Final Environmental Assessment

PROPOSED CENTRAL MAUI LANDFILL FACILITIES PROJECT, PU'UNĒNĒ, MAUI, HAWAI'I
(TMK (2)3-8-003:019 (por.))

VOLUME II OF II APPENDICES

Prepared for:

County of Maui,

Department of Environmental Management

July 2019

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MUNEKIYO HIRAGA

Planning. Project Management. Sustainable Solutions.

Final Environmental Assessment

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MUNEKIYO HIRAGA

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STATE SPECIAL PERMITS

SP 86-359

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAII

In the Matter of the Petition of COUNTY OF MAUI DEPARTMENT OF PUBLIC WORKS For a Special Permit to Establish a sanitary landfill, weigh station and access road on approximately 55 acres in the Agricultural District at Puunene, Wailuku, Maui, Tax Map Key Nos.: 3-8-03: 18, 19 and Portion of 4	SP86-359 - COUNTY OF MAUI DEPARTMENT OF PUBLIC WORKS

This is to certify that this is a true and correct copy of the Decision and Order on file in the office of the State Land Use Commission, Honolulu Hawaii.

JUL 2 1 1986 by
Date Executive Officer

FINDINGS OF FACT, CONCLUSIONS OF LAW
AND DECISION AND ORDER

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAII

In the Matter of the Petition of COUNTY OF MAUI DEPARTMENT OF PUBLIC WORKS For a Special Permit to Establish a sanitary landfill, weigh station and access road on approximately 55 acres in the Agricultural District at Puunene, Wailuku, Maui, Tax Map Key Nos.: 3-8-03: 18, 19 and Portion of 4	SP86-359 - COUNTY OF MAUI DEPARTMENT OF PUBLIC WORKS

FINDINGS OF FACT, CONCLUSIONS OF LAW AND DECISION AND ORDER

The County of Maui Department of Public Works initiated this proceeding pursuant to Section 205-6, Hawaii Revised Statutes, as amended, and Part IX of the Land Use commission's Rules of Practice and Procedure. The Land Use Commission, (hereinafter the "Commission") having considered the entire record on this matter, hereby makes the following findings of facts and conclusions of law:

FINDINGS OF FACT

General Description

1. The Commission received the record of the County of Maui Department of Public Works (hereinafter the "Petitioner") petition for a Special Permit from the County of Maui Planning Department on April 23, 1986.

2. Under the Special Permit, Petitioner proposes to establish a sanitary landfill, weigh station and access road (hereinafter the "Project") consisting of approximately 55 acres, in the State Land Use Agricultural District in Central Maui, near the town of Puunene, approximately one-quarter mile northeast of Pulehu Road and adjacent to the eastern side of Kalialinui Gulch.

3. The Project site is identified as Maui Tax Map Key Nos. 3-8-03:18, 19 and portion of 4 at Puunene, Wailuku, (hereinafter the "Property").

4. Petitioner proposes to situate the proposed Project within a portion of an existing quarry site now operated by Ameron HC&D under Land Use Commission Special Permit Docket No. SP77-271 approved on August 24, 1977. Petitioner proposes to obtain a release for a portion of the existing special permit from Ameron HC&D in order to establish the proposed Project.

5. Petitioner is currently negotiating the purchase or lease of the Property from Alexander and Baldwin, Inc. who is the fee owner.

6. Petitioner has determined that a new sanitary landfill site is needed for the Island of Maui to replace the existing Waikapu, Makani and Olowalu Landfills which have exceeded or are near capacity. The proposed Project will have a capacity to accommodate all landfill needs now being met by the Waikapu, Olowalu and Makani Landfills to 1998.

7. Access is currently provided by an existing quarry road off of Pulehu Road. Petitioner proposes to improve the existing quarry road, except two bridges which cross gullies, into a two-lane paved roadway. Petitioner estimates approximately 500 vehicles per day will use the road in 1987 and increasing to 700 vehicles per day by 1995.

8. Petitioner proposes to open the landfill in 1987 and operate the landfill 8 hours a day, 7 days a week. Two heavy equipment operators, a scale operator and utility person will man the facility.

9. During the operating day, Petitioner proposes to accept conventional refuse and limited special waste including demolition waste and bulky waste. Sludge generated by sewage treatment plants and animal remains will also be accepted. These wastes will be handled in a separate manner. Petitioner will not accept hazardous waste including toxic chemical and radioactive waste.

10. The Property's soil type are "Waiakoa silty clay loam" and "Rockland". Actual quarrying uncovered a 5 to 6 feet layer of topsoil, a layer or rock 40 feet thick below, and a cinder base underlying the rock layer.

11. The Land Study Bureau rates the Property in the vicinity of Kalialinui Gulch as "E" and the land adjacent to the gulch and currently in sugarcane as "A".

12. The proposed Project is not indicated on the County Wailuku-Kahului General Plan. However, Petitioner states that the proposed Wailuku-Kahului Community Plan, which will replace the General Plan, recommends a study to address County-wide solid waste management.

13. The Property is bounded by sugarcane fields to the north and east, existing rock quarry and cane fields to the south, and Kalialinui Gulch to the west.

14. The Property is not within the Department of Health's Underground Injection Project area.

15. The nearest municipal ground water source is in Wailuku approximately seven miles northwest of the Property.

16. Petitioner believes the Property is not subject to serious drainage problems as on-site storm generated runoff sheet flows throughout the Property. Kalialinui Gulch also does not experience serious flooding near the Property.

17. There are no known significant archaeological or historic sites associated with the Property. An old Japanese cemetery exists on the quarry site and has been continually maintained by the quarry operators. However, this cemetery is not within the Property.

18. The Property's vegetation include sparse growth of koa haole, kiawe bushes, and some grasses. Vegetation in Kalialinui Gulch include kiawe, klu, pili grass and koa haole.

19. Animals observed on the Property include rodents, mongoose, and common birds. Barn owls may roost in crevices of the quarry walls.

Environmental Concerns

20. Petitioner pointed out that leaching, or the transmission of pollutants by slow moving groundwater or percolation, is a potential adverse effect of the proposed landfill. Petitioner proposes to establish a fairly impervious floor and sides so as to not allow seepage into the ground in addition to installing perforated leachate collection pipes on the landfill floor to collect any leachate. Petitioner proposes to reapply the liquid effluent on top of the landfill for evaporation into the atmosphere and further filtration.

21. Petitioner's Final Environmental Impact Statement (EIS) for the proposed Project was accepted by the Mayor of Maui County on April 8, 1986. The EIS included a summary of probable impacts, probable adverse environmental effects and proposed mitigation measures, alternatives to the proposed action, irreversible and irretrievable commitments of resources, summary of unresolved issues, and other matters as required by Chapter 343, HRS.

Conformance to Special Permit Guidelines

22. The use of an existing quarry site provides a logical and economic location for a sanitary landfill. Upon the closing of the landfill, the land could be utilized for

agricultural production. As such, establishment of a sanitary landfill at the Property is not contrary to the objectives sought to be accomplished by the Land Use Law and Regulations.

23. Petitioner states that the proposed Project will utilize fencing for security purposes and to keep refuse away from surrounding uses. Petitioner believes that the Property is far enough from populated areas to mitigate impacts of odors, dust, noise vector, and leachate.

24. The proposed use would not unreasonably burden public agencies to provide roads and streets, sewers, water, drainage and school improvements, and police and fire protection.

25. Unusual conditions, trends and needs have arisen since the district boundaries and regulation were established. Petitioner believes that in the context of the use, the Project which is within the State Agricultural District is an appropriate one.

26. The existing quarried portion of the Property is not a productive agricultural site unless it is reclaimed and restored for agricultural use. As current site conditions indicate, the site is not conducive to production nor is it economical to restore it at this time. Hence, the site is unsuited for uses permitted within the Agricultural District.

County Recommendation

27. The Maui Planning Commission conducted a hearing on the subject Special Permit on April 8, 1986. At its meeting of

April 8, 1986, the Commission voted to recommend approval of the Special Permit subject to the following twelve conditions:

" 1. That the adjacent Kalialinui Gulch shall not be disturbed by the activities of the sanitary landfill with the exception of drainage from storm generated runoff.

" 2. That appropriate monitoring of the quality of water to be discharged into Kalialinui Gulch from drainage basins shall be undertaken to assure that toxic wastes are not part of the discharge.

" 3. That in the preparation of the sanitary landfill, the landfill floor shall be further compacted and be made relatively impervious to water in order to contain leachates. Proper disposal methods of leachates shall be installed within the landfill.

" 4. That a traffic assessment shall be developed to determine the impact on Pulehu Road once the sanitary landfill is operating. This assessment shall be completed no later than one year after said landfill is in operation. Findings of the assessment shall be submitted to the County of Maui's Department of Planning for review.

" 5. That the applicant shall stop work on the sanitary landfill and immediately contact the Department of Land and Natural Resources, Historic Sites Division, in the event that any previously unidentified historic, archaeological or cultural sites are encountered.

" 6. That appropriate internal vehicle circulation patterns shall be designed so as to not cause confusion and congestion within the sanitary landfill.

" 7. That full compliance with the requirements of the State's Department of Health for sanitary landfill operation shall be rendered.

" 8. That appropriate rules shall be established to prohibit scavenging within the sanitary landfill.

" 9. That appropriate mitigative measures to control excessive dust generation shall be implemented.

"10. That provisions shall be enacted to ensure emergency access to the sanitary landfill in case of fire or any other disaster.

"11. That warning signs shall be clearly posted near all entry points of the landfill to indicate any blasting activity on the adjacent rock quarry.

"12. That full compliance with any other applicable government requirements shall be met."

CONCLUSIONS OF LAW

The proposed use is an "unusual and reasonable" use as defined by Chapter 205-6, Hawaii Revised Statutes and the proposed use is not contrary to the objectives sought to be accomplished by the State Land Use Law and Regulation in that it could further the purpose of the Land Use Law to preserve, protect and encourage the development of lands in the State for

those uses to which they are best suited in the interest of the public health and welfare.

ORDER

IT IS HEREBY ORDERED that Special Permit Docket No. 86-359 for the establishment of a sanitary and fill, weigh station and access road on approximately 55 acres of land situated in the State Land Use Agricultural District at Puunene, Wailuku, Maui, Tax Map Key Nos. 3-8-03: 18, 19 and portion of 4, and approximately identified on Exhibit A attached hereto and incorporated by reference herein, be approved subject to the twelve conditions imposed by the Maui County Planning Commission and the following additional condition:

13. Petitioner will submit to the Commission a letter from Ameron HC&D requesting an amendment to the Special Permit issued under Docket No. SP77-271 to delete a portion of land consisting of the Property, currently approved for quarrying purposes, for the establishment of the Project, pursuant to Section 205-6, Hawaii Revised Statutes.

DOCKET NO. SP86-359 - COUNTY OF MAUI, DEPARTMENT OF PUBLIC WORKS

Done at Honolulu, Hawaii, this 21st day of July 1986, per motion on May 14, 1986.

