives considered, permitting requirements, wastewater reuse, facility management and operations.

- ***Schools.*** The Applicant is in the process of finalizing an Educational Contribution Agreement (ECA) with the Department of Education. The Agreement will document the cash and land contribution required of the Applicant. During pre-consultation meetings with the DOE, the Applicant was informed by the DOE's Facilities Development Branch that an elementary school would be developed on the property and that an intermediate school will be developed within Waiale. Since the precise timing of the facility is beyond the Applicant's control, and the ECA has not yet been finalized, the school facility will be added to the unresolved issues list in Section I.8 of the FEIS.

- ***Waiale Bypass Road.*** The Traffic Impact Analysis Report (TIAR) presented in the DEIS had assumed that the Waiale Bypass road would be constructed by 2022. This was a reasonable assumption because the bypass roadway was identified in the County's FY 2016 5-year Capital Improvement Program, the County's Department of Public Works had prepared a Final Environmental Assessment for the Bypass that it completed in July 2014, and during pre-consultation meetings with County and State agencies it was

generally acknowledged that the bypass roadway would be constructed.

However, the Waiale Bypass improvement was recently removed from the County's FY 2017 5-year Capital Improvement Program. Moreover, in response to the DEIS, the County's Department of Public Works informed the Applicant that the timing of the roadway was uncertain. As such, the Applicant has conducted a separate analysis that addresses the impact of the Project at full build-out without the Waiale Bypass road. This analysis has been incorporated into Section V.D.1 of the FEIS.

The WCT's FEIS can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

23. Mr. Richard “Dick” Mayer

TO: Applicant: Mr. Michael Atherton (209) 601-4187 coachpea20@sbcglobal.net
Waikapu Properties, LLC,
1670 Honoapiʻilani Highway Wailuku, HI 96793,
Consultant: Mr. Michael Summers (808) 269-6220 msummers@planningconsultantshawaii.com
Planning Consultants Hawaii, LLC,
2331 W. Main Street Wailuku, HI 96793,
Approving Agency: Mr. Daniel Orodenker (808) 587-3822
State of Hawaiʻi, Land Use Commission,
Department of Business, Economic Development and Tourism,
P.O. Box 2359, Honolulu, HI 96804-2359

From: Richard "Dick" Mayer dickmayer@earthlink.net
1111 Lower Kimo Dr.
Kula, Maui HI 96790

March 28, 2016

RE: **Waikapū Country Town Draft-EIS**

Initial Comment: After analyzing over 100 Draft-EIS documents over 40 years, I can honestly say that this may be the best, most comprehensive, and honest Draft-EIS that I have read. However, a significant assumption has been made and I do not believe it is accurate. It relates to **the expected population** of the completed Waikapu Country Town project.

There are numerous places in the Draft-EIS which use a total population figure of 3,511. However, I could find only one location in the entire three volume Draft-EIS where a potential population number is attempted to be calculated. It is based on the number of residential units that are being proposed. It is found in Volume 3, Appendix A, on PDF page 74. (See attachment on Page 3.)

The entire 3 volume Draft EIS relies on this number, calculated on PDF page 74. However, I believe that there is a significant error in the population calculations. Consequently, the whole Draft-EIS and all of the appendices (the entire document) are potentially in error!

Many of the potential impacts and all the infrastructure is dependent on the population calculations from Appendix A. For example, this population number is incorrectly used to calculate the number of students that will be going to school (school impacts). Also in potential error is the traffic TIAR report, the amount of solid waste, wastewater, water needs, etc. All of these are affected if the population figures that were calculated in Appendix A are incorrect.

How are they in error?

1. The number of potential ohana units is severely underestimated at a level of 146 units in a community of 1,050 single family residences. It can reasonably be expected that there may be as many as 400 to 500 ohana units, significantly increasing impacts. A drive around Kahului or Maui Lani at 7pm will show the fact that there are on average many more than 2 cars parked in front of most homes.

2. Appendix A states clearly that even this low number of 146 ohana units has NOT at all been utilized in calculating the expected population, -- those units are totally ignored.

3. There is a reference made (Volume 3, Appendix A, on bottom of PDF page 12) to the potential addition of 300 affordable houses being added to the project as a 201-H project. Although requirements for a 201-H project may be minimal, those three hundred (300) additional "affordable" homes, presumably with many children, will certainly have a significant impact on school enrollments. Furthermore, the 300 homes will certainly add traffic to each of the intersections and that has NOT been accounted for in the traffic TIAR study.

4. The multipliers for the number of residents in each unit are buried in the footnotes on the table on page PDF 74. Full-timers = 2.6 Part-timers = 3.2
The numbers seem reversed when it states that the full-timers will have a lower number of residents, by comparison to the part-timers. If the number of people in each unit is applied correctly we will see a significantly higher total number in the population totals; and it is that number that should have been used throughout the Draft-EIS.

The cumulative population impact of the above 4 items can be seen here:

	In the Draft-EIS	More Accurate
"Under-represented" ohana units ~300 units @ 3.0	0	900
Intentionally not included 146 ohana units @ 3.0 people/unit	0	438
300 potential 201-H "affordable houses" @ 3.2	0	960
SF + MF "Full-Timers" @ 2.6 (In the Draft-EIS)	3,363	--
SF + MF "Full-Timers" @ 3.2 (Corrected)	--	4,138
SF + MF "Part-Timers" @ 3.2 (In the Draft-EIS)	148	--
SF + MF "Part-Timers" @ 2.6 (Corrected)	--	83
TOTAL ➔	**3,511**	**6,519**
	In the Draft-EIS	More Accurate

Hopefully, the Final-EIS will use accurate population numbers throughout and in all the Appendices.

WAIKAPU COUNTRY TOWN DRAFT-EIS Appendix A PDF page 74

http://oeqc.doh.hawaii.gov/Shared%20Documents/EA_and_EIS_Online_Library/Maui/2010s/2016-02-08-MA-5E-DEIS-Waikapu-Country-Town-Appendices.pdf

TABLE III-4 Exhibit III

ESTIMATED RESIDENT POPULATION, HOUSEHOLD INCOME AND DISCRETIONARY EXPENDITURES
Market Study of the Waikapu Country Town
Waikapu, Maui, Hawaii
All Amounts Expressed in Constant 2015 Dollars

	Development, Sales & Stabilization Period			
	2016 to 2020	2021 to 2025	2026 to 2030	Totals
Number of Units Occupied	**690**	**1,284**	**1,433**	
Single Family Homes	**347**	**901**	**1,050**	
Percent of Total Units	50%	70%	73%	
Multifamily Units	**343**	**383**	**383**	
Percent of Total Units	50%	30%	27%	
Single Family Homes Population - Full-Time Residents (1)	767	1,992	2,321	
Single Family Homes Population - Part-Time Residents (2)	34	88	102	
Multifamily Homes Population - Full-Time Residents (1)	933	1,042	1,042	
Multiamily Homes Population - Part-Time Residents (2)	41	46	46	
Total Full-Time Resident Population	**1,700**	**3,034**	**3,362**	
Total Part-Time Resident Population	**75**	**134**	**148**	
Total De Facto Population	**1,775**	**3,168**	**3,511**	
RESIDENT HOUSEHOLD INCOME (4)				**During Build-Out**
Annually	**$66,133,060**	**$131,257,527**	**$147,857,819**	
Periodic	**$99,199,590**	**$493,476,468**	**$697,788,364**	**$1,290,464,422**
TOTAL DE FACTO POPULATION EXPENDITURES (5)				
Annually (at end of period)	**$35,256,311**	**$69,537,081**	**$78,260,291**	
Periodic	**$52,884,467**	**$261,983,481**	**$369,493,432**	**$684,361,379**

(1) Average household size of 2.60 persons.
(2) Average household size of 3.2 persons.
(4) Single Family households at 175% of Maui household income average, multifamily households at 125% of Maui average.
(5) For full-time residents assumes 15% of gross income for taxes, 30% for housing costs and 5% for utilities. Leaving 50% of gross income as net disposable.
For non-full time residents estimated disposable income at $80 per day (50% above average daily per resident spending of $53).

Source: The Hallstrom Group/CBRE

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Richard "Dick" Mayer
1111 Lower Kimo Drive
Kula, Maui HI 96790

Dear Mr. Mayer:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated March 28, 2016, regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following responses:

1. ***Initial Comment.*** Please note that Planning Consultants Hawaii (PCH) sincerely appreciates your positive compliments regarding the quality of the DEIS. We are very much aware of your professional expertise, hard work and dedication over the years to perpetuating *Maui No Ka Oi* and your compliments are taken with much gratitude.

2. ***WCT Population Impact.*** As discussed in the DEIS, a Market Study and Economic and Fiscal Impact Assessment report was prepared by the Hallstrom Appraisal Group | CBRE, Inc. in July 2015. The July 2015 study projected that with the buildout of 1,433 units (1,050 single-family units and 383 multi-family units) the de facto population of the Project would be approximately 3,511 persons[1], comprised of 3,362 full-time residents and 148 part-time residents and second home buyers. This projection was based on a population multiplier of 3.2 persons per single-family unit and 2.6 persons per multi-family unit.

[1] Assumes 85% of single- and multi-family units are occupied by residents. Assumes that 15% of the units are owned by part-time residents, whom occupy their units 25% of the time.

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

The DEIS noted that the increase in the Project's resident population would represent approximately 8.40% to 15.40% of the region's projected resident population growth to 2035.

However, in response to your comments the Hallstrom Appraisal Group | CBRE, Inc. revisited their model and did find an error in the calculation. This error was caused by reversing the multipliers for the single- and multi-family units. After adjusting for the error it was determined that the Project's de facto population (without Ohana units) would be 3,866 persons[2], which is an increase of 355 persons over the earlier calculation. Moreover, the Applicant and Applicant's market consultant concur that the persons occupying the Project's Ohana units should also be included in the Project's population estimate. If we assume that the Ohana units are occupied exclusively by residents and that the population per unit is 1.5 persons, then the Ohana units would increase the project population by an additional 219 persons. Thus, the revised defacto population, including the 146 Ohana units, would be 4,085 persons and the revised resident population would be 3,922 persons. Using the revised population projection, the WCT's resident population impact represents approximately 19.93% to 18.51% of the region's projected resident population growth to 2035. Section V.B.1, and related sections of the FEIS, have been updated to address your comments.

3. ***Number of Ohana Units***. The anticipated average residential lot size within the WCT is about 5,586 square feet. Within the project, there will likely be lots as small as 3,500 square feet and lots as large as 10,000 square feet with a net residential density of about 7.4 units per acre for the single-family residential lots. The rural lots are between .5 acres and 2-acres or more. Maui County Code (MCC) §19.35.020 requires a minimum lot size of 7,500 square feet to accommodate an Ohana unit.