LAND USE COMMISSION
STATE OF HAWAII

By _____
TEOFILO PHIL TACBIAN
Chairman and Commissioner

By _____
FREDERICK P. WHITTEMORE
Vice Chairman and Commissioner

By _____
RICHARD B. F. CHOY
Commissioner

By _____
ROBERT S. TAMAYE
Commissioner

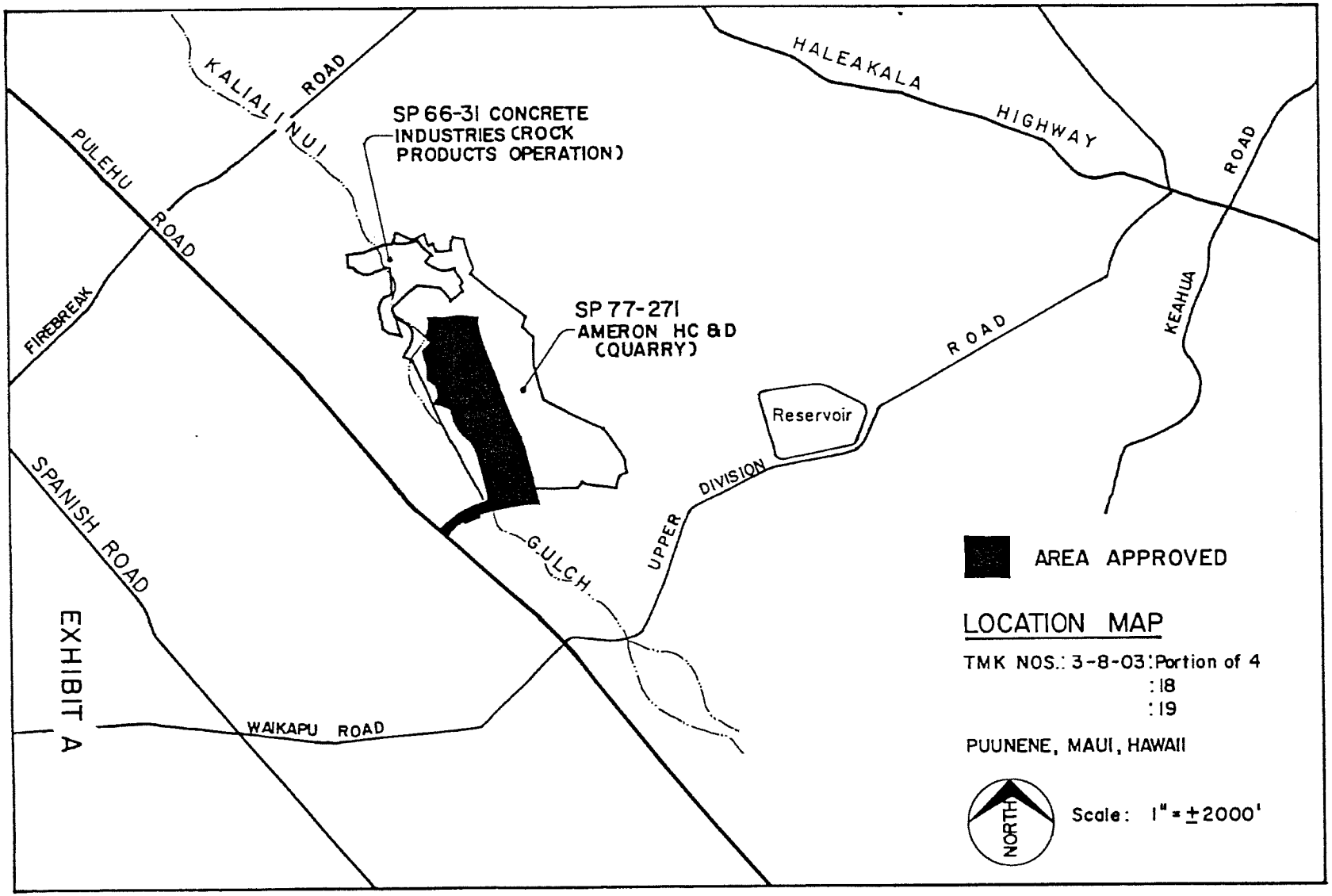
By _____
WINONA E. RUBIN
Commissioner

By _____
LAWRENCE F. CHUN
Commissioner

By _____
WILLIAM W. L. YUEN
Commissioner

By _____
EVERETT L. CUSKADEN
Commissioner

By _____
TORU SUZUKI
Commissioner


KALIALINUI ROAD
HALEAKALA HIGHWAY
ROAD
SP 66-31 CONCRETE INDUSTRIES (ROCK PRODUCTS OPERATION)
PULEHU ROAD
FIREBREAK
SP 77-271 AMERON HC & D (QUARRY)
KEAHUA
ROAD
Reservoir
UPPER DIVISION
SPANISH ROAD
GULCH
EXHIBIT A
WAIKAPU ROAD
AREA APPROVED
LOCATION MAP
TMK NOS.: 3-8-03: Portion of 4
: 18
: 19
PUUNENE, MAUI, HAWAII
NORTH
Scale: 1" = ±2000'

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAII

In the Matter of the Special Permit of	)	
COUNTY OF MAUI, DEPARTMENT OF PUBLIC WORKS	)	DOCKET NO. SP86-359
To Allow a Sanitary Landfill on Approximately 55 Acres of Land Situated Within the State Land Use Agricultural District at Puunene, Wailuku, Maui	)	COUNTY OF MAUI, DEPT. OF PUBLIC WORKS

CERTIFICATE OF SERVICE

I hereby certify that a copy of the Land Use Commission Decision and Order was served upon the following by either hand delivery or depositing the same in the U. S. Postal Service by certified mail:

CHRISTOPHER L. HART, Planning Director
Planning Department
County of Maui
250 South High Street
Wailuku, Hawaii 96793

ALVIN FUKUNAGA, Director
Department of Public Works
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dated: Honolulu, Hawaii this 21st day of July 1986.

ESTHER UEDA
Executive Officer

1st Amendment

County

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI'I

In The Matter Of The Application Of	)	DOCKET NO. SP86-359
	)	
COUNTY OF MAUI DEPARTMENT OF PUBLIC WORKS	)	DECISION AND ORDER APPROVING AN AMENDMENT TO A SPECIAL USE PERMIT
	)	
For A Special Use Permit To Establish A Sanitary Landfill, Weigh Station, And Access Road On Approximately 55 Acres Of Land In The Agricultural District At Pu`unene, Wailuku, Maui, Tax Map Key: 3-8-03: 18, 19, And Portion Of 4	)	

DECISION AND ORDER APPROVING AN AMENDMENT TO A SPECIAL USE PERMIT

This is to certify that this is a true and correct copy of the document on file in the office of the State Land Use Commission, Honolulu, Hawaii.

JAN - 9 2006 by _____
Date Executive Officer

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI'I

In The Matter Of The Application Of	)	DOCKET NO. SP86-359
	)	
COUNTY OF MAUI DEPARTMENT OF PUBLIC WORKS	)	DECISION AND ORDER APPROVING AN AMENDMENT TO A SPECIAL USE PERMIT
	)	
For A Special Use Permit To Establish A Sanitary Landfill, Weigh Station, And Access Road On Approximately 55 Acres Of Land In The Agricultural District At Pu`unene, Wailuku, Maui, Tax Map Key: 3-8-03: 18, 19, And Portion Of 4	)	

DECISION AND ORDER APPROVING AN AMENDMENT TO A SPECIAL USE PERMIT

On March 15, 2005, the County of Maui Department of Public Works and Environmental Management ("Applicant") (fka the Department of Public Works) filed a written request on behalf of Pacific Biodiesel, Inc., the subcontractor to the County of Maui's biosolids and greenwaste co-composting contractor, Maui EKO Systems, with the County of Maui Department of Planning ("DP") to amend the special use permit issued in the above-entitled docket pursuant to section 205-6, Hawai`i Revised Statutes ("HRS"), and sections 15-15-95 and 15-15-96, Hawai`i Administrative Rules ("HAR"). The Applicant requested that the special use permit issued pursuant to Findings of Fact, Conclusions of Law and Decision and Order ("Decision and Order") dated July 21, 1986, be amended to include the processing of special waste into marketable materials,

such as biodiesel and compost, as an additional permitted use on approximately 10 acres of land, identified as Tax Map Key: 3-8-03: por. 19 ("Property")[1], within Phase III of the Central Maui Sanitary Landfill ("Request").[2]

The Commission has jurisdiction over the Applicant's Request. Section 205-6, HRS, and sections 15-15-95 and 15-15-96, HAR, authorize this Commission to approve special use permits and amendments thereto for areas greater than 15 acres.

On May 24, 2005, the County of Maui Planning Commission ("Planning Commission") conducted a hearing on the Applicant's Request. There was no public testimony provided on the Request. After due deliberation, the Planning Commission recommended approval of the Applicant's Request to this Commission.

On July 21, 2005, the Commission received a copy of the decision and a portion of the record of the Planning Commission's proceedings on the Applicant's Request. On November 2, 2005, the Commission received the remaining portion of the record.

On December 1, 2005, the Commission met in Kahului, Maui, Hawai`i, to consider the Applicant's Request. Elaine Baker appeared on behalf of the Applicant.

---

[1] Due to the consolidation and resubdivision of the tax map key parcels following the issuance of the Decision and Order, the special use permit area is now identified as Tax Map Key: 3-8-03: 19.

[2] The Applicant originally requested to amend Condition Number 9 of the Decision and Order. To the extent that said condition pertained to the implementation of appropriate mitigative measures to control excessive dust generation, the Land Use Commission ("Commission") staff advised the Applicant through the DP's comment and recommendation process that the request should be restated to include the recycling operation as an additional use under the special use permit.

Jane Lovell, Esq., and Kivette Caigoy appeared on behalf of the DP. John W. K. Chang, Esq., and Abe Mitsuda also were present on behalf of the State Office of Planning ("OP").

At the meeting, Ms. Caigoy was asked to respond to the issue of the Applicant's conditional permit for the recycling operation on the Property. She pointed out that subsequent to the Planning Commission's action on the Applicant's Request, it was determined that the Property was not in the Agricultural Zoning District as previously thought but in the Interim Zoning District, and therefore a conditional permit was not applicable. She added that the DP was working with the Applicant to obtain a use variance permit.

Upon further discussion, the Commission raised questions in regard to the comments from the State Commission on Water Resource Management dated April 7, 2005, which expressed concerns about the potential for ground or surface water degradation/contamination and recommended that approvals for the Applicant's Request be conditioned upon a review by the State Department of Health ("DOH") and the Applicant's acceptance of any resulting requirements related to water quality. Ms. Baker responded that since 1995, the Applicant has tested the groundwater on a quarterly and biannual basis for volatiles and standard constituents and submitted reports to the DOH, which regulates landfills including the issuance of operating permits and the monitoring of groundwater. She added that several factors contributed

to the protection of the groundwater, including the depth of the aquifer, the density of the basalt layer overlying the aquifer, and surface containment. With respect to surface water, Ms. Baker noted that a National Pollutant Discharge Elimination System permit had been issued for the landfill. She further noted that the landfill has retention pond capacity and has not discharged stormwater for nine years.

The OP stated that it had no objections to the Applicant's Request. Upon questioning by the Commission, the DP stated that it had no objections to the conditions recommended in the Commission's staff report on the Applicant's Request.[3]

Thereafter, a motion was made and seconded to approve the Applicant's Request, subject to the following additional conditions to the Decision and Order dated July 21, 1986:

14. Permitted activities shall include the processing of special waste into marketable materials, such as biodiesel and compost, as an additional use under the special use permit.

15. That the Applicant shall satisfy the County of Maui Department of Water Supply standards for fire protection.

16. That security safety measures including, but not limited to, the methanol tanks, onsite catalyst, and lab container shall be implemented due to the type of products used and produced onsite.

[3] The staff report recommended that the Applicant's Request be subject to additional conditions based, in part, on the comments of the County of Maui Department of Water Supply, Police Department, and the Department of Fire and Public Safety on the Applicant's Request and its previous conditional permit application.

17. That a combustible liquid tank permit shall be acquired and maintained, as necessary.

18. That the Applicant shall timely provide without any prior notice, annual reports to the Commission and the County of Maui Department of Planning in connection with the status of the uses approved under the special use permit and the Applicant's progress in complying with the conditions imposed herein. The annual report shall be submitted in a form prescribed by the Executive Officer of the Commission.

Following deliberation by the Commissioners, a vote was taken on the motion. There being a vote tally of 7 ayes, 0 nays, and 1 absent, the motion carried.

ORDER

Having duly considered the complete record of the Applicant's Request and the oral arguments presented by the parties present in the proceeding, and a motion having been made at a meeting on December 1, 2005, in Kahului, Maui, Hawai`i, and the motion having received the affirmative votes required by section 15-15-13, HAR, and there being good cause for the motion, this Commission hereby APPROVES the Applicant's Request, subject to the following additional conditions to the Decision and Order dated July 21, 1986:

14. Permitted activities shall include the processing of special waste into marketable materials, such as biodiesel and compost, as an additional use under the special use permit.