   For planning purposes, it was assumed that about 14 percent of the 1,050 single-family and rural lots would have Ohana units. It is

[2] Assumes 85% of single- and multi-family units are occupied by residents and the remaining 15% are occupied by part-time residents. It is assumed that part-time residents occupy their units 25% of the time. The population multiplier per single-family unit is 3.2 persons per unit and for multi-family units it is 2.6 persons per unit. It is assumed that all Ohana units are occupied by residents at 1.5 persons per unit. As such the calculation was made as follows: [(1050 * .85)*3.2] + [(1050 * (.15)*(3.2)*(.25)] + [383*.85)*2.6] + [(383*(.15)*(2.6) *(.25)] + (146*1.5)

possible that the Ohana units could be developed concurrently with the primary residence or at some undetermined future date by individual property owners. Through the Project District Ordinance the number of Ohana units can be regulated by lot size, through a restriction to the permitted uses, by special use provisions, or by a quota. However, it should be noted that Ohana units offer an important source of affordable housing on Maui, especially for seniors and young adults. Moreover, many of the infrastructure and public facility impacts associated with the development of Ohana units can be mitigated at the time of building permit application. Prior to the issuance of building permits impacts to water, wastewater, schools and parks can be mitigated through impact fees, or if warranted, by denial of the building permit due to insufficient infrastructure or public facilities. This is the current policy of the County with respect to the issuance of water meters on many entitled lots within Central, South and Upcountry Maui. In any event, the impacts associated with the development of the 146 Ohana units were mostly documented in the DEIS, and where they were not documented, they have been documented in Chapter V of the FEIS.

4. ***Population Impacts upon Infrastructure and Public Facilities.*** As documented in the DEIS, the population created by the project will increase demand for infrastructure and public facility systems. The following summarizes the infrastructure and public facility impacts described in the DEIS that may need to be revised in response to the increase in the Project's estimated population:

   - *Traffic.* The Traffic Impact Assessment Report (TIAR) utilizes vehicle trip rates presented in *Trip Generation 9th Edition* (Institute of Transportation Engineers, 2012) to estimate the number of trips to and from the proposed project. The vehicle trip rates were applied to the 146 Ohana units as well as to all other land uses within the development. As such, the TIAR will not need to be revised as a result of the increase in the Project's population.

   - *Water.* The Preliminary Engineering Report includes an assessment of the Project's projected potable and water demand. The assessment relies upon the Department of Water Supply's Water System Standards (DWSWSS), dated 2002, in order to

calculate the Project's water demand.[3] The DEIS's potable water calculation accounted for the entire development, including the proposed 146 Ohana units. As such, the Project's water use assessment will not need to be revised as a result of the increase in the Project's population.

- ***Wastewater.*** The Preliminary Engineering Report includes an assessment of the Project's projected wastewater generation. The wastewater generation rates are based upon the unit type, unit number, land use, etc. The projected wastewater generation described in the DEIS included the entire WCT development, including the 146 Ohana units. As such, the Project's wastewater generation assessment will not need to be revised as a result of the increase in the Project's population.

- ***Parks.*** The DEIS includes a description of the WCT's impact upon parks and recreation facilities. A project's impact to park and recreation facilities is often documented by the ratio of population to available park space. As such, this section of the FEIS has been revised to document the impacts associated with the increase in the Project's population. Moreover, the DEIS did not document the additional park dedication that will be required by the County for the development of the Ohana units. As such, the FEIS has documented the additional park dedication that will be required of the Project as a result of the 146 Ohana units. Section V.C.1 of the FEIS has been revised to address your comments.

- ***Schools.*** The Department of Education (DOE) determines its school impacts based upon a ratio of the number and type of school aged children by residential unit type. As such, this projection will not be impacted by the increase in the Project's population. However, with respect to the 146 Ohana units, the DOE has not yet determined whether impact fees will be required of these units. This will be confirmed upon finalizing the Educational Contribution Agreement (ECA), which is in the

[3] Based upon pre-consultation between the Department of Water Supply and the Project's civil engineer, it was determined that the DWSWSS standards could be conservatively reduced by one-third if the proposed dual water system was used for the project.

process of being consummated between the Developer and the DOE.

- ***Police, Fire, Medical Facilities and Solid Waste.*** The DEIS includes a description of the WCT's impact upon police, fire, medical facilities and solid waste. A project's impacts to these facilities are often described by the ratio of population to available facilities. As such, this section of the FEIS has been revised to document the impacts associated with the additional population created by the development. Sections V.C.2, 3, 4 and 5 of the FEIS has been revised to address your comments.

5. ***201H Affordable Housing Project.*** Please note that adding additional units in the form of a 201H project is not being contemplated at this time. The reference to the potential addition of a 300-unit affordable housing project will be removed from Appendix A, *Market Study, Economic Impact Analysis and Public Facilities Assessment.* However, the alternatives analysis provided in Chapter VII of the FEIS includes this alternative since it was considered by the Applicant in the formulation of the Preferred Alternative.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

24. Mr. Richard “Dick” Mayer

TO: Applicant: Mr. Michael Atherton (209) 601-4187 coachpea20@sbcglobal.net
Waikapu Properties, LLC,
1670 Honoapiʻilani Highway Wailuku, HI 96793,
Consultant: Mr. Michael Summers (808) 269-6220 msumers@planningconsultantshawaii.com
Planning Consultants Hawaii, LLC,
2331 W. Main Street Wailuku, HI 96793,
Approving Agency: Mr. Daniel Orodenker (808) 587-3822
State of Hawaiʻi, Land Use Commission,
Department of Business, Economic Development and Tourism,
P.O. Box 2359, Honolulu, HI 96804-2359

From: Richard "Dick" Mayer dickmayer@earthlink.net
1111 Lower Kimo Dr.
Kula, Maui HI 96790

March 28, 2016

RE: **Waikapū Country Town Draft-EIS – SUPPLEMENTAL COMMENTS / ISSUES**

Initial Comment: This letter is a supplement to the letter dealing with the Waikapū Country Town population issue which was previously sent. It contains a number of issues/concerns that will need to be addressed in the Waikapū Country Town Final-EIS.

1. More information is needed with regard to the County requirements for **constructing affordable "workforce housing"**:

A. Where in this Waikapu community will the affordable housing be built? Mauka or makai? Near the center of town? Or on the periphery? As single-family units? Or only as smaller sized units in the multi-family buildings? Will space be available for larger families who are also low-income?

B. What types of units will be built? For home ownership? Or as rental units? Will units be given "affordable and workforce" status in-perpetuity?

C. What will be the phasing of the affordable units? Will they have to wait for the entire mauka phase area to be completed before they are built? That would not be good.

D. Since at least 20-25% of the units must be in the affordable category, at no time shall there be more than 80% of the completed units in the "market-priced" category.

E. Describe the process by which local "workforce-housing" families will be selected to purchase the affordable homes. Signups? Raffle drawings? Priority lists?

The Final-EIS should clarify these important social issues.

2. Traffic is probably the most problematic issue for this project. The TIAR traffic study mentions many of the other projects that will be built in the vicinity of the Waikapu Country Town. However, the traffic study has provided no explanation on how the proposed development of the other projects will be phased during the next 10 to 20 years. What will be their probable rate of implementation? In the same 10 year period as Waikapu Country Town is to be completed?

Potentially, the 1,500 – 1,800 units being proposed in Waikapu Country Town are in addition to the 2,550 Waiale area units; 600 - 800 units in Puunani; and 1,000 to 2,000 units in Kehalani and Maui Lani.

It is absolutely necessary that a Central Maui Transportation Master Plan be completed that will integrate the traffic impacts and needs of all of these communities since at present the environmental documents for each project do not adequately include the cumulative impacts from the other projects.

Waikapu Country Town should offer to pay its fair share to have a Central Maui Transportation Master Plan prepared. The Central Maui Transportation Master Plan should include three components:

A. A detailed description of the needed roads and intersections in Central Maui
B. Cost estimates to construct the needed roads and intersections; and
C. A fair allocation of the construction costs to be paid by:
each of the major residential developments; the State DOT; and Maui County. This would probably include the designation of particular traffic projects to a specific party.

3. Describe in greater detail the effects on the **Waikapu aquafer** of drawing water not only by the five Waikapu Country Town wells, but also from other wells that are now and in the future going to take water from the Waikapu aquifer. Will the sustainable yield be exceeded?

4. **Parking** There needs to be a more comprehensive discussion of the parking situation near the Town Center and especially on Main Street where there will be many stores and residences above the stores. The picture of Main Street leaves the impression that there will be inadequate parking for a commercial area. The major problems that present-day Wailuku has with inadequate parking may be replicated here.

5. Elevation differences and bicycle routes Will there be considerable difficulty in riding bicycles in a makai to mauka direction? The Draft-EIS indicates that there will be an elevation difference of 400 feet or the equivalent of a 40-story building. Is it reasonable to expect that for an average resident there will be bicycle traffic going uphill? For example, how many people in Wailuku could cycle up Main Street from the bridge over Waiale Road to the Baldwin House museum or higher? It is doubtful that elementary school children will ever be able to get to their mauka home from the elementary school and nearby park

6. Clarify in the Final-EIS exactly where all of the **storm water** from the built up environment will end up.

7. It seems clear that, sooner rather than later, a **wastewater treatment plant** will need to be built. Indicate in the Final-EIS where that proposed wastewater treatment plant will be constructed. On-site? Or off-site? And are there any environmental impacts from this very large (over $50 million) facility? Almost certainly: yes.

8. The Draft-EIS has an **extremely aggressive timetable for completion**. It indicates two 5 year phases which seems highly unrealistic given the experiences of the other multi-decade, residential communities in Central Maui: Kahului, Maui Lani, and Kehalani. What are the implications (financial, management, infrastructure, etc.) if the project timetable is lengthened?

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Richard "Dick" Mayer
1111 Lower Kimo Drive
Kula, Maui HI 96790

Dear Mr. Mayer:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your additional letter dated March 28, 2016, regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following responses:

1. ***County Workforce Housing***. The WCT will be subject to the County's Workforce Housing Policy as enumerated in Maui County Code (MCC) Chapter 2.96. The County's policy describes in significant detail the percentage of a residential development that must be sold as Workforce Housing, the required distribution of units amongst income categories, the required selling prices and/or rents for Workforce Housing, the phasing of Workforce Housing relative to market priced housing, buyer and/or renter qualification criteria for purchasing and/or renting Workforce Housing, and how Workforce Housing must be marketed by the Department of Housing & Human Concerns and the developer. MCC Chapter 2.96 also stipulates what the deed restrictions and resale restrictions are for Workforce Housing units.

   The Applicant intends to develop the required Workforce Housing within the Waikapu Country Town (WCT) project area boundaries. As required by MCC Chapter 2.96, the Workforce Housing will be constructed concurrently with and in the required proportion to the

2331 West Main Street, Wailuku, HI 96793 • Ph. 808-244-6231
msummers@planningconsultantshawaii.com

market rate housing. The Applicant desires to have a mixture of housing types, configurations and unit sizes, which would be sold as Workforce Housing pursuant the requirements of MCC Chapter 2.96. The Workforce Housing product will be built within locations on the site where development of the Workforce Housing can be done most cost effectively, where it is closest to public facilities and provides the most convenient non-vehicular access to shopping, schools, parks and public transit. The Applicant intends to make the Workforce Housing available in multi-family and single-family formats to accommodate a variety of household sizes and demographics. In consideration of the pricing restrictions placed upon Workforce Housing, it is likely that Workforce Housing single-family lots will be smaller than the market priced lots and the home sizes may also be smaller in order to make this housing option more affordable to prospective buyers. The Applicant also intends to include rental Workforce Housing units, but the ultimate mix of for sale and rental housing is not known at this time. Sections III.B.1, 7 and V.B.1 of the FEIS have been updated to address your comments.