15. That the Applicant shall satisfy the County of Maui Department of Water Supply standards for fire protection.

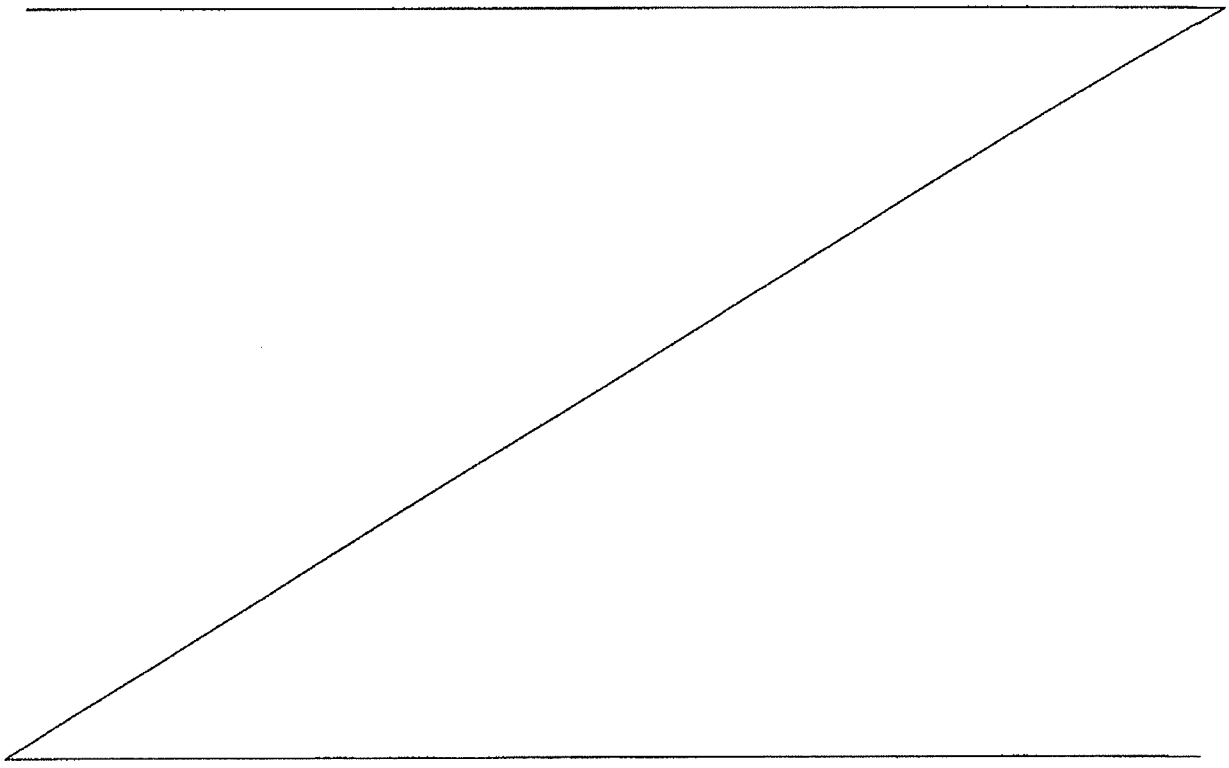
16. That security safety measures including, but not limited to, the methanol tanks, onsite catalyst, and lab container shall be

implemented due to the type of products used and produced onsite.

17. That a combustible liquid tank permit shall be acquired and maintained, as necessary.

18. That the Applicant shall timely provide without any prior notice, annual reports to the Commission and the County of Maui Department of Planning in connection with the status of the uses approved under the special use permit and the Applicant's progress in complying with the conditions imposed herein. The annual report shall be submitted in a form prescribed by the Executive Officer of the Commission.

All other conditions to the Decision and Order dated July 21, 1986, are hereby reaffirmed and shall continue in effect.



ADOPTION OF ORDER

The undersigned Commissioners, being familiar with the record and proceedings, hereby adopt and approve the foregoing ORDER this 9th day of January, 2006. This ORDER and its ADOPTION shall take effect upon the date this ORDER is certified and filed by this Commission.

Done at Honolulu, Hawai`i, this 9th day of January, 2006, per motion on December 1, 2005.

APPROVED AS TO FORM

Deputy Attorney General

LAND USE COMMISSION
STATE OF HAWAI`I

By
RANDALL F. SAKUMOTO
Chairperson and Commissioner

By
STEVEN LEE MONTGOMERY
Vice-Chairperson and Commissioner

By
LISA M. JUDGE
Vice-Chairperson and Commissioner

By (absent)
THOMAS CONTRADES
Commissioner

By
MICHAEL D. FORMBY
Commissioner

By
KYONG-SU IM
Commissioner

By
DUANE KANUHA
Commissioner

By
RANSOM PIETZ
Commissioner

Filed and effective on
JAN - 9 2006

Certified by:

ANTHONY J. H. CHING

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI'I

In The Matter Of The Application Of	)	DOCKET NO. SP86-359
	)	
COUNTY OF MAUI DEPARTMENT OF PUBLIC WORKS	)	CERTIFICATE OF SERVICE
	)	
For A Special Use Permit To Establish A Sanitary Landfill, Weigh Station, And Access Road On Approximately 55 Acres Of Land In The Agricultural District At Pu'unene, Wailuku, Maui, Tax Map Key: 3-8-03: 18, 19, And Portion Of 4	)	

CERTIFICATE OF SERVICE

I hereby certify that a copy of the Decision And Order Approving An Amendment To A Special Use Permit was served upon the following by either hand delivery or depositing the same in the U. S. Postal Service by regular or certified mail as noted:

DEL. LAURA THIELEN, Director
Office of Planning
P. O. Box 2359
Honolulu, Hawaii 96804-2359

JOHN CHANG, Esq.
Deputy Attorney General
Hale Auhau, Third Floor
425 Queen Street
Honolulu, Hawaii 96813

MICHAEL FOLEY, Director
County of Maui, Planning Department
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Wailuku, Hawaii 96793

BRIAN MOTO, Esq.
JANE LOVELL, Esq.
Corporation Counsel
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Honolulu, Hawai`i, JAN - 9 2006.

ANTHONY J. H. CHING
Executive Officer

SP 97-390

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAII

In the Matter of the Petition of DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT, SOLID WASTE DIVISION, COUNTY OF MAUI For a Special Permit to Establish and Operate an Expansion to the Central Maui Sanitary Landfill on Approximately 29.340 Acres of Land Situated Within the State Land Use Agricultural District at Puunene, Maui, Hawaii; TMK: 3-8-03: portion of 4	DOCKET NO. SP97-390 FINDINGS OF FACT, CONCLUSIONS OF LAW, AND DECISION AND ORDER

This is to certify that this is a true and correct copy of the Decision and Order on file in the office of the State Land Use Commission, Honolulu Hawaii.

JUL 2 1 1997 by
Date Executive Officer

LAND USE COMMISSION
STATE OF HAWAII
1997 JUL 21 A 9:09

FINDINGS OF FACT, CONCLUSIONS OF LAW, AND DECISION AND ORDER

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAII

In the Matter of the Petition of DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT, SOLID WASTE DIVISION, COUNTY OF MAUI For a Special Permit to Establish and Operate an Expansion to the Central Maui Sanitary Landfill on Approximately 29.340 Acres of Land Situated Within the State Land Use Agricultural District at Puunene, Maui, Hawaii; TMK: 3-8-03: portion of 4	)	DOCKET NO. SP97-390 FINDINGS OF FACT, CONCLUSIONS OF LAW, AND DECISION AND ORDER

FINDINGS OF FACT, CONCLUSIONS OF LAW, AND DECISION AND ORDER

The Department of Public Works and Waste Management, Solid Waste Division, County of Maui (hereinafter "Applicant") initiated this proceeding pursuant to Section 205-6, Hawai'i Revised Statutes (hereinafter "HRS"), as amended, and Subchapter 12, Chapter 15-15, Hawai'i Administrative Rules (hereinafter "HAR"). The Land Use Commission (hereinafter "LUC"), having considered the entire record on this matter, hereby makes the following findings of fact, conclusions of law, and decision and order:

FINDINGS OF FACT

PROCEDURAL MATTERS

1. The Special Permit Application (hereinafter "Application") for establishment and operation of an expansion of the Central Maui Sanitary Landfill on approximately 30 acres at

Puunene, Maui, was filed by the Applicant with the County of Maui Planning Department (hereinafter "Planning Department") on August 12, 1996.

2. On January 28, 1997, the Maui Planning Commission (hereinafter "Planning Commission") conducted a public hearing on the Application.

3. On January 28, 1997, the Planning Commission recommended approval of the Permit to the LUC subject to eleven (11) conditions. The LUC received a portion of the record of the County's proceedings on the Permit on March 20, 1997.

4. On May 1, 1997, the LUC received a copy of the minutes for the January 28, 1997 Planning Commission meeting from the Planning Department. Upon receipt of the minutes, the record was deemed complete for processing. The LUC also received clarification from the Planning Department that the acreage of the subject lands under the Application was approximately 29.340 acres.

DESCRIPTION OF THE PROPERTY AND SURROUNDING AREA

5. The Special Permit area consists of approximately 29.340 acres situated at Puunene, Maui, and further identified as Tax Map Key No.: 3-8-03: portion of 4 (hereinafter "Property").

6. The Property is located approximately 4 miles southeast of Kahului. The Property is owned by A&B Properties, Inc. The Applicant is in the process of acquiring the Property from A&B Properties, Inc.

7. Access to the Property is via the existing access road for the existing Central Maui Sanitary Landfill located off of Pulehu Road.

8. The Property is currently being utilized for a quarry operation.

9. The slope of area in which the Property is situated is approximately 3.5%, and the Property slopes downward towards the northwest.

10. Rainfall in the area is estimated to be approximately 20 inches annually.

11. The U.S. Department of Agriculture Soil Conservation Service classifies the Property as having two types of soil series, Rock Land (rRK) and Waiakoa silty clay loam (WeB).

12. The Land Study Bureau's Detailed Land Classification Report designates the Property as Class "A" lands.

13. The State of Hawaii's Agricultural Lands of Importance to the State of Hawaii (ALISH) system classifies the Property as "Prime."

14. According to the U.S. Army Corps of Engineers Flood Insurance Rate Map (FIRM), the Property is within an area of minimal flooding or Zone "C."

15. Adjacent uses to the Property are primarily agricultural in nature with existing quarry operations and Kalialinui Gulch to the north and east of the Property, respectively.

SUMMARY OF PROPOSED USE

16. The Applicant is requesting a Special Permit to establish and operate an expansion of the existing Central Maui Sanitary Landfill, which is located east of the Property beyond Kalialinui Gulch. This expansion area will operate as a Municipal Solid Waste Landfill as defined by Federal regulations 40 CFR §257 and §258 (also known as Subtitle D), and HAR Title 11, Department of Health Chapter 58.1, §11-58.1-03.

17. Federal regulations requires new landfills constructed after October 9, 1993 to include a bottom liner consisting of a layer of clay overlain by a layer of plastic.

18. The proposed expansion of the Central Maui Sanitary Landfill on the Property will include the following improvements: drainage control via perimeter drainage channel in accordance with Department of Health (hereinafter "DOH") regulations; lining of the expansion area with a composite, flexible membrane liner and a minimum two-foot layer of compacted soil or geocomposite liner if soils on the Property are not suitable; leachate collection and removal system designed and installed pursuant to DOH regulations; groundwater monitoring required by Federal and State regulations; gas extraction system; landfill operation and maintenance; landfill closure plan to be prepared when landfill operations are near completion; and off-site improvements including possible improvements to the existing transfer station (hereinafter collectively referred to as "Project").

19. The Applicant anticipates that no change to the existing operations at the existing Central Maui Sanitary Landfill will occur. No new buildings will be constructed for the expansion area, and no expansion will take place for existing buildings at the current landfill area.

20. The Project is intended to provide an expansion of the existing landfill located east of the Property, which is reaching capacity.

21. The Applicant has determined that utilizing the existing quarry pit on the Property would be feasible compared to excavating lands to develop the landfill expansion at another location.

22. The Applicant has also determined that the combination of a central yet rural location and compatible physical characteristics make the Property operationally and environmentally feasible for expansion of the existing landfill.

STATE AND COUNTY PLANS AND PROGRAMS

23. The State Land Use District Classification of the Property is Agricultural, as reflected on State Land Use District boundary map M-7 (Paia).

24. The Wailuku-Kahului Community Plan designates the area as Agricultural. The existing landfill is designated as Public/Quasi-Public.

25. Current zoning for the Property is County Interim.

26. The Property is not located within the County of Maui Special Management Area.

SUMMARY OF COUNTY, STATE, AND FEDERAL AGENCIES COMMENTS

27. The County of Maui Department of Public Works and Waste Management determined that a Special Permit is required for the proposed landfill expansion and no other permits would be required with the exception of a DOH operating permit and county building permits.

28. The County of Maui Police Department noted that the proposed expansion will have an impact on traffic and escaping litter from the landfill due to high winds.

29. The County of Maui Department of Parks and Recreation had no objections to the proposed Project.

30. The State Department of Transportation commented that the Project is not anticipated to have an adverse impact on State transportation facilities.

31. The Division of Aquatic Resources, State Department of Land and Natural Resources (hereinafter "DLNR"), commented that appropriate mitigative measures to minimize erosion and prevention of hazardous material spilling and leaching into the ground should be taken by the Applicant.

32. The State Historic Preservation Division, DLNR, determined that the proposed Project would have "no effect" on significant historic sites provided that all expansion activities avoid Kalialinui Gulch.

33. The Clean Air Branch, DOH, provided mitigative measures to address possible nuisance odors and the potential for fugitive dust emissions.

34. The Solid Waste Management Office, DOH, noted that it will review environmental concerns and proposed mitigative measures upon receipt for an application for solid waste permit.

35. The LUC staff commented that Condition No. 13 of LUC Docket No. SP86-359/County of Maui, Department of Public Works (existing Central Maui Sanitary Landfill) had not been complied with.

36. The Department of Hawaiian Home Lands had no objections to the landfill expansion.

37. The Natural Resources Conservation Service, U.S. Department of Agriculture, had no comments on the Application.

38. The U.S. Fish and Wildlife Service did not anticipate significant adverse impacts to fish and wildlife resources, as the area lacks rare, threatened, or endangered species.

39. The Army Corps of Engineers noted that a Department of Army permit pursuant to the Flood Control Act of 1960, would not be required for the proposed expansion.

40. Maui Electric Company (hereinafter "MECO") had no objections to the Project and recommended that the Applicant meet with MECO to plan for electrical requirements.

SOCIO-ECONOMIC IMPACTS

41. The primary beneficial impact of the proposed landfill expansion is long-term and will occur in the area of public services and public health. The growing Maui community requires an adequate solid waste disposal system, and the proposed expansion will meet Maui's refuse disposal needs.

Phase IV has an estimated capacity of approximately 2.2 million cubic yards and a life expectancy of approximately 6 years.

42. Short-term economic impacts include increased demand for goods and services during construction of improvements.

43. The Final Environmental Impact Statement (hereinafter "FEIS") for the total overall expansion of the Central Maui Sanitary Landfill, of which the Project is one phase, states that the total overall landfill expansion may adversely impact the island's economy by placing a large capital expenditure on the County to establish the facility. Therefore, the total expansion has been phased, with this Application addressing the first expansion phase.

44. The FEIS states that continuing operation of the existing landfill will be easier and more cost effective than establishment of a new landfill at a new location.

45. The FEIS states that a secondary economic impact from expansion of the landfill may be rapid urban expansion and a corresponding increase in the cost of goods and services in the area.

IMPACTS UPON THE RESOURCES OF THE AREA

Agricultural Resources

46. The Property is located within an area classified as "Prime" agricultural lands under the ALISH classification system. However, the site is already disturbed and will be even more so as quarry operations and landfill operations progress.

47. The proposed expansion is not expected to disturb activities on adjacent agricultural lands.

Flora/Fauna

48. The landfill expansion area may attract and encourage proliferation of scavenger-types fauna. Rats, birds and flies may encourage disease vector problems. Daily cover and dust and litter control measures will minimize impacts on flora and fauna.

Scenic Resources

49. The Project will have an adverse visual impact as the Property is located along Pulehu Road. A perimeter design, including trees, will be implemented in order to mitigate the visual impact of land filling activities.

Archaeological and Cultural Resources

50. No known significant or historical sites have been found on the Property or the immediate surrounding area. This has been confirmed by the State Historic Preservation Division, DLNR, in its comment letter regarding the Project.

51. The State Historic Preservation Division, DLNR, has concluded that the Project will have "no effect" on significant historic sites provided that all expansion activities avoid Kalialinui Gulch.

ADEQUACY OF PUBLIC FACILITIES AND UTILITIES

Highways and Roadway Facilities

52. Traffic is expected to increase during construction of the Project. However, overall traffic is not expected to increase in the immediate area.

Drainage

53. A perimeter drainage channel will be included as part of the landfill expansion on the Property. This channel is to collect runoff from the adjacent watershed and landfill fill slopes. This and other drainage improvements have been designed and will be implemented in accordance with applicable Federal and State rules and regulations.

Air Quality

54. Air quality is expected to be similar to the existing operation of the Central Maui Sanitary Landfill. Short-term impacts will be as a result of construction during the proposed expansion. Long-term impacts may result from decomposing refuse and landfill gases.

Noise

55. Noise levels in the area are relatively low. The only significant generator of noise in the area is the quarry operations adjacent to the Property. Seasonal noise impacts occur during harvesting of sugarcane on adjacent fields. The existing landfill operations contribute little noise pollution in the area.

56. Prevailing winds direct sounds towards adjacent sugarcane fields, and the Property's rural characteristics and distance from populated area serve to mitigate noise impacts.

Water

57. No potable water supply is available in the existing landfill or Property. Water requirements for fire and dust control are currently being provided by water trucks. A

portable storage facility is located in the area of the existing landfill, east of the Property, and has a capacity of 53,700 gallons with a reserve of 25,000 gallons for fire control.

Sewage

58. No sewer facilities are available at or near the Property. Plans for the Project provide for existing infrastructure (i.e, weighing station, etc.) to remain in its current location within the existing landfill, thus no other sewage requirements are required for the Property.

Electricity/Telephone Service

59. The Property has electrical and telephone services nearby. The Project is not anticipated to have any impact on such services.

CONFORMANCE WITH SPECIAL USE PERMIT TESTS

60. The Planning Department, in its staff report to the Planning Commission, provided the following comments with respect to the Permit's conformance with the Special Use Permit Tests as follows:

(a) The use shall not be contrary to the objective sought to be accomplished by Chapters 205 and 205A, Hawaii Revised Statutes, as amended, and the rules of the State Land Use Commission.

"The proposed expansion of Central Maui Sanitary Landfill is not listed as a permitted use within the State Agricultural District, but the use is not contrary to the objectives of the Land Use Law, Chapter 205 and 205 which is to preserve, protect, and encourage the development of lands in the State for those uses to which these lands are best suited in the interest of public health and welfare of the people of the State of Hawaii."

(b) The desired use would not adversely affect surrounding property.

"The desired use would not adversely affect surrounding property since most surrounding properties are either undeveloped or are being mined. The existing quarry operations will leave the site essentially no (sic) suitable for any other use."

(c) The use would not unreasonably burden public agencies to provide roads and streets, sewers, water drainage and school improvements, and police and fire protection.

"No burden will be created to public agencies to provide roads, streets, sewers, water, or drainage facilities. No unreasonable burden to police and fire protection agencies is anticipated. There will be no burden on the school system."

(d) Unusual conditions, trends and needs have arisen since the district boundaries and rules were established.

"The use is in close proximity to other properties with landfill and quarrying uses."

(e) The land upon which the proposed use is sought is unsuited for the uses permitted within the district.

"The land upon which the proposed use is sought is part of a mining operation and therefore would not be suitable for agricultural purposes."

PLANNING COMMISSION RECOMMENDATION

61. At its meeting of January 28, 1997, the Planning Commission recommended approval of the Application to the LUC, subject to the following conditions:

1. That the Land Use Commission Special Use Permit shall be valid for a period of ten (10) years from the date of its granting, subject to extensions by the Maui Planning Commission and the State Land Use Commission upon a timely request for extension

filed at least ninety (90) days prior to its expiration.

2. That full compliance with all applicable governmental requirements shall be rendered.

3. Petitioner shall begin construction of the landfill expansion within 6 months from the issuance of the Land Use Commission's decision and order. Construction shall include any improvements necessary to operate the landfill pursuant to all applicable laws and regulations.

4. That the applicant shall take appropriate mitigative measures to minimize erosion, and prevent cement products, oil, fuel, and other toxic substances associated with the use of heavy machinery from spilling or leaching into the ground.

5. That the applicant shall provide adequate dust control measures during all phases of landfill operations in accordance with the provisions of Chapter 11-60.1, Hawaii Administrative Rules, Section 11-60.1-33 on Fugitive Dust, but not limited to:

   a. Minimizing the amount of dust generating materials and activities, centralizing material transfer points and onsite activities, centralizing material transfer points and onsite vehicular traffic routes, and locating potentially dusty equipment in areas of the least impact;

   b. Providing an adequate water source at site prior to startup of construction activities;

   c. Landscaping and rapid covering of bare areas, including slopes, starting from the initial grading phase;

   d. Control of dust from shoulders, project entrances, and access roads;

   e. Providing adequate dust and odor control measures as required by law during landfill closures, after hours, and prior to daily startup of construction activities; and

   f. Odor control measures shall be taken during all phases of landfill operations.

6. That full compliance with the requirements of the State's Department of Health for sanitary landfill operation shall be rendered.

7. That provisions shall be enacted to ensure emergency access to the sanitary landfill in case of fire or any other disaster.

8. That the applicant shall utilize non-potable water, to the extent possible, for grading, dust control, and irrigation of the landfill.

9. That the applicant shall reasonably ensure that windblown debris around the perimeter of the landfill, particularly within areas visible from the public right-of-way shall be removed in a timely manner.

10. That the applicant shall immediately stop work and contact the State Historic Preservation Division, Department of Land and Natural Resources should any previously unidentified archaeological resources such as artifacts, shell, bone, charcoal deposits, human burial, rock or coral alignments, pavings or wall be encountered during development of the Special Use Permit area.

11. That the applicant shall timely provide without any prior notice, annual reports to the Land Use Commission and the County of Maui Planning Department in connection with the status of the subject project and Applicant's progress in complying with the conditions imposed herein. The annual report shall also include the capacity remaining in the landfill at the time of submissions of the annual report. The annual report shall be submitted in a form prescribed by the Executive Officer of the Land Use Commission.

62. Any findings of fact that may be a conclusion of law shall be deemed a conclusion of law.

CONCLUSIONS OF LAW

The Special Permit request to allow establishment and operation of an expansion of the Central Maui Sanitary Landfill on the island of Maui constitutes an "unusual and reasonable" use as defined in Section 205-6, Hawaii Revised Statutes, as amended,

and the proposed use is not contrary to the objectives sought to be accomplished by the State Land Use Law to preserve, protect, and encourage development of lands in the State for those uses to which they are best suited in the interest of the public health and welfare.

ORDER

IT IS HEREBY ORDERED that the Special Permit under LUC Docket No. SP97-390 to allow establishment and operation of an expansion to the Central Maui Sanitary Landfill on approximately 29.340 acres of land designated within the State Land Use Agricultural District, Tax Map Key No.: 3-8-03: portion of 4 at Puunene, Maui, and approximately identified on Exhibit "A" attached hereto and incorporated by reference herein, is hereby approved and subject to the following conditions:

1. That the Land Use Commission Special Permit shall be valid for a period of ten (10) years from the issuance of the Land Use Commission's decision and order, subject to extensions by the Maui Planning Commission and the State Land Use Commission upon a timely request for extension filed at least ninety (90) days prior to its expiration.

2. That full compliance with all applicable governmental requirements shall be rendered.

3. Applicant shall begin construction of the landfill expansion within 6 months from the issuance of the Land Use Commission's decision and order. Construction shall include any improvements necessary to operate the landfill pursuant to all applicable laws and regulations.

4. That the Applicant shall take appropriate mitigative measures to minimize erosion, and prevent cement products, oil, fuel, and other toxic substances associated with the use of heavy machinery from spilling or leaching into the ground.

5. That the Applicant shall provide adequate dust control measures during all phases of landfill operations in accordance with the provisions of Chapter 11-60.1, Hawaii Administrative Rules, Section 11-60.1-33 on Fugitive Dust, but not limited to:

a. Minimizing the amount of dust generating materials and activities, centralizing material transfer points and onsite activities, centralizing material transfer points and onsite vehicular traffic routes, and locating potentially dusty equipment in areas of the least impact;

b. Providing an adequate water source at site prior to startup of construction activities;

c. Landscaping and rapid covering of bare areas, including slopes, starting from the initial grading phase;

d. Control of dust from shoulders, project entrances, and access roads;

e. Providing adequate dust and odor control measures as required by law during landfill closures, after hours, and prior to daily startup of construction activities; and

f. Odor control measures shall be taken during all phases of landfill operations.

6. That full compliance with the requirements of the State's Department of Health for sanitary landfill operation shall be rendered.

7. That provisions shall be enacted to ensure emergency access to the sanitary landfill in case of fire or any other disaster.

8. That the Applicant shall utilize non-potable water, to the extent possible, for grading, dust control, and irrigation of the landfill.

9. That the Applicant shall reasonably ensure that windblown debris around the perimeter of the landfill, particularly within areas visible from the public right-of-way shall be removed in a timely manner.