2. ***Traffic.*** The DEIS includes a Traffic Impact Analysis Report (TIAR) prepared by a traffic engineer. The TIAR is included as Appendix L in the FEIS and it is summarized in Section V.D.1 of the FEIS.

The prescribed methodology for conducting a TIAR is to document operating conditions at impacted intersections during the AM and PM peak hours. This is done for existing conditions, conditions in the future without the project, and conditions in the future with the project. In determining conditions in the future without the project, the traffic engineer includes in the traffic model cumulative growth within the region together with foreseeable planned roadway improvements. The TIAR describes this process as follows on page 24 of the TIAR (Appendix L of the FEIS):

> *"The cumulative base traffic projections include two elements: 1) model forecasts of future traffic volumes that take into account the expected changes in traffic over the existing traffic volumes caused by traffic generated by specific cumulative projects located in the study area and overall regional growth; and 2) by roadway network changes and street system improvements."*

The cumulative analysis in the TIAR accounts for both planned future development, such as Waiale, as well as the State DOT's traffic projections, which are based upon socio-economic data developed by the State of Hawaii. Attached for your convenience as Exhibit A are pages 24 - 30 of the TIAR, which documents how the cumulative base traffic volumes were estimated.

3. ***Central Maui Transportation Master Plan.*** The Applicant understands that the State of Hawaii relies upon the Federal-Aid Highways 2035 Transportation Plan for the District of Maui and its Statewide Transportation Improvement Plan (STIP) for its highways planning. The WCT's TIAR, as well as recently completed TIAR's completed by neighboring developments, would offer important data and analysis to support any State and/or County effort to conduct a transportation master plan for Central Maui.

   Note that the State and County require "fair share" improvements or "fair share" costs for improvements by developers to address off-site impacts. Moreover, a development may be required to pay for the entire off-site improvement if the impact from the developer's project reduces the LOS of an intersection to an unacceptable Level-of-Service.

4. The Commission on Water Resource Management (CWRM) regulates well drilling and groundwater resources in Hawaii and has established hydrologic units with sustainable yield values in million gallons per day (mgd) for the purpose of groundwater management throughout the State. The Project lies within the Waikapu Aquifer System of the Wailuku Hydrologic Sector. The sustainable yield (amount of groundwater that can be safely developed over the long-term) from the Waikapu Aquifer System has been established at 3 mgd. When the CWRM officially designates a hydrologic sector or aquifer system for groundwater management, it has the responsibility to regulate the amount of groundwater use from wells within the designated area. The Waikapu Aquifer has been designated a Special Groundwater Management Area by the CWRM and therefore any water drawn from this Aquifer must first be approved by the CWRM.

   The WCT has drilled six wells on the property. Pump tests have been conducted for three (3) of these wells. The pump tests determined that

Well 1 has a sustainable capacity of 1.39 mgd and Well 2 has a sustainable capacity of 1.03 mgd. Further pump testing is required to confirm the sustainable capacity of Well 3. Pump and water quality tests are to be conducted in the future for Wells 4 and 5. Well 6 is to serve as a monitoring well. Before the subject wells can be put into use a groundwater use permit must be approved by the CWRM. The results of the 10-day pumping tests for Wells 1, 2 and 3 have been incorporated into the FEIS as Appendix I. Section V.D.4, and other applicable sections, of the FEIS have been updated to address your comments.

5. ***Parking***. The Applicant appreciates your comments regarding on-site parking. Parking requirements for the Project will be specified within the Project District zoning ordinance and Design Guidelines that will be prepared to implement the land use plan. The parking standards developed for the WCT will be designed to ensure that adequate parking will be provided throughout the development. It is intended that the parking standards and design guidelines will function together to offer innovative solutions to mitigate some of the deleterious effects that parking can have upon the natural environment and the built urban form. The WCT's parking standards and design guidelines will create opportunities for strategic and centrally located parking lots within the town center and near the main street business districts. It will also allow for on street parking, joint-use parking and the opportunity for cash-in-lieu fees, where appropriate. Minimum on-site parking requirements will be established by use. As noted, the WCT's parking standards and design guidelines will be subject to review and approval by the Maui Planning Commission and County Council as part of the zoning entitlement process. Section III.B.D has been incorporated into the FEIS to address your comments.

6. ***Elevation Differences and Bicycle Routes.*** The Applicant intends to develop a community where walking and bicycling are the preferred modes of transportation for short commutes. This can be accomplished by providing safe, secure and pleasant routes for walking and bicycling. The WCT is accomplishing this goal by developing a network of sidewalks, separated multi-use pedestrian and bicycle trails and separated pedestrian paths that link the Project's major activity centers with its residential neighborhoods.

As Figure 21, "Walkability Diagram", in the FEIS shows, the WCT's residential neighborhoods are mostly within a one-half mile walk of the elementary school. A one-half mile walk translates into an approximate 10-minute walk. Preliminary slope estimates indicate that the approximate slope for bicyclists travelling north to south is between 1.2% and 2.0%. Meanwhile, a preliminary estimate of the grades are 3.4% to 3.5% traveling mauka to makai within the makai side of the project. Mauka of Honoapiilani Highway a preliminary estimate is that the mauka to makai grades may range between 5.7 to 6.0%. It is generally accepted that for multi-use paths grades of 3% or less are comfortable for most riders, but that grades up to five percent are generally acceptable. If possible, the Applicant will try to avoid slopes greater that 5% in order to facilitate more bicycle riding between the Project's mauka and makai neighborhoods.

7. ***Storm Water.*** Section V.D.3 of the FEIS includes Figure 46, "Proposed Drainage System Improvements, which documents where on-site drainage is retained on-site.

8. ***Wastewater Treatment Plant.*** As noted in the DEIS, a wastewater reclamation plant will be required to treat wastewater generated by the Project. The Applicant's preferred wastewater technology is an Organica FCR solution that consists of a series of biological treatment zones simultaneously utilizing both fixed biofilm and suspended biomass in the reactors. The reclamation facility will serve the dual purpose of recycling the WCT's wastewater so that it can be reused for irrigation purposes. It is estimated that at full buildout the facility will be capable of generating approximately .65 million gallons per day of recycled water that may be used for irrigation of the Project's agricultural lands and urban open space areas. The facility and its impacts are described in detail in Sections III.B.8 and V.D.5 of the FEIS.

9. ***Project Schedule.*** Once all entitlements and building permits have been secured, the ultimate build-out of the Project will be subject to the strength of demand for single- and multi-family housing and the supporting commercial development. As described in Section II.E of the FEIS and in Appendix A, "Market Study, Economic Impact Analysis, and Public Fiscal Assessment, the Applicant expects that the market will be strong enough to absorb the Project within the 10-year

schedule. Should the market demand be considerably weaker than projected, then the schedule would be adjusted to meet the demand. Given the high up-front capital costs to develop the infrastructure to support the development, if market demand is too weak to support the Project's capital costs, then the Project, as proposed, may not be built.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce

4. FUTURE TRAFFIC PROJECTIONS

To evaluate the potential impact of traffic generated by the proposed project on the surrounding street system, it was necessary to develop estimates of future traffic conditions in the area both with and without the project. Future traffic conditions without the proposed project reflect traffic increases due to general regional growth and development, as well as traffic increases generated by other specific developments near the project site. These conditions are referred to as the cumulative base condition (i.e., no project conditions). The sum of the cumulative base and project-generated traffic represents the cumulative plus project conditions. Development of these future traffic scenarios is described in this chapter.

CUMULATIVE BASE TRAFFIC PROJECTIONS

The cumulative base traffic projections include two elements: 1) model forecasts of future traffic volumes that take into account the expected changes in traffic over the existing traffic volumes caused by traffic generated by specific cumulative projects located in the study area and overall regional growth; and 2) by roadway network changes and street system improvements.

Although the anticipated completion year of the first phase of the WCT development is 2021, the analysis used 2022 for the horizon year for Phase 1 to be consistent with the planned completion of large background projects in the area, such as the Waiale development and the Waiale Bypass, providing a more conservative cumulative forecast against which to assess potential project impacts.

AREAWIDE TRAFFIC GROWTH AND CUMULATIVE DEVELOPMENT PROJECTS

Information was obtained from the County of Maui on approved, planned, and proposed development projects throughout Central Maui. This information was used to estimate future traffic volumes for the study area, since the growth and changes in traffic caused by anticipated projects in the Kahului, Wailuku and Waikapu areas could affect conditions on the streets around WCT. **Table 4** is a compiled list of future cumulative projects in the Central Maui vicinity. **Appendix C** provides a more detailed list with available project descriptions for residential projects that the County is monitoring, as well as maps of other residential and non-residential development projects in Central Maui that have come to the attention of the Department of Planning.

Exhibit A, Pages 24 - 30 of the TIAR

TABLE 4 – CENTRAL MAUI FUTURE CUMULATIVE PROJECT LIST [1,2]

Project Name	
• `Aina o Kane Condos	• Kehalani (C-9)
• Alternative Care Services, Inc.	• Kehalani Commercial Center
• Central Maui Regional Park	• Maui Beach Hotel Addition
• Central Maui Senior Housing	• Maui Lani Church
• Civil Defense Center	• Maui Lani Homes 1
• Consolidated Baseyards	• Maui Lani Lot 4
• Habitat For Humanity Condos	• Maui Lani Lot 7B
• Hale Ho`omalu Mental Health Kokua	• Maui Lani MF7 Condos
• Hale Mua	• Maui Lani Parkway Commercial
• Hale Kapili Project	• Maui Lani The Parkways
• Ka Lima O Maui Affordable Housing	• Maui Lani Village
• Kahawai Condos	• MEO B.E.S.T. House
• Kahului Harbor Improvements	• Mission Street Affordable Apts.
• Kahului Town Center Redevelopment	• Na Leo Pulama O Maui Hawaiian School Hale Hou
• Kehalani (C-12)	• Pi`ihana Project District 2
• Kehalani (C-13)	• Pu`unani Residences
• Kehalani (C-14)	• Valley Isle Fellowship Condos
• Kehalani (C-18)	• Wai`ale
• Kehalani (C-19)	• Wai'ale Affordable Homes
• Kehalani (C-3)	• Waiehu Mauka Affordable Townhomes
• Kehalani (C-6)	• Waikapu Gardens II
• Kehalani (C-7)	• Waikapu Light Industrial Park
• Kehalani (C-8)	• Waikapu Rural Village

Notes:

[1]The list above of development projects in Central Maui were pulled from multiple sources, including: conversations with County staff, a residential project list for Central Maui provided by the County of Maui in December 2013, available and relevant environmental assessments or impact studies available on the State's website for Maui, and the 2011 Central Maui Development Project maps and Development Project GIS layer available on the County website.

[2]During the related project review process, the socioeconomic and land use data in the interim year and long-term year No Build models was consistent with the future cumulative projects listed above.