10. That the Applicant shall immediately stop work and contact the State Historic Preservation Division, Department of Land and Natural Resources should any previously unidentified archaeological resources such as artifacts, shell, bone, charcoal deposits, human burial, rock or coral alignments, pavings or wall be encountered during development of the Special Use Permit area.

11. That the Applicant shall timely provide without any prior notice, annual reports to the Land Use Commission and the County of Maui Planning Department in connection with the status of the subject project and Applicant's progress in complying with the conditions imposed herein. The annual report shall also include the capacity remaining in the landfill at the

time of submission of the annual report. The annual report shall be submitted in a form prescribed by the Executive Officer of the Land Use Commission.

DOCKET NO. SP97-390 - DEPARTMENT OF PUBLIC WORKS & WASTE MANAGEMENT, SOLID WASTE DIVISION

Done at Honolulu, Hawai'i, this 21st day of July 1997, per motions on June 26, 1997 and July 17, 1997.

LAND USE COMMISSION
STATE OF HAWAI'I

By _____
TRUDY K. SENDA
Chairperson and Commissioner

By _____
RUPERT K. CHUN
Vice Chairperson and Commissioner

By _____
LAWRENCE N.C. ING
Commissioner

By _____
M. CASEY JARMAN
Commissioner

By (absent)
HERBERT S.K. KAOPUA, SR.
Commissioner

By (absent)
LLOYD F. KAWAKAMI
Commissioner

By _____
MERLE A. K. KELAI
Commissioner

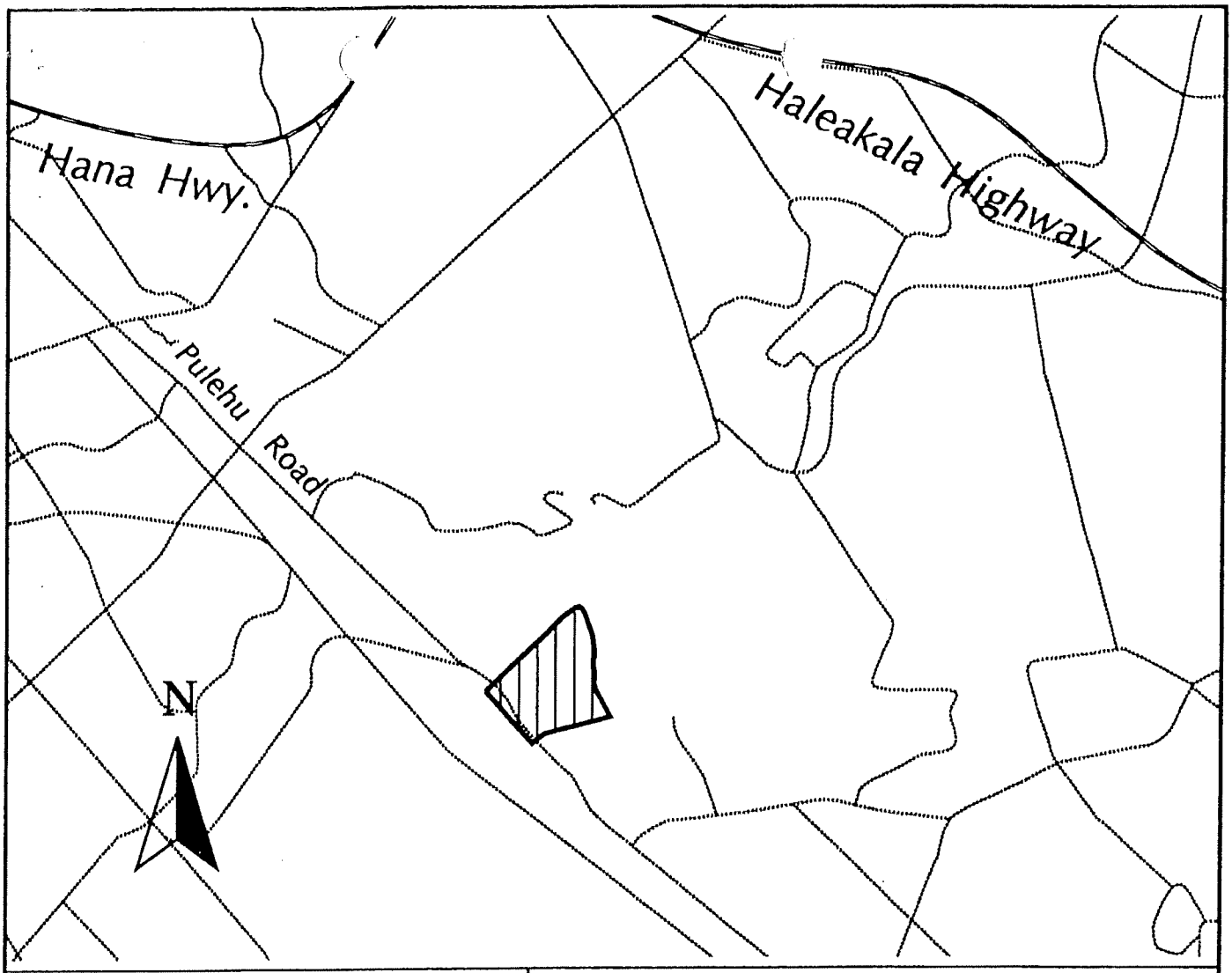
By (absent)
EUSEBIO LAPENIA, JR.
Commissioner

By _____
JOANN N. MATTSON

Filed and effective on
July 21, 1997

Certified by:

_____
Executive Officer



SP97-390 / DEPARTMENT OF PUBLIC WORKS & WASTE MANAGEMENT, SOLID WASTE DIVISION, COUNTY OF MAUI

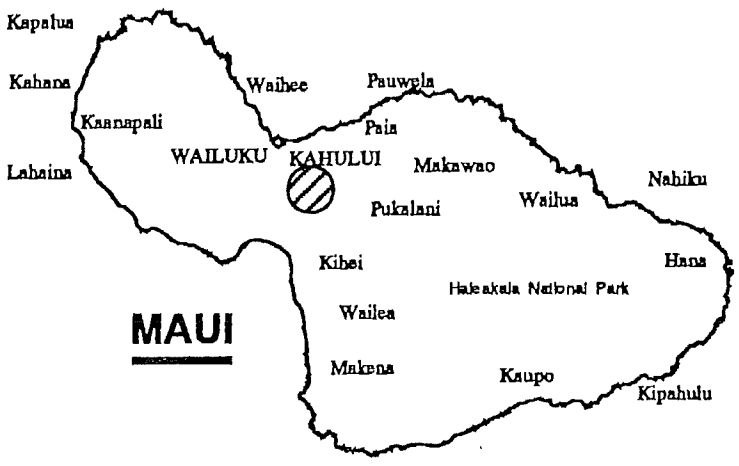
LOCATION MAP

TAX MAP KEY: 3-8-03: por. 4

Puunene, Maui, Hawaii

PERMIT AREA (APPROXIMATE)

EXHIBIT "A"



BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAII

In the Matter of the Petition of DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT, SOLID WASTE DIVISION, COUNTY OF MAUI For a Special Permit to Establish and Operate an Expansion to the Central Maui Sanitary Landfill on Approximately 29.340 Acres of Land Situated Within the State Land Use Agricultural District at Puunene, Maui, Hawaii; TMK: 3-8-03: portion of 4	DOCKET NO. SP97-390 CERTIFICATE OF SERVICE

CERTIFICATE OF SERVICE

I hereby certify that a copy of the Findings of Fact, Conclusions of Law, and Decision and Order was served upon the following by either hand delivery or depositing the same in the U. S. Postal Service by certified mail:

CERT. DAVID W. BLANE, Director of Planning
Planning Department, County of Maui
250 South High Street
Wailuku, Hawaii 96793

CERT. CHARLES JENCKS, Director
Department of Public Works and Waste Management
Solid Waste Division
200 South High Street
Wailuku, Hawaii 96793

DATED: Honolulu, Hawaii, this 21st day of July 1997.

ESTHER UEDA
Executive Officer

57962

RECEIVED
MAY 14 2002
LAND USE COMMISSION
STATE OF HAWAII

L-2901

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI`I

In The Matter Of The Application Of The	)	DOCKET NO. SP97-390
	)	
DEPARTMENT OF PUBLIC WORKS	)	DECISION AND ORDER
AND WASTE MANAGEMENT, SOLID	)	APPROVING AN
WASTE DIVISION, COUNTY OF MAUI	)	AMENDMENT TO A
	)	SPECIAL USE PERMIT
Fór A Special Use Permit To Establish	)	
And Operate An Expansion To The	)	
Central Maui Sanitary Landfill On	)	
Approximately 29.340 Acres Of Land	)	
Situated Within The State Land Use	)	
Agricultural District At Pu`unene,	)	
Maui, Hawai`i, TMK No: 3-8-03: 25	)	
	)	

This is to certify that this is a true and correct copy of the document on file in the office of the State Land Use Commission, Honolulu, Hawaii.

MAY 13 2002 by _____
Date **Executive Officer**

DECISION AND ORDER APPROVING AN AMENDMENT
TO A SPECIAL USE PERMIT

LAND USE COMMISSION
STATE OF HAWAII
2002 MAY 13 P 12:32

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI`I

In The Matter Of The Application Of The	)	DOCKET NO. SP97-390
	)	
DEPARTMENT OF PUBLIC WORKS	)	DECISION AND ORDER
AND WASTE MANAGEMENT, SOLID	)	APPROVING AN
WASTE DIVISION, COUNTY OF MAUI	)	AMENDMENT TO A
	)	SPECIAL USE PERMIT
For A Special Use Permit To Establish	)	
And Operate An Expansion To The	)	
Central Maui Sanitary Landfill On	)	
Approximately 29.340 Acres Of Land	)	
Situated Within The State Land Use	)	
Agricultural District At Pu`unene,	)	
Maui, Hawai`i, TMK No: 3-8-03: 25	)	
	)	

DECISION AND ORDER APPROVING AN AMENDMENT TO A SPECIAL USE PERMIT

On April 30, 2001, the Department of Public Works and Waste Management, Solid Waste Division, County of Maui ("Applicant"), filed an application to amend the Special Use Permit issued in the above-entitled docket ("Application") with the County of Maui Planning Department ("Planning Department"), pursuant to section 205-6, Hawai`i Revised Statutes ("HRS"), and sections 15-15-95 and 15-15-96, Hawai`i Administrative Rules ("HAR"). The Applicant proposes to construct and operate a new entrance facility and related improvements as a part of the Central Maui Landfill expansion. The facility will include an entry road; perimeter road; self-haul

recycling and service area; reuse center for materials exchange; self-haul disposal and service area; scale and scale house; office building; wash slab for heavy equipment; and water, septic, and power infrastructure ("Project"). The Project will be located on approximately 5.3 acres of land within the State Land Use Agricultural District at Pu`unene, Maui, Hawai`i, identified as TMK No: 3-8-03: por. 25 ("Property"). The County of Maui owns the Property.

The Land Use Commission ("Commission") has jurisdiction over the Application. Section 205-6, HRS, and sections 15-15-95 and 15-15-96, HAR, authorize the Commission to approve special permits for areas greater than 15 acres.

On May 18, 2001, the Applicant certified the Application as complete and ready for processing.

On September 11, 2001, the County of Maui Planning Commission ("Planning Commission") conducted a hearing on the Application, pursuant to a public notice published in the Maui News on August 10, 2001. There was no public testimony provided on the Project. After due deliberation, the Planning Commission recommended approval of the Application to the Commission, subject to 14 conditions.[1]

On November 13, 2001, the Commission received a copy of the decision and a portion of the record of the Planning Commission's proceedings on the Application. On March 8 and 12, 2002, the Commission received additional materials to

[1] The 14 conditions included the original conditions and amendments thereto as well as new conditions.

the record. On March 13, 2002, the Commission received the remaining portion of the record.

On March 21, 2002, the Commission met in Kailua-Kona, Hawai`i, to consider the Application. John Harder appeared on behalf of the Applicant. Richard Minatoya, Esq., and Joe Alueta appeared on behalf of the Planning Department.

At the meeting, the Applicant pointed out that i) the proposed entry road on TMK No: 3-8-03: por. 4 is an integral part of the Project and should be included as a part of the Application[2]; ii) improvements on the entry road will include two lanes of paving and a chain link fence with a gated entry; and iii) the approximately 5.3 acres comprising the Property includes the proposed entry road. The Applicant further stated that it will obtain written authorization from landowner A&B-Hawaii, Inc., to utilize the land on which the entry road is proposed and provide said authorization to the Commission.

Conformance With Special Use Permit Criteria

Following discussion by the Commissioners, and with the understanding that the proposed entry road is an integral part of the Project and should be included as a part of the Application, a motion was made and seconded to approve the Application,

[2] The tax map key designation of the proposed entry road was inadvertently left out of the description of the Property in the Application, hearing notice, and other documents. The road will be located at the site of access and utility easement "A," which runs from Pulehu Road to the Property. This easement was included together with the Property A&B-Hawaii, Inc., conveyed to the County of Maui by Warranty Deed dated September 19, 1997.

subject to the conditions as recommended by the Planning Commission, with the exception that i) original Condition Numbers 10 and 11 relating to archaeological resources and annual reports, respectively, be retained; and ii) Condition Number 5 relating to a compliance report as recommended by the Planning Commission be deleted. The Commission found that i) The Project is in proximity to other areas with landfill and quarrying uses; ii) The Property is relatively barren with clumps of pili grass. There are no endangered or rare fauna present on the Property; iii) No archaeological or historic sites or remains were discovered during the construction of Phase IV of the landfill expansion, which includes the Property. There are no known cultural resources on the Property; iv) The Project would not adversely affect surrounding property since most of the surrounding lands are either undeveloped and under agricultural production or are being mined. The existing quarry operation will leave the site unsuitable for any other use; v) The Project will result in construction-related impacts to air quality that will be mitigated by dust control measures, such as regular watering and sprinkling. The ground surface of the Project will be covered by either asphalt or vegetation. Odor problems will be minimized through proper waste handling and soil covering; vi) The Project may result in minor short-term noise impacts. Construction activities will be restricted to normal daylight working hours. Landfill and entrance facility functions, such as weighing and recycling, do not generate loud noises in the long term; vii) A litter control plan is included in the Operations

Manual for Phase IV to reduce litter problems associated with the landfill expansion. Slopes and other unpaved surfaces will be covered with groundcover. A landscaping plan will be prepared that meets the water and wind conditions of the Property; viii) The Project primarily involves weighing, recycling, and reuse functions, which will place minimum demand on public facilities and services; ix) Since the district boundaries and rules were established, the economy of Maui has diversified from agriculture to the resort and retail trade industries, which placed further demand on solid waste facilities; x) The Project will provide direct access to the landfill expansion without commercial and County trucks fording Kalialinui Gulch, which becomes impassable when it flows. The Project will provide the public with a safe alternative to disposing of their refuse at the landfill and an additional opportunity for recycling, which will contribute to the life of the landfill; and xi) The Project is located on land that was previously quarried, which removed the topsoil and made it unsuitable for agricultural purposes. Following discussion by the Commissioners, a vote was taken on this motion. There being a vote tally of 6 ayes and 0 nays, the motion carried.

ORDER

Having duly considered the complete record of the Application and the oral arguments presented by the parties in the proceeding, and a motion having been made at a hearing conducted on March 21, 2002, in Kailua-Kona, Hawai`i, and the motion having received the affirmative votes required by section 15-15-13, HAR, and

there being good cause for the motion, the Commission hereby APPROVES the Application to amend the Special Use Permit to construct and operate a new entrance facility and related improvements as a part of the Central Maui Landfill expansion on approximately 5.3 acres of land within the State Land Use Agricultural District at Pu`unene, Maui, Hawai`i, identified as TMK No: 3-8-03: por. 4 and por. 25, and approximately identified on Exhibit "A," attached hereto and incorporated by reference herein, subject to the following conditions:

1. That the State Land Use Commission Special Use Permit shall be valid until July 21, 2007, subject to further extensions by the Land Use Commission upon a timely request for extension filed at least one-hundred twenty (120) days prior to its expiration. The appropriate Planning Commission shall make a recommendation to the Land Use Commission and may require a public hearing on the time extension.

2. That the conditions of this State Land Use Commission Special Use Permit shall be enforced pursuant to Sections 205-12 and 205-13, Hawai'i Revised Statutes. Failure to comply with one or more of the conditions herein shall result in a notice of violation issued by the appropriate enforcement agency, notifying the permit holder of the violation and providing the permit holder no more than sixty (60) days to cure the violation. If the permit holder fails to cure the violation within sixty (60) days of said notice, the appropriate enforcement agency shall issue an order which may require one or more of the following: that the violative activity cease; that the violative

development be removed; that a civil fine be paid not to exceed ONE THOUSAND AND NO/100 DOLLARS ($1,000.00) per violation; that a civil fine not to exceed FIVE THOUSAND AND NO/100 DOLLARS ($5,000.00) shall be issued if violation not cured within six months of the issuance of the order. The order shall become final thirty (30) days after the date of its mailing or hand-delivery unless written request for a hearing is mailed or delivered to the Planning Department within said thirty (30) days. Upon receipt of a request for a hearing, the Planning Department shall specify a time and place for the permit holder to appear and be heard. The hearing shall be conducted by the Planning Director or the Director's designee in accordance with the provisions of Chapter 91, HRS, as amended.

3. That the subject State Land Use Commission Special Use Permit shall not be transferred without the prior written approval of the Land Use Commission. The appropriate Planning Commission shall make a recommendation to the Land Use Commission. However, in the event that a contested case hearing preceded issuance of said State Land Use Commission Special Use Permit, a public hearing shall be held by the appropriate Planning Commission upon due published notice, including actual written notice to the last known addresses of parties to said contested case and their counsel.

4. That full compliance with all applicable governmental requirements shall be rendered.

5. That the Applicant shall develop the Property in substantial compliance with the representations made to the Land Use Commission in obtaining the State Land Use Commission Special Use Permit. Failure to so develop the Property may result in the revocation of the permit.

6. That the Applicant shall begin construction of the landfill expansion within six months from issuance of the Land Use Commission's decision and order on the amendment. Construction shall include any improvements necessary to operate the landfill pursuant to all applicable laws and regulations.

7. That the Applicant shall take appropriate mitigative measures to minimize erosion, and prevent cement products, oil, fuel, and other toxic substances associated with the use of heavy machinery from spilling or leaching into the ground.

8. That the Applicant shall comply with Department of Health Ambient Air Quality Standards, Hawai'i Administrative Rules, Title 11, Chapter 59 and Air Pollution Control, HAR 11-60.

9. That the Applicant shall comply with the EPA's New Source Performance Standards.

10. That the Applicant shall immediately stop work and contact the State Historic Preservation Division, Department of Land and Natural Resources should any previously unidentified archaeological resources such as artifacts, shell, bone,

charcoal deposits, human burial, rock or coral alignments, pavings or wall be encountered during development of the Special Use Permit area.

11. That provisions shall be enacted to ensure emergency access to the sanitary landfill in case of fire or any other disaster.

12. That the Applicant shall timely provide without any prior notice, annual reports to the Land Use Commission and the County of Maui Planning Department in connection with the status of the subject project and Applicant's progress in complying with the conditions imposed herein. The annual report shall also include the capacity remaining in the landfill at the time of submission of the annual report. The annual report shall be submitted in a form prescribed by the Executive Officer of the Land Use Commission.

13. That the Applicant shall utilize non-potable water, to the extent possible, for grading, dust control, and irrigation of the landfill.

14. That the Applicant shall ensure that windblown debris around the perimeter of the landfill, particularly within areas visible from the public right of way, are removed in a timely manner.

15. That full compliance with the requirements of the State's Department of Health for sanitary landfill operation shall be rendered.

Dated: Honolulu, Hawai`i, MAY 13 2002

LAND USE COMMISSION
STATE OF HAWAI`I

By MERLE A.K. KELAI
Chairperson and Commissioner

Filed and effective on
MAY 13 2002, 2002
Certified by:

APPROVED AS TO FORM:

Deputy Attorney General

Executive Officer

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI'I

In The Matter Of The Application Of The	)	DOCKET NO. SP97-390
	)	
DEPARTMENT OF PUBLIC WORKS	)	CERTIFICATE OF SERVICE
AND WASTE MANAGEMENT, SOLID	)	
WASTE DIVISION, COUNTY OF MAUI	)	
	)	
For A Special Use Permit To Establish	)	
And Operate An Expansion To The	)	
Central Maui Sanitary Landfill On	)	
Approximately 29.340 Acres Of Land	)	
Situated Within The State Land Use	)	
Agricultural District At Pu'unene,	)	
Maui, Hawai'i, TMK No: 3-8-03: 25	)	
	)	

CERTIFICATE OF SERVICE

I hereby certify that a copy of the Decision and Order Approving an Amendment to a Special Use Permit was served upon the following by either hand delivery or depositing the same in the U. S. Postal Service by certified mail:

CERT. DAVID W. BLANE, Director
Office of Planning
P. O. Box 2359
Honolulu, Hawaii 96804-2359

CERT. JOHN CHANG, ESQ., Deputy Attorney General
Department of the Attorney General
Hale Auhau
425 Queen Street
Honolulu, Hawaii 96813

DAVID GOODE, Director
CERT. Department of Public Works and Waste Management
Solid Waste Division
200 South High Street
Wailuku, Hawaii 96793

JOHN E. MIN, Director of Planning
CERT. Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793

JAMES B. TAKAYESU, ESQ.
CERT. Corporation Counsel
County of Maui
200 South High Street
Wailuku, Hawaii 96793

DATED: Honolulu, Hawaii, this 13th day of May, 2002.

ANTHONY J. H. CHING
Executive Officer

04/45595

'04 DEC 15 P2:30

DEPT OF PLANNING
CC

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI`I

In The Matter Of The Application Of The	)	DOCKET NO. SP97-390
	)	
DEPARTMENT OF PUBLIC WORKS	)	DECISION AND ORDER
AND WASTE MANAGEMENT, SOLID	)	APPROVING A SECOND
WASTE DIVISION, COUNTY OF MAUI	)	AMENDMENT TO A
	)	SPECIAL USE PERMIT
For A Special Use Permit To Establish	)	
And Operate An Expansion To The	)	
Central Maui Sanitary Landfill On	)	
Approximately 34.640 Acres Of Land	)	
Situated Within The State Land Use	)	
Agricultural District At Pu`unene,	)	
Maui, Hawai`i, TMK No: 3-8-03: Por. 4	)	
And 25	)	
	)	

DECISION AND ORDER APPROVING A SECOND AMENDMENT TO A SPECIAL USE PERMIT

This is to certify that this is a true and correct copy of the document on file in the office of the State Land Use Commission, Honolulu, Hawaii.

DEC 14 2004 by
Date Executive Officer

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI`I

In The Matter Of The Application Of The	)	DOCKET NO. SP97-390
	)	
DEPARTMENT OF PUBLIC WORKS	)	DECISION AND ORDER
AND WASTE MANAGEMENT, SOLID	)	APPROVING A SECOND
WASTE DIVISION, COUNTY OF MAUI	)	AMENDMENT TO A
	)	SPECIAL USE PERMIT
For A Special Use Permit To Establish	)	
And Operate An Expansion To The	)	
Central Maui Sanitary Landfill On	)	
Approximately 34.640 Acres Of Land	)	
Situated Within The State Land Use	)	
Agricultural District At Pu`unene,	)	
Maui, Hawai`i, TMK No: 3-8-03: Por. 4	)	
And 25	)	
	)	

DECISION AND ORDER APPROVING A SECOND AMENDMENT TO A SPECIAL USE PERMIT

On October 13, 2003, the County of Maui Department of Public Works and Environmental Management (fka the Department of Public Works and Waste Management) ("Applicant") filed a written request to amend the special use permit issued in the above-entitled docket ("Request") with the County of Maui Planning Department ("Planning Department"), pursuant to section 205-6, Hawai`i Revised Statutes ("HRS"), and sections 15-15-95 and 15-15-96, Hawai`i Administrative Rules ("HAR"). The Applicant's Request involves (i) a site plan modification of the new entrance facility for the Central Maui Sanitary Landfill expansion by adding

approximately 1.395 acres of land within the State Land Use Agricultural District at Pu`unene, Maui, Hawai`i, identified as Tax Map Key: 3-8-03: por. 4 ("Property")[1]; and (ii) an extension of the time in which to initiate construction of the Central Maui Sanitary Landfill expansion due to the site plan modification by amending Condition Number 6 of the Decision And Order Approving An Amendment To A Special Use Permit ("Decision and Order") dated May 13, 2002.[2]

The Land Use Commission ("Commission") has jurisdiction over the Applicant's Request. Section 205-6, HRS, and sections 15-15-95 and 15-15-96, HAR, authorize this Commission to approve special use permits and amendments thereto for areas greater than 15 acres.