By 2022 and by 2026, the WCT study area will have experienced significant residential growth and development of new commercial, industrial, business, and institutional land uses, primarily because of the following projects:

- *Waiale,* located along Waiko Road, south of the Maui Lani development, east of Waiale Road, and directly west of Kuihelani Highway, is assumed to be completed by 2022.[1] The planned mixed-use community will include 2,550 single-family and multi-family dwellings, commercial and light industrial land uses, as well as a middle school.
- *Maui Lani Development* is partially complete and assumed to be fully completed by 2026. This master planned community along Mauilani Parkway between Waiale Road and Kuihelani Highway, comprises of a mixture of residential subdivisions that total approximately 1,000 single-family and multi-family households and commercial uses. Specifically, the development includes the Maui Lani Village Center, which will be about 540,000 square feet or 79 lots available for commercial, business, or medical office uses.
- *Kehalani Development* is partially complete and assumed to be fully completed by 2026. This master planned community of 2,400 homes is located north of Kuikahi Drive, south of Iao Valley Road, east of the West Maui Mountains, and primarily west of Honoapiilani Highway.[2]
- *Puunani Residences* is located on the southwest quadrant of the intersection of Honoapiilani Highway & Kuikahi Drive. It is assumed that 20% and 40% of the project would be completed by both 2022 and 2026, respectively. Kuikahi Drive and Honoapiilani Highway are planned to provide access to the 600-home neighborhood.

Traffic generated by the above related projects and other developments were projected using the Maui Travel Demand Forecasting Model (TDFM)[3] and the trip generation methodology. The TDFM assigns land use and socioeconomic data provided by the County of Maui in 2007 to Traffic Analysis Zones (TAZs). These attributes were further used to generate and assign traffic across the roadway network for the base and horizon years, respectively.

[1] The TIAR for the Waiale development analyzed the project with Base Year 2022 conditions (Austin, Tsutsumi, and Associates, Inc., 2011).

[2] Source: http://www.kehalani.org/

[3] The base 2007 model, the interim horizon 2020 No Build model, and the long-term horizon 2035 No Build model were obtained from HDOT. The socioeconomic and land use data supplied by Maui County in 2007 was used to calibrate the TDFM.

BASELINE STREET SYSTEM IMPROVEMENTS

Discussions were held with County and State agency staff regarding the roadway improvements in or near the study area planned for completion by 2022. These improvements, whether the result of local capital improvement programs or in connection with planned or approved projects, would result in dramatically improved mobility options for residents and visitors as well as capacity changes at various locations throughout the study area as discussed below.

Based on the information received from agency staff, the review of planning documents related to the nearby projects, and the review of the roadway network changes between the base and horizon year models, the proposed transportation system changes that are projected to occur between 2007 and 2022 are included in the cumulative base traffic network of each horizon year No Build model.[4] The improvements are listed in detail below:

- Hana Highway Widening – The 2020 and 2035 roadway networks of the TDFM includes the widening of Hana Highway from a four-lane to a six-lane divided highway from Kaahumanu Avenue to the vicinity of the also proposed Kahului Airport Access Road.

- Honoapiilani Highway Widening – The 2020 and 2035 roadway networks of the TDFM includes the widening of Honoapiilani Highway between Lahainaluna Road and Aholo Road in West Maui from being a two-lane roadway to a four-lane roadway.

- Kahului Airport Access Road – This four-lane bypass will be constructed from Puunene Avenue to Hana Highway. The purpose of this road is to provide an alternative route to congested existing routes (i.e., Dairy Road) to Kahului Airport. This roadway improvement project is assumed in the 2020 and 2035 roadway networks of the TDFM.

- Kamehameha Avenue Extension – To support the Waiale development and related traffic, it is assumed that Kamehameha Avenue will extend southward from its existing terminus near its intersection with Maui Lani Parkway to intersect Waiko Road and eventually to intersect with the Waiale project site Road B.

- Intersection 7: Kamehameha Avenue & Waiko Road – This future side street stop-controlled, four-legged intersection will consist of one left-turn lane and one shared through/right-turn lane on all

[4] Per HDOT, No Build scenarios are considered baseline conditions, which includes socioeconomic forecasts but without implementing projects, such as major roadway improvements and some private developments. At the time the model files were obtained, HDOT was currently working on the build scenario that modeled future projects. Because some of the roadway improvements listed in the TIAR were absent from both the 2020 No Build model and 2035 No Build model roadway networks, the roadway network for each model horizon year was updated to ensure these future facility improvements are appropriately modeled.

approaches. This intersection is assumed to be constructed under cumulative base conditions, as it would provide access to portions of the Waiale mixed-use community.

- Lahaina Bypass – This two-lane highway will be located in West Maui and will extend between Launiupoko south of Lahaina and Honokowai to the north. This roadway improvement project was added to the 2020 and 2035 roadway networks of the TDFM.

- Maui Lani Parkway Extension – To support the Maui Lani developments and related traffic, it is assumed that Maui Lani Parkway will extend and connect Waiinu Street and Kuikahi Drive. It is assumed that the extension will provide one lane in each direction.

- Puunene Avenue Widening – The 2020 and 2035 roadway networks of the TDFM includes the widening of Puunene Avenue from two to four lanes from Wakea Avenue to Kuihelani Highway.

- Roadway Detailing for Waiale – To support the Waiale project and related traffic, the construction of the following roadways are assumed within the Waiale project site: Road A, Kamehameha Avenue extension, Road C, and Road B. These roadways are assumed to be constructed under cumulative base conditions, as it would provide access to various areas of the Waiale mixed-use community.

- Waiale Bypass – Waiale Road would extend from its existing terminus at Waiko Road to intersect Honoapiilani Highway approximately one mile south of Honoapiilani Highway/ Waiko Road. It is assumed that the bypass would be constructed as a two-way, two-lane roadway and left-turn pockets will be provided at key intersections, including the two future study intersections (discussed below).

- Intersection 6: Waiale Road & Waiko Road – This intersection will become a four-legged intersection under cumulative base conditions and the fourth (south) leg will be constructed as part of the Waiale Bypass. It is assumed that the reconfigured intersection will consist of one left-turn lane and one shared through/right-turn lane at the eastbound and southbound approaches, while the northbound and westbound approaches are assumed to consist of one left-turn lane, one through lane, and one right-turn lane. This existing, unsignalized intersection is assumed to become signalized as part of the construction of the Waiale Bypass.

- Intersection 13: Honoapi`ilani Highway & Waiale Road – This future intersection will consist of a northbound approach that provides one through lane and one free right-turn lane, a southbound approach that provide one through lane and one left-turn lane, and a westbound approach with one left-turn lane and one right-turn lane. This intersection is assumed to be signalized and constructed as part of the Waiale Bypass project under cumulative base conditions.

Cumulative Base Traffic Projection Methodology

Related projects were checked against the model growth between the base year (2007) and each of the horizon years (2020 and 2035) to see if the land use and socioeconomic attributes included the known related projects, such as those listed in **Table 4**. Since the horizon year models obtained from HDOT were No Build scenarios,[5] some of the major projects planned in the vicinity of the WCT study area were noticeably absent in the TDFM's projections; therefore, in order to appropriately model these future projects, the respective land use and socioeconomic attributes were adjusted for the corresponding horizon year the related projects are anticipated to be completed by. The changes in land use and socioeconomic assumptions between the updated 2020 and 2035 model were then used to interpolate the land use and socioeconomic data for the scaled 2022 and 2026 models, which were used to forecast cumulative base traffic volumes for 2022 and 2026, respectively.

After the land use and socioeconomic data adjustments were completed, trips generated by the related projects were estimated and assigned by the model to the future roadway system based on their locations and anticipated distribution patterns. The geographic distribution of traffic generated by new development depends on several factors, such as the type and density of the proposed land uses, the geographic distribution of the population from which employees and/or patrons may be drawn, the geographic distribution of activity centers (employment, commercial, and other) to which residents of proposed residential projects may be drawn, and the location of those developments in relation to the surrounding future street system.

Between 2013[6] and 2026, the TDFM anticipates an aggregate, island-wide growth of approximately 17,000 households and about 24,000 employees for Maui. Additionally, after land use and socioeconomic data adjustments were completed for the 2026 model, the TDFM projected an approximate 20% increase in demand over existing conditions along Honoapiilani Highway between Kuikahi Drive and Kuihelani Highway. The TDFM also projected an approximate 30% increase in demand along Kuihelani Highway over existing conditions between Maui Lani Parkway and Honoapiilani Highway. [7]

[5] Ibid.

[6] The Base Year (2007) for the TDFM was adjusted to include known socioeconomic changes up to 2013 (See Appendix C for specific projects). Therefore, the updated Base Year TDFM used in this analysis reflects land use and employment updates between 2007 and 2013.

[7] The overall percentage increase in traffic demand was based on averaging the calculated percentage increase in each of the PM peak hour roadway segment volumes between the updated base year and 2026 horizon year models.

CUMULATIVE BASE TRAFFIC VOLUMES

The resulting cumulative base traffic volumes and the anticipated lane configurations, representing future conditions without the project for year 2022 and 2026, are presented in **Figure 4** and **Figure 5**, respectively. These future projections take into account the estimated overall growth in the surrounding area without the addition of traffic generated by the proposed Waikapu Country Town Project. To analyze level of service, post-processed model volumes for the 2022 cumulative base and the 2026 cumulative base were loaded into Synchro 8.0.

PROJECT TRAFFIC PROJECTIONS

Development of future traffic projections related to the amount of traffic added to the roadway system by WCT is estimated using a three-step process: (1) project trip generation, (2) trip distribution, and (3) trip assignment. The first step estimates the amount of project-generated traffic will be added to the roadway network. The second step estimates the direction of travel to and from the project site. The new trips are assigned to specific street segments and intersection turning movements during the third step. This process is described in more detail in the following sections.

PROJECT STREET SYSTEM IMPROVEMENTS

Based on feedback from agency staff and review of the proposed street network, the proposed transportation system changes described previously are anticipated to occur between 2013 and 2022/2026 and are therefore included in the cumulative base traffic network. Additional improvements will be made as part of the proposed project and are listed below:

- Intersection 9: Honoapiilani Highway & Main Street – This future intersection will be constructed as part of the Year 2022 Conditions (Phase 1) of the proposed project. The intersection is assumed to be configured with northbound and southbound approaches that provide one left-turn lane, one through lane, and one right-turn lane and eastbound and westbound approaches that provide one left-turn lane and one shared through/right-turn lane.

25. Mr. Albert Perez, Executive Director, Maui Tomorrow

TO: Applicant: Mr. Michael Atherton (209) 601-4187 March 30, 2016
Waikapu Properties, LLC,
1670 Honoapi‘ilani Highway Wailuku, HI 96793,
Consultant: Mr. Michael Summers (808) 269-6220
Planning Consultants Hawaii, LLC,
2331 W. Main Street Wailuku, HI 96793,
Approving Agency: Mr. Daniel Orodenker (808) 587-3822
State of Hawai‘i, Land Use Commission,
Department of Business, Economic Development and Tourism,
P.O. Box 2359, Honolulu, HI 96804-2359

From: Maui Tomorrow Foundation
RE: Waikapū Country Town Draft-EIS

Mahalo for the opportunity to review this Draft EIS. In general the EIS discusses a variety of the project's impacts openly and offers constructive mitigations. The fact that the project is offering to set aside an 800 acre ag preserve and commit to providing local opportunities for food and other production is a unique feature in developments of this size in central Maui.

There are, however, several areas in the Draft EIS that lack sufficient or accurate information/maps or other data to adequately cover the likely impacts of the action. We ask that this information be provided in the Final EIS.