On October 14, 2003, the Planning Commission conducted a hearing on the Applicant's Request. There was no public testimony provided on the Request. After due deliberation, the Planning Commission recommended approval of the Applicant's Request to this Commission, subject to the following amendment to Condition Number 6:

> 6. That the Applicant shall begin construction of the landfill expansion within 12 months from issuance of the Land Use

---

[1] The Property consists of a 75-foot-wide construction easement located on the southwest side of Phase IV of the Central Maui Sanitary Landfill, between the property line and Pulehu Road.

[2] The Decision and Order approved the Applicant's request to construct and operate a new entrance facility and related improvements on approximately 5.3 acres of land as part of the Central Maui Sanitary Landfill expansion. The improvements included an entry road; perimeter road; self-haul recycling and service area; reuse center for materials exchange; self-haul disposal and service area; scale and scale house; office building; wash slab for heavy equipment; and water, septic, and power infrastructure.

Commission's decision and order on the amendment. Construction shall include any improvements necessary to the operation of the landfill pursuant to all applicable laws and regulations.

On November 19, 2003, the Commission received a copy of the decision and a portion of the record of the Planning Commission's proceedings on the Applicant's Request. On October 6, 2004, the Commission received the remaining portion of the record.

On November 5, 2004, the Commission met in Makena, Maui, Hawai`i, to consider the Applicant's Request. Michael Souza, Acting Chief of the Solid Waste Division, and Bruce Mizel, CIP Project Coordinator, appeared on behalf of the Applicant. Madelyn S. D'enbeau, Esq., appeared on behalf of the Planning Department. John W. K. Chang, Esq., and Abe Mitsuda also were present on behalf of the State Office of Planning.

At the meeting, the Applicant pointed out, among other things, that (i) approximately 90 percent of the remedial work required by the State Department of Health to bring the landfill into compliance had been completed, with the remaining 10 percent of the work anticipated for completion within 3 to 4 weeks; (ii) the construction of the new entrance facility was completed to the satisfaction of the Applicant, and the Certificate of Occupancy was expected to be issued shortly; (iii) the Applicant had no objection to the incorporation of the Decision and Order issuance date in Condition

Number 6; and (iv) the Central Maui Sanitary Landfill has potentially 25 to 30 years of landfill space.

Following discussion by the Commissioners, a motion was made and seconded to approve the Applicant's Request, subject to the following amendment to Condition Number 6:

> 6. That the Applicant shall begin construction of the landfill expansion within 12 months from issuance of the Land Use Commission's decision and order dated May 13, 2002. Construction shall include any improvements necessary to the operation of the landfill pursuant to all applicable laws and regulations.

Following deliberation by the Commissioners, a vote was taken on the motion. There being a vote tally of 6 ayes, 0 nays, and 3 absent, the motion carried.

ORDER

Having duly considered the complete record of the Applicant's Request and the oral arguments presented by the parties present in the proceeding, and a motion having been made at a meeting on November 5, 2004, in Makena, Maui, Hawai`i, and the motion having received the affirmative votes required by section 15-15-13, HAR, and there being good cause for the motion, the Commission hereby APPROVES the Applicant's Request to (i) modify the site plan to the new entrance facility for the Central Maui Sanitary Landfill expansion by adding approximately 1.395 acres of land within the State Land Use Agricultural District at Pu`unene, Maui,

Hawai`i, identified as Tax Map Key: 3-8-03: por. 4, and approximately shown on Exhibit "A," attached hereto and incorporated by reference herein; and (ii) extend the time in which to initiate construction of the Central Maui Sanitary Landfill expansion due to the site plan modification by amending Condition Number 6 of the Decision and Order dated May 13, 2002, to read as follows:

> 6. That the Applicant shall begin construction of the landfill expansion within 12 months from issuance of the Land Use Commission's decision and order dated May 13, 2002. Construction shall include any improvements necessary to the operation of the landfill pursuant to all applicable laws and regulations.

All other conditions to the Decision and Order dated May 13, 2002, are hereby reaffirmed and shall continue in effect.

ADOPTION OF ORDER

The undersigned Commissioners, being familiar with the record and proceedings, hereby adopt and approve the foregoing ORDER this 14th day of December, 2004. This ORDER and its ADOPTION shall take effect upon the date this ORDER is certified and filed by this Commission.

Done at Honolulu, Hawai`i, this 14th day of December, 2004, per motion on November 5, 2004.

APPROVED AS TO FORM

Deputy Attorney General

LAND USE COMMISSION
STATE OF HAWAI`I

By
P. ROY CATALANI
Chairperson and Commissioner

By
RANDALL SAKUMOTO
Vice-Chairperson and Commissioner

By
STEVEN LEE MONTGOMERY
Vice Chairperson and Commissioner

By _____
PRAVIN DESAI
Commissioner

By _____
ISAAC FIESTA, JR.
Commissioner

By _____
MICHAEL D. FORMBY
Commissioner

By _____
KYONG-SU IM
Commissioner

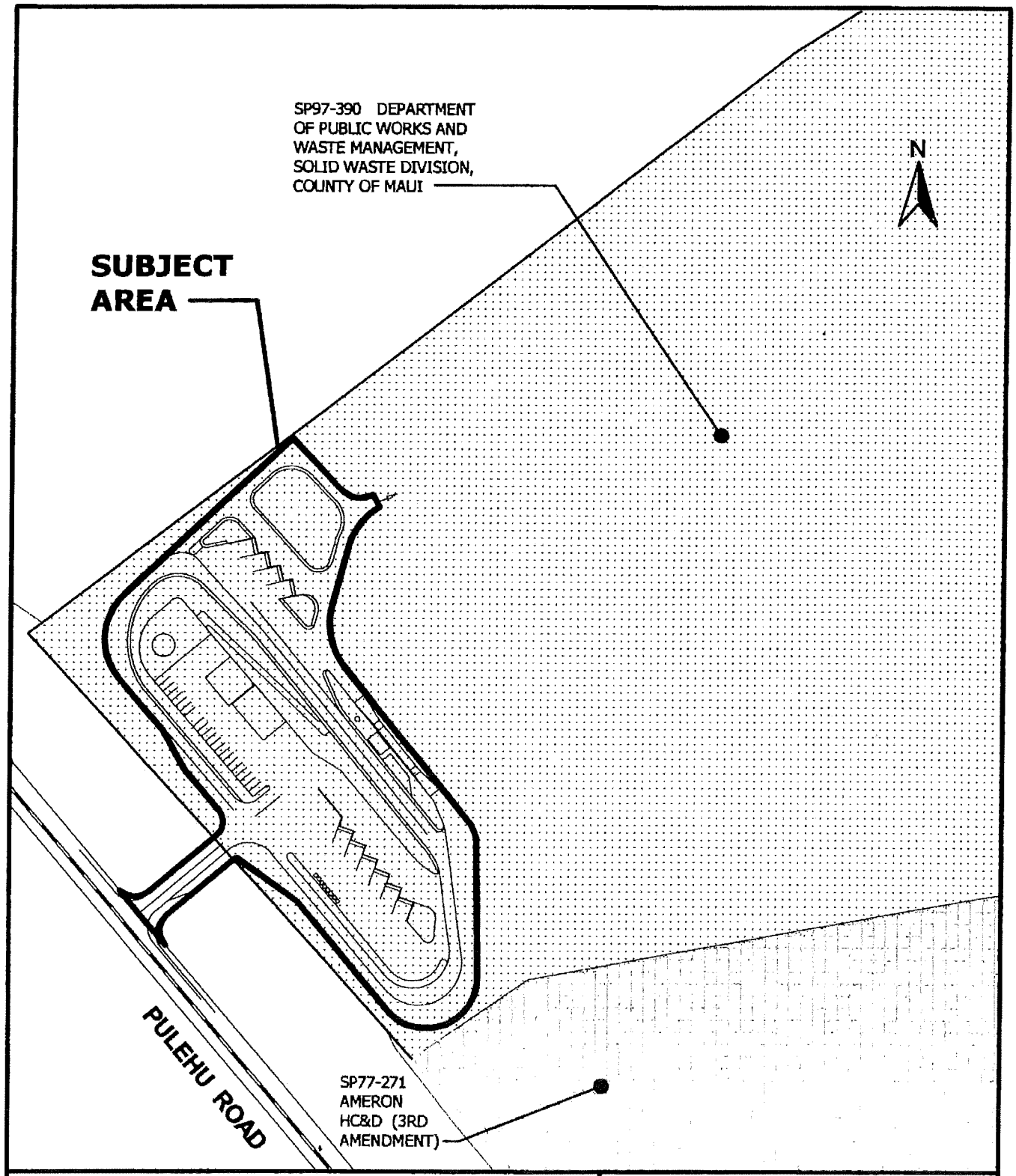
Filed and effective on
DEC 14 2004

By (absent)
LISA M. JUDGE
Commissioner

Certified by:

_____
ANTHONY CHING

By _____
PETER YUKIMURA
Commissioner

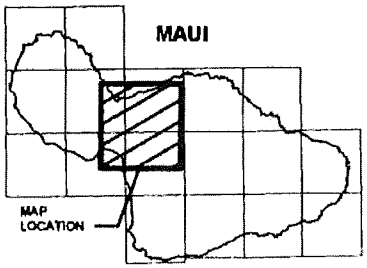


SP97-390 Department of Public Works and Waste Management, Solid Waste Division, County of Maui

LOCATION MAP

TAX MAP KEY NO.: 3-8-03: por. 4 & por. 25
PU`UNENE, MAUI, HAWAI`I
SCALE: 1" = 200 ft.

EXHIBIT "A"



BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI`I

In The Matter Of The Application Of The	)	DOCKET NO. SP97-390
	)	
DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT, SOLID WASTE DIVISION, COUNTY OF MAUI	)	CERTIFICATE OF SERVICE
	)	
For A Special Use Permit To Establish And Operate An Expansion To The Central Maui Sanitary Landfill On Approximately 34.640 Acres Of Land Situated Within The State Land Use Agricultural District At Pu`unene, Maui, Hawai`i, TMK No: 3-8-03: Por. 4 And 25	)	

CERTIFICATE OF SERVICE

I hereby certify that a copy of the Decision And Order Approving A Second Amendment To A Special Use Permit was served upon the following by either hand delivery or depositing the same in the U. S. Postal Service by regular or certified mail as noted:

DEL. MARY LOU KOBAYASHI, Acting Director
Office of Planning
P. O. Box 2359
Honolulu, Hawaii 96804-2359

JOHN CHANG, Esq.
Deputy Attorney General
Hale Auhau, Third Floor
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Wailuku, Hawaii 96793

BRIAN MOTO, Esq.
JANE LOVELL, Esq.
Corporation Counsel
County of Maui
250 South High Street
Wailuku, Hawaii 96793

GILBERT COLOMA-AGARAN
Department of Public Works & Environmental Management
Solid Waste Division
200 South High Street
Wailuku, Hawaii 96793

Dated: Honolulu, Hawaii, DEC 14 2004.

ANTHONY J. H. CHING
Executive Officer

BEFORE THE LAND USE COMMISSION
STATE OF HAWAI'I

In The Matter Of The Petition Of	)	DOCKET NO. SP97-390
	)	
PUBLIC WORKS AND WASTE MANAGEMENT, SOLID WASTE DIVISION, COUNTY OF MAUI (DEPT. OF ENVIRONMENTAL MANAGEMENT)	)	APPROVING A THIRD AMENDMENT TO THE LAND USE COMMISSION'S SPECIAL USE PERMIT
To Obtain A Third Amendment To Land Use Commission Special Use Permit To Obtain a Time Extension; For Expansion Of The Permit Area By 41.2 Acres, For Addition Of Composting And Quarrying Related Activities as Permitted Uses; And To Request A Transfer Of Permit Holder To Establish And Operate Central Maui Sanitary Landfill On Approximately 70.5 Acres Of Land Situated Within The State Land Use Agricultural District At Pu`unene Maui, Hawai`i, Tax Map Key: 3-8-03: Por. 4, Por. 20, and Por. 21	)	

DECISION AND ORDER APPROVING A THIRD AMENDMENT TO THE LAND USE COMMISSION'S SPECIAL USE PERMIT

THIS IS TO CERTIFY THAT THIS IS A TRUE AND CORRECT COPY OF THE DOCUMENT ON FILE IN THE OFFICE OF THE STATE LAND USE COMMISSION, HONOLULU, HAWAII.