Population figures that form the basis of many calculations are not clear. Appendix A includes Table III-4 which indicates expected population from single family units as: 2321 plus 102 part time residents. This is based upon an occupancy rate of 2.6 persons for fulltime residents and 3.2 persons for part time. According to US Census data for 2010-2014 for the Wailuku area the average occupancy for each household is 2.94 person/unit. This would give a full time population of 4,213, rather than 3,362 and a defacto population of 4,361. The DEIS does not justify why the census number was not used.

Section I comments: “Unresolved Issues”

A Wastewater Treatment
Discussed on p.I-38 as an “unresolved issue.” It is clear from the County DEM comments that eventually a new wastewater facility will need to be constructed onsite or off. A map is not provided in the DEIS report to show the possible location of the treatment facility. A verbal description of possible location is given as North-East corner of the property. This should be illustrated on a map and any possible impacts to the park/school-site planned in that location should be discussed. The DEIS should also the relative costs to local residents of a private treatment facility versus a public one. Likewise, any possible offsite locations should also be discussed.

Wai`ale By-pass Road Improvements
DEIS should discuss impacts on project design if this essential upgrade is not funded during the proposed first phase of the project.

Final Water Quality Testing
Since water quality testing results for the project's wells were not available in the EISPN or the DEIS, this effectively means that the public has had no chance to review or comment upon the information in the tests until the Final EIS, when public comment is no longer taken. This circumvents the Ch. 343 process of timely access by the public and agencies to project information.

Section II comments:

p. II-3 " HC&S continues to lease approximately 938 acres for sugarcane cultivation from the Project Applicant." This should be updated in FEIS.

p. II-21-26 discusses the phasing of the various aspects of the project. There is no discussion of the phasing of decisions re: the proposed ag preserve; ag park or large ag lots. Will all these be established in phase 1or phase 2? Maps like Fig 2 and various plan design maps do not clearly indicate where the potential ag park, ag preserve or ag lots will be located. The Department of Agriculture made the same comment. The DEIS should also identify the accepting agency or organization of the conservation easement, the timing of when the easement will be established and discuss how the conservation easement is to be implemented and managed.

The DEIS includes up to 146 ohana units in infrastructure planning data, which is very much appreciated. The FEIS, however, should note if there would be additional impacts if double that number of ohanas, and resulting 10% or more increase in the project population, were to be part of the finished project design. Would there be sufficient water, sewage capacity, road capacity, park space etc. to accommodate additional households, vehicles and infrastructure demands?

Chapter III Comments

p.III-16 states that "A range of housing types will be provided within easy walking distance of the Village Center" and gives a listing of types of housing. The EIS should specifically indicate whether any rental housing will be built in the project's first phase.
COMMENT: Mr. Atherton referred to a possible 201-H project as part of the development, and it is referenced in the DEIS as having up to 300 additional units.The EIS needs to indicate where that would be located and what additional infrastructure support it would involve since the 201-H process can waive Community Plan Amendment, Change in Zoning Application and other usual requirements to expedite the construction of affordable homes.

P.III-28 Discusses the use of a Complete Streets concept in project design. This is very desirable and we applaud the Applicant for adopting this strategy.

COMMENT: The DEIS, however, does not discuss how there would be hiking access to Waikapu stream from the upper (mauka) parts of the project. What happens to existing jeep road along stream? The DEIS has no discussion of community or cultural access to upper part of Waikapu stream, yet the stream was identified as the most important cultural feature on the land in the summary of the CIA.

COMMENT: The maps do not make it clear exactly what roads will service future agricultural lands.

P. III-31 The DEIS describes the Village Green as “the site of the existing Mill House Restaurant and MTP lagoon.”
COMMENT: The DEIS does not discuss if the proposed 1.5 acre “Village Green” size offers enough space for both WCT residents and potential visitor activities, although both are likely to be major users. What is the use capacity of a space that size? If more accurate residential population figures are used, is the Village Green size adequate?

P. III- 47 Table 17 (costs and phasing-) refers to a private Wastewater Facility being needed.

COMMENT: As mentioned above, location of this future facility should be shown on maps in the DEIS.

p. III-48 Shows substantial infrastructure costs: $79 mil for phase 1.
COMMENT: The DEIS should discuss what would happen if funding is not available for those significant costs or if there are alternative methods of phasing the project if the infrastructure is not developed.

Fig 29 is labeled “Drainage Improvements” but appears to show sewage lines. This should be clarified. p. 139. EXHIBIT 8 in the Engineering Report of the DEIS shows the proposed drainage system.

Section IV Comments:

Flora & Fauna
Mitigation measures to avoid harm to the endangered Blackburn Sphinx moth on the site are discussed in Section IV.A.4 of the DEIS and Appendix L (“EISPN Agency Comment and Response Letters”), In Section VII-p. 4 the DEIS concludes that “Implementing the USFWS mitigation measures will not constrain development of the property.”
COMMENT: The USFWS letter in Appendix L makes it clear that “implementation of these measures does not ensure that impacts to listed species can be avoided and further consultation with the Service with compliance on the ESA may be required.” The DEIS should indicate if the project is able to set aside any habitat area for the moth, if that is eventually required, and how that habitat area would affect project design.

Section V Comments

Historical and Archaeological Resources

VII-5-6 The AIS indicates the presence of mostly plantation era historic sites on the property. It appears that this may be because the area Archaeological Services Hawai‘i, LLC conducted an archaeological inventory survey (AIS) of the subject parcels to be developed (TMK’s 3-6-002:003; 3-6-004:003, 006; and 3- 6-005:007).

COMMENT: the AIS does not mention TMK parcel 3-6-002:001 which is referred to in other sections of DEIS. This parcel is shown in Fig 10 Community Plan Map but one parcel, TMK 3-6-002:003 is not shown on that map. Is this an error? Both parcels appear to be part of the project area.

Fig 32 Survey area map and the accompanying narrative indicate that only a 612 ac portion of the 1579 acre parcel was subject to the AIS survey. The SHPD process requires projects to discuss traditional properties on the affected area as well as adjoining lands. It does not appear that the lands along the mauka portions of Waikapu stream and the other 967 acres of the property were surveyed for historic properties, except where they may contain portions of the plantation ditch systems.

The AIS summary in the DEIS states: “During the investigation, no evidence of traditional Hawai‘ian activities, with the possible exception of Site 7882 (remnant retaining wall or terrace) was recorded. These negative results are primarily due to the compounded disturbances from sugarcane cultivation, historic habitation and modern land use; and possibly the inherent bias of random sampling during the inventory survey testing.”

COMMENT: The absence of traditional Hawai‘ian activities in the project site, could be due to the fact that only a portion of the “project site” was surveyed, and such limited surveys do not meet the specifications called for in State Historic laws.

HAR 13-276-2 defines project area as “the area the proposed project may potentially affect, either directly or indirectly. It includes not only the area where the project will take place, but also the proposed project’s area of potential effect.”

HAR 13-276-3 defines the scope of an AIS:
Archaeological inventory survey, generally.
“An archeological inventory survey shall:
(1) Determine if archaeological historic properties are present in the project area and, if so, identify all such historic properties.
(2) Gather sufficient information to evaluate each historic property's significance in accordance with the significance criteria listed in section 13-275-6(b).

The project area for Historic review for WCT is the entire 1579 acres. The AIS cannot conclude that there is “No Impact” to historic or archaeological sites if the entire acreage was not surveyed. The DEIS cannot make that same conclusion either.

Cultural practitioners were widely consulted on the Cultural Impact Assessment but do not appear to have been part of the AIS process, as also required by HAR 13-276-7:

> “the report shall contain information on the consultation process with individuals knowledgeable about the project area's history, if discussions with the SHPD, background research or public input indicate a need to consult with knowledgeable individuals.”

The two processes should be better integrated. It would be unusual to have such a large area with virtually no pre-contact features, even given its history of plantation cultivation. Monitoring is not a substitute for adequate archeological survey work.

Section VII comments:

VII-7 -8 Applicant is said to be “committed”.
COMMENT: Those actual commitments should be discussed in the FEIS.

VII-11 Describes 800 acres of land left as permanent ag designation as an ag park and 277 acres of the project site left as ag designation, but subdivided into 5 ag lots with possible farm dwellings.

COMMENT: It does not appear that these potentially residential lots are included in the potable water calculations. There are no figures given in the PER for non-potable water use other than an estimate that non-potable residential use is estimated as 1/3 of the usual Maui County use standards. Will the non-potable use of the 277 acres of ag lots compete with the 800 acre ag preserve operations for non-potable water, or is there plenty of water for all? These 277 acres are not like the average size "ag lot" of 2,5 or 10 acres. NOTE: as noted below, the acreages of ag land given in section VII are also not consistent with those given in the Preliminary Engineering Report in Appendix H.

COMMENT: The project's five wells are described in this section, but there is no mention of one well serving as a monitor well, as has been previously stated by the landowner in meetings with community groups. Will there be a monitor well? The FEIS should make this clear since so little information regarding water viability and quality is provided.

p. VII-12 The WCT will also be providing approximately 32.5 acres of public park land within the project, of which at least 16.5 acres will be dedicated to the County.

COMMENT: 6.5% of project land is park. If the population numbers are actually higher than predicted, because an unverified household size was used for the calculations and potential ohana units were estimated for just 148 of the 1050 single family lots, would more park area be needed?

The DEIS states that "The State of Hawai'i will also receive a 12-acre elementary school site." COMMENT: Does the State need to purchase this site? The FEIS should make this clear, as it could affect the viability of a new school being built for the community.

VII-14 .The DEIS states the project " ...will require that between twenty and twenty-five percent of the Project's housing be sold to low, low-moderate and gap groups in accordance with sales price and resale restrictions enumerated in Chapter 2.96, MCC."

COMMENT: How many units each of single family and multifamily are anticipated to be constructed to meet the County's workforce housing requirements?

Appendix H Preliminary Engineering Report (PER) and Drainage Reports

1.0 Introduction

p.1 of the PER has a project description not consistent with the rest of the DEIS report. It states: **"**WCT will be a master-planned community with a mixture of single- and multi-family residential, commercial, and civic uses. The Maui Island Plan's Directed Growth Plan designated approximately 503 acres of WCT's 1,562 acres into urban small town and rural growth boundaries. The remaining 1,059 acres will remain in the State's Agricultural District.

Approximately 800 acres of the Project's agricultural lands will be preserved in perpetuity for agricultural use through a conservation easement, and the remaining 274 acres will be kept in large agricultural lots.

COMMENT: The PER refers to different amounts of ag land than other parts of the DEIS 800 acres + 274 acres = 1,074 acres, not 1,059 acres of ag land. The discrepancy should be addressed.

Drainage: Existing and Post-Construction Conditions

The DEIS states: "Currently there are seven (7) diversion berms along the upper most portion of the mauka site, which intercepts surface runoff and diverts it into Waikapu Stream (See Exhibit 7). The diversion berms are part of the agricultural preserve that will not be developed and will remain in place as function as it is presently doing. Based on a 50-year, 1-hour storm, the existing diversion berms intercepts approximately 140,509 cubic feet of storm runoff and diverts it into Waikapu Stream. These diversion berms prevent runoff from sheet flowing into the proposed development areas."

p.16 of the PER further states: **"**After the development of the proposed project, **there will be no change in the volume of runoff diverted to Waikapu Stream from the upper agricultural preservation area**. The existing diversion berms will continue to divert runoff from the areas mauka of the project site into Waikapu Stream."

COMMENT: Given that the CIA identifies Waikapu Stream as the area's most important cultural feature and the major concern of cultural practitioners is sedimentation impacts to the stream, the DEIS should discuss any measures that could be taken to improve the water quality of the discharge from the bermed areas and remove the sediment. Comments in Vol III of the DEIS from Alec Wong of DOH Clean Water Branch asked the applicant to: "Identify opportunities to retrofit or bioengineer existing storm water infrastructure" to improve water quality. Redesign of the mauka bermed areas of the WCT project to detain and filter sediment from the existing discharge would appear to be in accord with this comment.

The DEIS states: **"**Based on the above drainage design criteria, the Phase I development mauka of Honoapiilani Highway will be required to mitigate an increase in runoff of 45 cfs and provide a minimum storage volume of 148,916 cubic feet and mitigate 266 cfs and provide a minimum storage volume of 771,963 cubic feet makai of Honoapiilani Highway."

COMMENT: Does this include mitigation for runoff from the makai side of Phase 1 as well?

The DEIS states in the PER: "In accordance with the County's *"Rules for the Design of Storm Water Treatment Best Management Practices",* the design of the stormwater system will include water quality treatment to reduce the discharge of pollutants to the maximum extent practicable. Some examples of stormwater best management practices (BMP) are:

Grassed Swales will be implemented within the landscaped areas where practical. Grass and groundcover provides natural filtration and allows for percolation into the underlying soils."

COMMENT: Chapter 18.20 of MCC which implements new post-construction water quality standards now required under Chapter16.26.3306 Maui County Code "Rules for the Design of Stormwater Treatment Best Management Practices " sets specific goals to be met by the project for reduction of water quality impacts. The DEIS does not specifically address how these standards will be met, only stating that the project's systems will "reduce the discharge of pollutants to the maximum extent practicable." The FEIS should include a discussion of the

capacity of detention basins to hold specific volumes of stormwater over a given period of time to allow the sediment loads to settle and be retained in the basin.

Ch 18.20 is much more specific. It requires projects to meet these standards:

1. After construction has been completed and the site is permanently stabilized reduce the average annual total suspended solid (TSS) loadings by 80%. For the purposes of this measure an 80% TSS reduction is to be determined on an average annual basis for the 2 year /24 hour storm.

2 Reduce the post development loadings of TSS so that the average annual TSS loadings are no greater than predevelopment loadings.

COMMENT: Creation of swales along contours actually allow them to capture more stormwater and more effectively recharge the underlying aquifer. This strategy should be discussed as part of the project's "Sustainable Practices."

The DEIS states: "A maintenance plan will be developed for the stormwater BMPs. The plan will include the requirements for removal of the accumulated debris and sediment, maintaining vegetation, and performing inspections to insure that the BMPs are functioning properly."

COMMENT: It is good to see the need for ongoing maintenance addressed in an EIS, as it is rarely discussed. The FEIS shoud discuss who will fund the ongoing maintenance activities during each phase of the development.

The DEIS states: "The drainage design criteria will be to minimize any alterations to the drainage pattern of the existing onsite surface runoff. No additional runoff will be allowed to sheet flow toward Kealia Pond."

COMMENT: The DEIS should have a specific discussion of direct compliance with County regulations regarding the quality of the water retained on the site. As with the existing runoff into Waikapu stream, existing onsite surface runoff towards Kealia Pond presents an opportunity to re-engineer and turn to biological solutions that improve water quality, even though only newly created runoff is REQUIRED to be mitigated by the project.

Wastewater:

The DEIS states in the PER: According to the Wastewater Reclamation Division, County of Maui, as of July 31, 2014, the KWRF has a capacity of 7.9 million gallons per day (mgd). The average flow into the KWRF is 4.7 mgd and the allocated capacity is 6.33 mgd. **The remaining wastewater capacity at the KWRF is approximately 1.57 mgd.**

COMMENT: Who is the allocated capacity promised to? Will it actually be utilized as planned?

p. 20 of the PER states: "The policy of the DEM is that **wastewater capacity cannot be reserved until the project is ready to receive building permits.** If capacity at the KWRF is available at the time building permits are ready to be issued for the project, **the project proposes to temporarily connect to the County's sewer system and complete the required upgrades to connect up to 650 units in the Phase I development."**

COMMENT: Appendix A Table III-4 gives a total of 690 units, not 650 in Phase I of the WCT project. Table III-4 also accounts only for the 1433 primary units and not the 146 ohana units

anticipated at full buildout which would include the 46 units anticipated in Phase I. Does this mean that part of Phase I (40 units plus 46 ohana's) would not have sewer capacity until a new treatment facility is built? How would that possibility be structured in the project? Would it affect any of the affordable housing units?

The DEIS states**: "**The Waikapu Country Town development will need to construct a stand-alone private wastewater treatment facility or partner with other projects in the Waikapu area, such as A&B's Waiale project or the County of Maui to construct a regional wastewater treatment facility. The planning and design of a stand-alone or combined wastewater treatment facility will be coordinated with the availability of capacity within the County system. If required, a private wastewater treatment facility will be designed, constructed and in operation upon completion of the first home.

In addition to any capacity that may be available in the County's sewer system, the developers are looking into several private wastewater treatment facility alternatives. The first is a conventional wastewater treatment facility. This alternative generally involves liquids treatment consisting of preliminary treatment, flow equalization, primary sedimentation treatment, secondary biological treatment, secondary sedimentation treatment, disinfection, and disposal. The treatment of solids includes stabilization, dewatering, and disposal.

The second wastewater treatment alternative is to utilize a Food Chain Reactor (FCR) configuration, consisting of biological treatment in successive reactor zones utilizing fixed biomass on a combination of natural plant roots and engineered biofiber media, along with a limited amount of suspended biomass. This alternative generally involves pretreatment, secondary biological treatment through a FCR zone, process aeration, chemical phosphorus removal/coagulation, flocculation, disinfection and disposal."

COMMENT: The EIS is the place to examine the impacts, advantages, costs and benefits of the two wastewater treatment technologies mentioned, and any anticipated mitigations needed, but they are not analyzed, only mentioned. The DEIS is incomplete without some analysis of strategies for wastewater disposal. The County of Maui appears clear in that any preliminary hookups for the project in the County's Kahului facility would be on a temporary basis while a new onsite or regional facility is being built. The EIS must explore the topic in greater depth, since very expensive offsite upgrades would be required to hook into the county system.

The DEIS states: "The Waikapu Country Town development could construct a stand-alone private wastewater treatment plant near **the northeast corner of the project site after the maximum units is serviced by the County's wastewater system.** However, the treatment plant will be needed in about 2017 and the developers will continue to work with the County and other projects within the Waikapu area on a collaborative wastewater treatment facility. At the time the wastewater treatment plant is constructed, any units which temporarily connected to the County's wastewater system will be connected to the new wastewater treatment plant."

COMMENT: How can a project inform the Land Use Commission that it plans to begin construction in 2017 or 2018 while it has no finalized plans for wastewater treatment as of 2016? There are no DEIS maps indicating the potential Wastewater Treatment site in the project area. The NE corner is near a school and park. The FEIS should analyze the various alternative treatment plant locations available on the 1579 acre project site with regard to their advantages and impacts.

WATER

Comment: A water quality analysis is required in the project's engineering report to identify all contaminants. The DOH Clean Drinking water branch commented on this requirement. The engineering report needs to satisfy requirements of HAR11-20-29.
Public water sources must also undergo a source water assessment, but the DEIS does not address this.

p. 23 of the DEIS, PER states: "According to the Commission on Water Resource Management, the sustainable yield of the Waikapu aquifer is 3.0 million gallons per day. The three potable water wells have been approved by the State of Hawaii, Commission on Water Resource Management for a **total pumping capacity of 2,300 gallons per minute (gpm)."**

COMMENT: The EIS should explain to the reader that 2,300 gpm capacity of the well pumps is actually, 3.3 mgd, or somewhat greater than the total capacity of the Waikapu aquifer. The two non- potable wells appear to account for 1100 gpm of that capacity, but it is not made clear if these wells have chloride levels that would render them unusable for potable purposes or what the expected non-potable demand of the agricultural activities on the project's 1074 acres of ag land will be.

The EIS states: "Based on the water usage, the projected water projected average daily water demand for **Phase I is 311,033 gallons per day (gpd)**. In accordance with the DWSWSS, the maximum daily water demand is calculated as being 1.5 times the average daily demand, or 466,550 gpd. The projected average daily water **demand for Phase II is 334,475 gpd** and the maximum daily water demand 501,713 gpd. Irrigation of parks and open spaces will be provided by the non-potable water system."

COMMENT: The DEIS water use chart does account for the 146 ohanas in its usage figures, but there should be a discussion of a larger demand if additional ohana units were to be constructed over time on the 970 Single Family units plus 80 Rural dwellings. The water demands of the possible 300 units of the 201-H project also appear to be left out of the discussion. Also, as noted before, the water chart does not include any information on estimated non-potable ag water use or potable water use on the 227 acres of "Ag lots." The Hawaii State Department of Agriculture also requested more information on Ag water use on the 5 ag lots on the 227 acres; this should be provided.

Appendix M "Boundary Amendment Petition" was left blank in the electronic version of the DEIS. This should be corrected.

General spelling/typo errors

p. III-35 **TYPO**: Waikapū Properties LLC is also raising a heard of Texas Longhorn Cattle on the higher elevation agricultural lands.
ALSO III-36 Grazing of WCT Long-horn Cattle (4). A heard of approximately 200 Longhorn cattle are currently grazing the WCT's mauka agricultural lands. It is envisioned that a larger heard of cattle may be established on WCT lands not used for other diversified agricultural uses.

same page: MISSING WORD: Renewable Energy (6). Establishing one **or** more small solar farms may be considered if these farms are technically and economically viable and do not interfere with agricultural operations.

FIG 24 map of ag master plan should have acreages of parcels

p.III-38 TYPO: EU.1.d
Incorporate adequate **transmit** stops throughout the development

p. 292 (pdf) VII-8 typo missing word:
The Applicant will strictly adhere **to the _____ set** forth by the State Commission on Water Resources Management (CWRM) to ensure that the pumpage from the on-site wells remains well within the sustainable yield for the aquifer.

Mahalo for this opportunity to comment. We support the general intent of the project design and are looking forward to the additional information being supplied in the FEIS.

Albert Perez,
Executive Director
Maui Tomorrow Foundation, Inc.

PLANNING
CONSULTANTS
HAWAII, LLC
URBAN & REGIONAL PLANNING

Land Use Planning • Sustainability Services • Community Planning • Development Permits

December 12, 2016

Mr. Albert Perez
Executive Director
Maui Tomorrow

Dear Mr. Perez:

Re: **Draft Environmental Impact Statement** Prepared for the Proposed Waikapu Country Town Project in Waikapu, Maui, Hawaii; TMK Nos: (2) 3-6-002:001, (2) 3-6-002:003, (2) 3-6-4:003, (2) 3-6-004:006, (2) 3-6-005:007 and (2) 3-6-006:036.

Thank you for your letter dated March 30, 2016, regarding the Draft Environmental Impact Statement (DEIS) prepared for the above-referenced project. In response to your comments, please find the following:

1. ***Population Estimates.*** In response to a DEIS comment, the Market Study and Economic and Fiscal Impact Assessment report prepared by the Hallstrom Appraisal Group | CBRE, Inc. in July 2015 was updated to address an error in the calculation of the Project's population. After adjusting for the error it was determined that the Project's de facto population would be 3,866 persons[1], which is an increase of 355 persons over the earlier calculation contained in the DEIS. Moreover, the population impact from the Project's 146 Ohana units is also being incorporated into the Market Study. If it is assumed that the Ohana units will be occupied exclusively by residents and that the population multiplier per unit is equivalent to 1.5 persons per unit, then the Ohana units would increase the project population by an additional 219 persons.

[1] Assumes 85% of single- and multi-family units are occupied by residents and the remaining 15% are occupied by part-time residents. It is assumed that part-time residents occupy their units 25% of the time. The population multiplier per single-family unit is 3.2 persons per unit and for multi-family units it is 2.6 persons per unit. It is assumed that all Ohana units are occupied by residents. As such the calculation was made as follows: [(1050 * .85)*3.2] + [(1050 * (.15)*(3.2)*(.25)] + [383*.85)*2.6] + [(383*(.15)*(2.6) *(.25)] + (146*2.6)

2331 West Main Street, Wailuku, HI 96793 ▪ Ph. 808-244-6231
msummers@planningconsultantshawaii.com

Thus, the revised defacto population, including the 146 Ohana units, would be 4,085 persons and the revised resident population would be 3,922 persons. Using the revised population projection, the WCT's resident population impact represents approximately 9.93% to 18.51% of the region's projected resident population growth through 2035.

The average household size used for the WCT population forecast was 2.87 persons per unit, which is just higher than the 2010-2014 U.S. Census household size of 2.81 persons per unit for the Wailuku Census Designated Place (CDP). The WCT's estimate is slightly lower than the average occupancy of 2.94 persons per unit for Maui County, which is the figure that your letter references. Note that Section V.B.1, and other applicable sections, of the FEIS have been updated to address your comments.

2. ***Wastewater Treatment Site Location.*** Sections III.B.8, V.D.5, and Chapter VII of the FEIS have been updated to provide a thorough description of the WCT's preferred wastewater treatment facility. The analysis will includes a location map, description of the preferred location, alternatives to the preferred alternative, alternatives to the preferred location, and impacts from the facility.

3. ***Waiale Road Bypass Improvements.*** Please note that in response to comments from the County's Department of Public Works regarding the uncertainty of the timing of the Waiale Bypass road improvement, the FEIS includes an analysis of the traffic impacts and required mitigation measures at full buildout without the construction of the Waiale Bypass. This analysis is summarized in Section V.D.1 of the FEIS and incorporated in its entirety as Appendix M of the FEIS.

4. ***Final Water Quality Testing.*** Pump and water quality testing were recently completed on Well Nos. 1, 2 and 3 and the results are summarized in Section V.D.4 of the FEIS and incorporated in their entirety as Appendix I of the FEIS.

5. ***HC&S Agricultural Lands.*** In July 2016 HC&S notified the Applicant that it would no longer be leasing WCT agricultural lands. In response, WCT will be using those lands for diversified agricultural

production. Sections III.B.5, V.A.7 and V.D.4 of the FEIS have been updated to address the closure of HC&S.

6. ***Agricultural Preserve.*** The Agricultural Preserve will be dedicated in perpetuity to agricultural conservation once all of the entitlements for the WCT's proposed urban and rural lands are granted in accordance with the WCT Master Plan as described in Chapter III.B of the FEIS. It is anticipated that diversified agricultural development within the 800-acre Agricultural Preserve, as well as on the 277 additional acres of agricultural land to the north and west of the Preserve, will be ongoing through development of Phases I and II of the Project and in perpetuity thereafter. The WCT's Agricultural Preserve, and adjoining agricultural lands are shown conceptually in Section I, Figure 4 and in Section III.B.1, Figure 11, A-B and Section III.B.8, Figure 26, A-C of the FEIS.

7. ***Infrastructure and Public Facility Impacts from Ohana Units.*** The DEIS addressed the impact of the 146 Ohana units upon traffic, water and wastewater. Chapter V of the FEIS has been be updated to address the impacts of the Ohana units upon parks, police, fire, schools and solid waste. See Sections V.C.1, 2, 3, 4 and 5.

   For planning purposes, it was assumed that about 14 percent of the 1,050 single-family and rural lots would have Ohana units. It is possible that the Ohana units could be developed concurrently with the primary residence or at some undetermined future date by the individual property owner. Through the Project District Ordinance the number of Ohana units can be regulated by lot size, through a restriction to the permitted uses, by special use classification, or by a quota. However, it should be noted that Ohana units offer an important source of affordable housing on Maui, especially for seniors and young adults. Moreover, many of the infrastructure and public facility impacts associated with the development of Ohana units can be mitigated at the time of building permit application. Prior to the issuance of building permits impacts to water, wastewater, schools and parks can be mitigated through impact fees, or if warranted, by denial of the building permit due to insufficient infrastructure or public facilities. This is currently the practice of the County with respect to the issuance of water meters on many entitled lots within Central, South and Upcountry Maui. In any event, the impacts associated with

the development of the 146 Ohana units were largely documented in the DEIS, and where they were not documented, they have been documented in Chapter V of the FEIS.

8. ***Rental Housing***. The Applicant intends to incorporate rental housing within the project. However, the timing, quantity and location of the rental units are not known at this time.

9. ***201 H Affordable Housing Project***. Please note that a 201H project is not being contemplated at this time. The reference to the potential addition of a 300-unit affordable housing project will be removed from Appendix A, *Market Study, Economic Impact Analysis and Public Facilities Assessment*. However, the discussion of a 201 H project will remain in Chapter VIII, "Alternatives Analysis", of the FEIS.

10. ***Hiking Access into Waikapu Valley***. Public hiking access through the Project's agricultural lands into the Waikapu Valley will be carefully managed in order to mitigate land owner liability as well as impacts to natural and cultural resources. Access through the subject property by Native Hawaiians for the purpose of participating in cultural activities protected by State law will be maintained. Discussion with the Waikapu community will be ongoing to define appropriate management of public access into the valley once the Project is developed.

11. ***Agricultural Roads***. Chapter III.B.5 of the FEIS provides conceptual illustrations (Figure 26, A-C) of the agricultural roads within the 800-acre Agricultural Preserve.

12. ***Village Green***. The Village Green is intended to create a place of nature, beauty and open space within the center of the Village Center. It is envisioned that the green will be a popular public gathering place and will be suitable for a variety of formal and informal uses. The green is appropriately sized for this type of informal and passive recreational purpose.

13. ***Infrastructure Funding.*** As described in Chapter II.E of the FEIS and in Appendix A, "Market Study, Economic Impact Analysis, and Public Fiscal Assessment, the Applicant expects that the market will be strong enough to absorb the development within the 10-year schedule. Should the market demand be considerably weaker than projected, then the project schedule would be adjusted to meet the demand. Given the high up-front capital costs to develop the infrastructure to support the development, if market demand is too weak to support the Project's capital costs, then the Project as proposed would likely not be built.

14. ***Figure 29, Drainage Improvements.*** Please note that Figure 29 in the DEIS mistakenly repeated the proposed sewer improvements. This has been corrected in the FEIS. See Figures 34 and 36 of the FEIS.

15. ***Blackburn Sphinx moth Habitat.*** The Applicant will work closely with the Fish & Wildlife Service (FWS) to ensure that the project site is developed in a manner that complies with FWS guidance to minimize impacts to the Blackburn Sphinx moth. The Applicant does not anticipate any significant impact to the project design as FSW guidance allows for the removal of host plants pursuant established protocols.

16. ***Historic and Archaeological Resources.*** The Archaeological Inventory Survey (AIS) was prepared to address potential impacts associated with development of the WCT lands that are located within the Maui Island Plan's (MIP's) Urban and Rural Grown Boundaries. These lands comprise approximately 503 acres and are proposed for entitlement changes that would allow for their development. The agricultural lands beyond the Urban and Rural growth boundaries will remain in agricultural use as they have been actively farmed for over a century.

    The AIS was conducted for all lands proposed for development. The AIS also addressed traditional sites previously identified in adjoining lands and or near the project. These sites were discussed in significant detail in the Traditional and Historical Background and Previous Archaeology sections of the AIS. See Appendix E of the FEIS.

As described in the AIS, the Project's Area of Potential Effect is the lands that will undergo ground altering activities during development. These lands underwent pedestrian inspections and subsurface testing comprised of over 180 backhoe trenches (31 in 2007 and 150 in 2013) with primarily negative findings. Furthermore, the mauka most property along Waikapu Stream within TMK [2] 3-6-004:030 is to be developed utilizing only hiking trails and open space, which already currently exist, and thus minimal ground altering activities are anticipated; however, as noted, this area was subjected to 31 backhoe trenches in 2007. Note that these lands are to remain in agricultural use, are not subject to changes in land use entitlements, and will not be subject to urban or rural development.

Due to the extensive grubbing and grading activities which have occurred throughout the project area for the last 50 to 100 years, the likelihood of traditional surface historic properties was low. However the potential for subsurface cultural remains from the pre-Contact through the post-Contact period was low to high; thus extensive and intensive subsurface testing was initiated in preparing the AIS. The survey work of the project area (the proposed development areas) was well planned and executed and thus more than adequate. Monitoring is part of several mitigation strategies utilized to protect known and unknown historic properties and burials within a project area.

During the AIS work, informal discussions were performed with long-time landowners in the adjoining areas and with residents of Waikapu Town as it pertained to land use and archaeological issues. Since the Cultural Impact Assessment (CIA) for the project area was prepared and reviewed during the AIS procedures, formal interviews were not undertaken. See Appendix F, "Cultural Impact Assessment" of the FEIS.

17. ***Section VII-7-8 regarding Applicant "Commitments".*** As noted in the DEIS, the Applicant is committed to working with Waikapu community stakeholders to address concerns regarding sedimentation of the Waikapu Stream and how public access will be managed through the property and into the Waikapu watershed. In any event, access into the Waikapu Valley and along the Waikapu Stream will be available to Native Hawaiians in accordance with State law. The Applicant desires to work directly with stakeholders to identify

appropriate and mutually agreed upon commitments to address the access mangement issues.

18. Agricultural Lands and Potable Water Use.

- ***Future farm dwellings.*** The Maui Island Plan (MIP) directed 1,433 residential units, plus or minus ten percent, to the lands that comprise the WCT development. The DEIS states that the approximate 277 acres of agricultural lands not located within the 800-acre Agricultural Preserve may be subdivided into no more than five (5) agricultural lots. The potential potable water demand created by future farm dwellings on these lots were not accessed in the DEIS for the following reasons: 1) these lands are beyond the Project's urban and rural grown boundaries and are not included in the 1,433 units allocated to the development in the MIP; 2) there is no current proposal to subdivide these lands and build farm dwelling; and 3) a subdivision of these lands into agricultural lots can proceed independently of the WCT since the agricultural lands are already entitled.

  In any event, the WCT's proposed potable water system does have sufficient capacity to service these farm dwellings should they ever be built. It is estimated that the system's capacity will be approximately 3 million gallons per day (MGD) whereas the Project's estimated potable water demand is about 968,263 gallons per day (GPD). The agricultural water demand for all of the WCT's agricultural lands was estimated and incorporated into the Section V.D.4 of the FEIS.

- ***Irrigation of Agricultural Lands.*** Irrigation of the Project's agricultural lands will be from surface water from the Iao Stream via the Iao-Waikapu Ditch and Waikapu Stream via the South Waikapu Ditch and Waihee Ditch, which are operated by the Wailuku Water Company. These water sources, which are part of the larger surface water system known as the "Na Wai Eha", have been designated by the CWRM as a Surface Water Management Area. Before drawing water from the Na Wai Eha, a surface water use permit will be required from the CWRM, which has regulatory jurisdiction over the the Na Wai Eha. The Na Wai Eha has provided irrigation water to WCT's agricultural

lands, which were used historically for Kalo cultivation and thereafter for sugarcane and pineapple cultivation. In addition to Ditch water, the Applicant proposes to use agricultural wells and pump non-potable water that will be stored in agricultural reservoirs and also used for irrigation. The use of the agricultural wells will require a ground water use permit from the CWRM since the water would be drawn from the Waikapu Aquifer, which has been designated by the CWRM as a Ground Water Management Area.

An additional source of non-potable irrigation water will be recycled water from WCT's wastewater reclamation facility. Table 1 documents potential supply versus estimated WCT demand:

Table 1: WCT's Potential Non-potable Water Supply Versus its Projected Non-potable Irrigation Demand

Non-Potable Water Source	Estimated Historical Supply in MGD	Estimated Future Supply in MGD	Estimated WCT Demand in MGD	Surplus / Deficit in MGD
Ditch Water[2]	5.82[3]	5.82		
Pumped Well Water	N/A	Unknown		
Reclaimed Wastewater	N/A	.650		
TOTAL	5.82	6.47	3.42[4]	+3.05

[2] WCT's future use of ground water from the Iao and Waikapu Streams will require the issuance of a Surface Water Use Permit from the Commission on Water Resources Management. These permit requests have been filed but not yet issued.

[3] Based upon a water duty of 5408 gallons per acre per day (GAD). In the Na Wai Eha IIFS proceedings, the Commission on Water Resources Management determined that this was a reasonable daily water use requirement for sugarcane cultivation.

[4] Assumes a demand for 2.75 mgd to irrigate 1077 acres of agricultural lands based upon a water duty of 3400 GAD for diversified agriculture. This is the application rate used by the State Department of Agriculture for diversified crops. The estimate assumes that 75 percent of the crop land is being irrigated at any given time (1077*.75)*3,400 ≈ 2.75 MGD. Urban open space demand for non-potable irrigation water is estimated to be about 0.67 mgd.

As is shown in Table 1, it is expected that sufficient non-potable irrigation water will be available to irrigate the agricultural lands as well as the urban and rural open space lands.

Section V.D.4 of the FEIS has been updated to address your comments.

19. ***Acres in Agriculture.*** The agricultural lands comprise 1077 acres, of which 800-acres are within the Agricultural Preserve.

20. ***Monitor Well.*** The WCT water system is comprised of six (6) wells. Well Number 6 will be used as a monitoring well.

21. ***Acres for Parks.*** The County of Maui determines the required acres of parkland for a development based upon the following formula: [(Number of units minus three) * (500 square feet per unit)]. As such, if you add the 146 Ohana units to the 1,433 units proposed, the total acres required by the County for parks is 18.10 acres. As noted in the DEIS, there will be approximately 32.5 acres of active and passive park land, 80% more than required by the County. Moreover, an additional 50 acres of greenways and other open space elements are also planned within the WCT. Section V.C of the FEIS was updated to access any impact to public facilities, including parks, which might result from the projected change in the Project's population.

22. ***Elementary School Site.*** The State of Hawaii (DOE) requires both a land dedication as well as a construction fee to mitigate the Project's impact upon school facilities. The required land dedication for the project is 11.389 acres, whereas the Applicant is dedicating 12-acres to the State DOE. In addition to land, the State DOE will require a construction fee of approximately $2.6 million from the Applicant. Section V.C.5 of the FEIS discusses the WCT's Educational Contribution Agreement (ECA) that is in the process of being consummated between the Applicant and the DOE.

23. ***Single- and Multi-Family Workforce Housing.*** The precise mix of single- and multi-family units that will be offered for sale as Workforce

Housing units, in accordance with the provisions of MCC Chapter 2.96, has not been determined.

24. ***Acres in Agriculture.*** The acreages shown in the Preliminary Engineering Report (PER) have been revised and the updated report included in the FEIS as Appendix H. As noted in the DEIS, the WCT urban and rural development will comprise approximately 499 acres and the agricultural lands will comprise about 1,077 acres.

25. ***Runoff from Agricultural Lands into the Waikapu Stream.*** As noted, the Applicant is committed to working with Waikapu community stakeholders to address concerns regarding stormwater runoff from the agricultural lands that may be contributing to sedimentation of the Waikapu Stream. The implementation of on-site low impact development techniques (LID's) may help to mitigate these concerns. LID's that may be feasible along the upper reaches of the Waikapu Stream include: 1) a landscaped buffer and or riparian zone adjacent to the stream that is planted with vegetation to promote filtration and infiltration; 2) grass swales; and 3) bio-retention systems. All of these techniques are proven to promote infiltration and filtration of groundwater. The Applicant intends to consult with Waikapu stakeholders, including WCT and Kuleana farmers and cultural practitioners, to identify appropriate and mutually agreed upon commitments to address these issues. Sections III.B and V.D.3 of the FEIS describe the Project's drainage BMP's, including measures that might further mitigate sedimentation of the upper reaches of the Waikapu Stream from on-going agricultural activities.

26. ***On-site Runoff Calculation.*** The total increase in post-development runoff volume for Phase I, both mauka and makai of Honoapiilani Highway, is 920,879 cubic feet. This includes 148,916 cubic feet for Phase I mauka and 771,963 cubic feet for Phase 1 makai. Section V.D.3 of the FEIS documents the increase in runoff created by the Project.

27. ***Post-Construction Water Quality Goals and Standards.*** The Project's drainage system will be designed to meet the County's drainage and water quality standards. BMPs will consist of grassed swales and retention basins sized adequately to promote infiltration and filter pollutants to meet water quality standards. Other Low Impact

Development Techniques (LID's) will also be explored to help reduce runoff volumes, promote infiltration and filtration of groundwater. Some of these measures may include promoting rain gardens, the use of rain barrels, developing green roofs, and use of permeable paving surfaces, where appropriate, within residential, commercial, and institutional developments. The Applicant will also explore the opportunity of utilizing bio-retention swales with native plantings at appropriate locations within the street network to reduce and filter stormwater runoff and to take advantage of natural drainage for irrigation. Sections III.B and V.D.3 of the FEIS describe the Project's drainage BMP's.

28. ***Funding of Drainage Program Maintenance Activities.*** The funding of on-site programs to maintain the Project's stormwater BMP's will be the responsibility of an association of WCT property owners. However, the funding of stormwater BMP's for infrastructure that is dedicated to the public will be the responsibility of the State or County agencies receiving those facilities.

29. ***Biological Solutions to Improve Water Quality.*** Section III.B.6, "Sustainability Plan" and Section V.D.3, "Drainage" of the FEIS incorporate further discussion regarding the use of biological solutions to improve the quality of stormwater runoff.

30. ***KWRF Wastewater Allocation.*** According to the Department of Environmental Management's Wastewater Division, the difference between the average flow into the KWRF and the allocated capacity is to accommodate for peak flow events. The Applicant understands that the remaining 1.57 mgd of wastewater capacity is intended to service infill development within the County's existing wastewater service area.

31. ***Assessment of Wastewater Treatment Facility.*** In response to comments from the Department of Environmental Management stating that the WCT will not be allowed to treat its wastewater at the Kahului Wastewater Reclamation Facility (KWWRF) because of insufficient capacity, the Applicant has decided to construct a private wastewater reclamation facility on-site. Sections III.B.8, V.D.5 and Chapter VIII of the FEIS include a thorough description of the

preferred treatment facility and its alternatives, location, potential impacts, and mitigation measures.

32. ***Water Quality Analysis.*** The results of pump and water quality tests for three of the six on-site wells were completed in August 2016. The test results are summarized in Section V.D.4 of the FEIS and incorporated into the FEIS as Appendix I. Regarding water quality, water samples were collected from the pumping wells and tested by Eurofins Analytical, an approved lab, for testing of water from new potable water sources as required by the Hawaii Department of Health. The overall results for the three wells showed no pesticides or other organic chemicals present, and all other contaminants tested were non-detectable or below maximum contaminant levels (MCL).

33. ***Potable and Non-Potable Water Demand.*** A total of six wells have been drilled on WCT lands and their locations are shown in Section 5.D.4 of the FEIS. The DEIS Pump Test results were conducted for Well Nos. 1, 2 and 3. The 10-day Pump Test results show that Well No. 1 has a sustainable pumping capacity of 1.39 mgd or more with good water quality. Well No. 2 was shown to have a sustainable pumping capacity of 1.03 mgd, or more, producing good water quality. Well No. 3 was demonstrated to have a sustainable pumping capacity of less than 1.07 mgd, but additional testing is required to determine Well No. 3's sustainable pumping capacity with regard to chlorides. Well's 4, 5, and 6 have not been fitted with permanent casings and were not tested. Well 6 is intended to serve as a monitoring well.

As noted, Well Numbers 1 and 2 has a sustainable pumping capacity 2.42 mgd, producing excellent water quality. The Applicant expects that when all wells are developed the wells will be able to sustainably produce at least 3.0 mgd from the Waikapu Aquifer. It should be noted that the Waikapu Aquifer is within a designated Ground Water Management Area. The Commission on Water Resource Management (CWRM) regulates the use waters within Water Management Areas. Any use by the WCT of water from the Waikapu Aquifer will require prior approval of the CWRM. The CWRM will not permit pumping from the aquifer to exceed its sustainable yield.

Number 18 addressed previously in this letter documents the WCT's projected non-potable water demand and its proposed non-potable water supply. Section V.D.4, and other applicable sections, of the FEIS has been updated to address your comments.

34. ***Appendix M, Boundary Amendment Petition.*** The Applicant has confirmed that *Appendix M, Boundary Amendment Petition,* of the DEIS was made part of the downloadable electronic versions of the Land Use Commission's (LUC's) and Hawaii Office of Environmental Quality Control's (OEQC's) DEIS reports.

35. ***General Spelling/Typo. Errors.*** The Applicant appreciates your thorough review and interest in the DEIS. The FEIS addresses the spelling and typo errors you have identified in the DEIS.

The WCT's Final Environmental Impact Statement (FEIS) can be downloaded from the State Office of Environmental Quality Control's (OEQC's) website and the State Land Use Commission's website. The document may also be downloaded from www.waikapu.com. Thank you very much for your interest in this important Central Maui project. Should you have any questions, please contact me at (808) 269-6220 or by e-mail at msummers@planningconsultantshawaii.com.

Sincerely yours,

Michael J. Summers

Michael J. Summers
President

Attachment
c: Mr. Michael Atherton
Mr. Albert Boyce