MAR 23 2009 BY _____
Date Executive Officer

BEFORE THE LAND USE COMMISSION
STATE OF HAWAI'I

In The Matter Of The Petition Of	)	DOCKET NO. SP97-390
	)	
PUBLIC WORKS AND WASTE MANAGEMENT, SOLID WASTE DIVISION, COUNTY OF MAUI (DEPT. OF ENVIRONMENTAL MANAGEMENT)	)	APPROVING A THIRD AMENDMENT TO THE LAND USE COMMISSION SPECIAL USE PERMIT
To Obtain A Third Amendment To Land Use Commission Special Use Permit To Obtain a Time Extension; For Expansion Of The Permit Area By 41.2 Acres, For Addition Of Composting And Quarrying Related Activities as Permitted Uses; And To Request A Transfer Of Permit Holder To Establish And Operate Central Maui Sanitary Landfill On Approximately 70.5 Acres Of Land Situated Within The State Land Use Agricultural District At Pu`unene Maui, Hawai`i, Tax Map Key: 3-8-03: Por. 4, Por. 20, and Por. 21	)	

DECISION AND ORDER APPROVING A THIRD AMENDMENT TO THE LAND USE COMMISSION'S SPECIAL USE PERMIT

On June 12, 2008, the County of Maui, Department of Environmental Management ("Petitioner"), filed a written request for amendment to State Special Use Permit SP97-390 with the County of Maui Department of Planning ("DP"), pursuant to section 205-6, Hawai`i Revised Statutes ("HRS"), and sections 15-15-95 and 15-15-96, Hawai`i Administrative Rules ("HAR").[1]

The Petitioner sought to amend SP97-390 by: 1) Requesting a Ten Year Time Extension; 2) Expanding the Permit Area by 41.2 acres; 3) adding composting and quarrying related uses; and 4) requesting a transfer of permit holder from the Department of Public Works to the Department of Environmental Management. The Maui Planning Department supported the request with conditions.

On October 28, 2008, the County of Maui Planning Commission ("Planning Commission") conducted a hearing on the Petitioner's Request. One public witness expressed opposition to the request. After due deliberation, the Planning Commission voted to approve the amendment with the existing Conditions currently included in SP97-390, as amended, plus the addition of two new Conditions that provide as follows: 1)" That the Applicant shall clarify the entire acreage that is the subject of LUC Docket No. SP97-390 with the Maui Planning

---

[1] The Applicant concurrently filed applications for a Special Management Area ("SMA") Use Permit and a County Special Use Permit. This is the Third Amendment to this Docket. The Applicant had titled it the Second Amendment.

Commission and the LUC by filing an aerial photographic map with overlay and a site map clearly depicting the proper acreage of SP97-390."; and 2) " That to the extent practicable, leachate generated at the landfill shall be returned to the landfill." The Planning Commission also amended existing Condition 1. by extending the term of the Special Permit 20 years until October 31, 2028, instead of the ten years recommended by the Planning Department.

The Land Use Commission ("Commission") has jurisdiction over the Applicant's Request. Section 205-6, HRS, and sections 15-15-95 and 15-15-96, HAR, authorize this Commission to approve special use permits and amendments thereto for areas greater than 15 acres.

On December 24, 2008, the Commission received a copy of the decision and a portion of the record of the Planning Commission's proceedings on the Petitioner's Request. On February 9, 2009, the Commission received the remaining portion of the record.

On February 19, 2009, the Commission met in Kahului, Maui, Hawai`i, to consider the Petitioner's Request. Cheryl Okuma, Director of the Maui Department of Environmental Management, and Tracy Takamine of the Department of Environmental Management represented the Petitioner. Michael Hopper, Esq. and Robyn Loudermilk represented the County of Maui Planning Department.

Following a presentation by Petitioner, in which it pointed out that approval of this special permit was needed to satisfy Department of Health requirements, and questions and discussion by the Commissioners, a motion was made and seconded to approve the Petitioner's Request as approved by the Maui Planning Commission, subject to the following amendments to the existing Conditions and the addition of new Conditions 16 and 17 as recommended by the Maui Planning Commission. However, the Commission approved a 10 year rather than 20 year extension of the Special Permit. The amended conditions provide as follows:

1. That the State Land Use Commission Special Permit shall be valid until October 31, 2018, subject to further time extensions by the Land Use Commission upon a timely request for extension filed at least one-hundred twenty (120) days prior to its expiration. The appropriate Commission shall make a recommendation to the Land Use Commission and may require a public hearing on the time extension.

13. That the Applicant use non-drinking water, to the extent possible, for grading, dust control, and irrigation of the landfill.

14. That the Applicant shall reasonably ensure that windblown debris around the perimeter of the landfill, particularly within areas visible from the public right-of-way, are removed on a daily basis.

16. That the Applicant shall clarify the entire acreage that is the subject of LUC Docket No. SP97-390 with the Maui Planning Commission and the LUC by filing an aerial photographic map with overlay and a site map clearly depicting the proper acreage of SP97-390.

17. That to the extent practicable, leachate generated at the landfill shall be returned to the landfill.

Following deliberation by the Commissioners, a vote was taken on the motion. There being a vote tally 7 ayes and 2 absent, the motion carried.

ORDER

Having duly considered the complete record of Petitioner's Request and the oral arguments presented by the parties present in the proceeding, and a motion having been made at a meeting on February 19, 2009, in Kahului, Maui, Hawai`i , and the motion having received the affirmative votes required by section 15-15-13, HAR, and there being good cause for the motion, the LUC hereby APPROVES Petitioner's Request to (i) transfer the Permit holder from the Department of Public Works and Waste Management, Solid Waste Division County of Maui to the Department of Environmental Management, County of Maui; (ii) add approximately 41.2 acres of land to the Permit Area as shown on Exhibit "A" attached hereto and incorporated by reference herein; and (iii) add composting and quarrying activities as allowed uses in this 41.2 acre area being added to the Permit Area; subject to the following Amendments: to the existing Permit Conditions and new Conditions 16 and 17:

1. That the State Land Use Commission Special Permit shall be valid until October 31, 2018, subject to further time extensions by the Land Use Commission upon a timely request for extension filed at least one-hundred twenty (120) days prior to its expiration. The appropriate Commission

shall make a recommendation to the Land Use Commission and may require a public hearing on the time extension.

13. That the Applicant use non-drinking water, to the extent possible, for grading, dust control, and irrigation of the landfill.

14. That the Applicant shall reasonably ensure that windblown debris around the perimeter of the landfill, particularly within areas visible from the public right-of-way, are removed on a daily basis.

16. That the Applicant shall clarify the entire acreage that is the subject of LUC Docket No. SP97-390 with the Maui Planning Commission and the LUC by filing an aerial photographic map with overlay and a site map clearly depicting the proper acreage of SP97-390.

17. That to the extent practicable, leachate generated at the landfill shall be returned to the landfill.

All other conditions to the Decision and Order dated May 13, 2002, as further amended by Decision and Order dated December 14, 2004 are hereby reaffirmed and shall continue in effect.

DONE at Honolulu, Hawai`i, this 19th day of March, 2009, per motion on February 19, 2009.

APPROVED AS TO FORM:

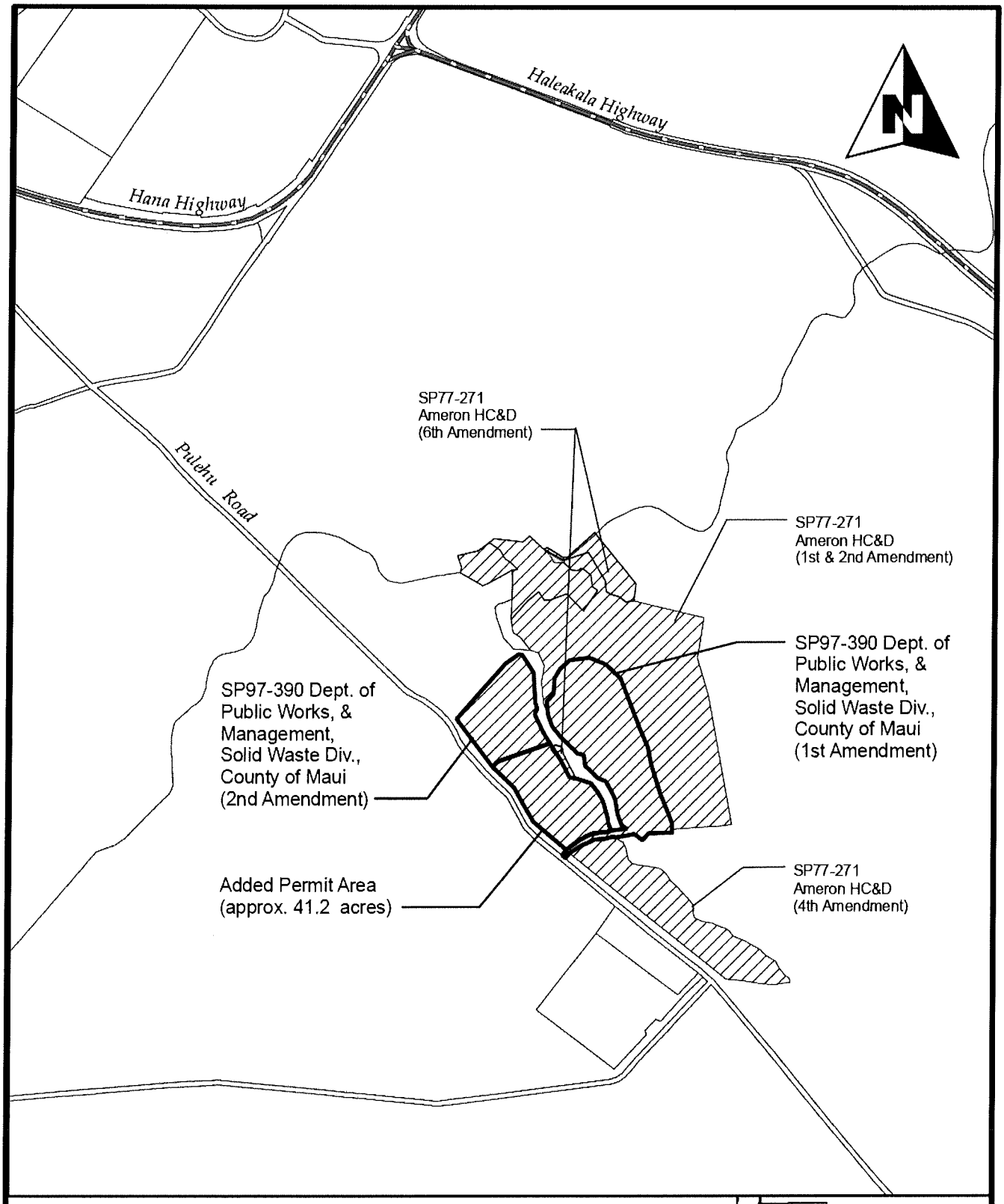
Deputy Attorney General

LAND USE COMMISSION
STATE OF HAWAII

By
DUANE KANUHA
Chairperson and Commissioner

Filed on:
MAR 23 2009

Executive Officer



SP97-390 PUBLIC WORKS AND WASTE MANAGEMENT, SOLID WASTE DIVISION, COUNTY OF MAUI (DEPT. OF ENVIRONMENTAL MANAGEMENT)

Location Map

Tax Map Key: 3-8-03: Por. 4, Por. 20, and Por. 21

Pu`unene, Maui, Hawai`i

Scale: 1" = 2,000 ft.

Exhibit "A"

c:/websluc/dockets/sp97390dpwwm/sp77271dando_exhibit_a.mxd

BEFORE THE LAND USE COMMISSION
STATE OF HAWAI'I

In The Matter Of The Petition Of	)	DOCKET NO. SP97-390
	)	
PUBLIC WORKS AND WASTE MANAGEMENT, SOLID WASTE DIVISION, COUNTY OF MAUI (DEPT. OF ENVIRONMENTAL MANAGEMENT)	)	CERTIFICATE OF SERVICE
To Obtain A Third Amendment To Land Use Commission Special Use Permit To Obtain a Time Extension; For Expansion Of The Permit Area By 41.2 Acres, For Addition Of Composting And Quarrying Related Activities as Permitted Uses; And To Request A Transfer Of Permit Holder To Establish And Operate Central Maui Sanitary Landfill On Approximately 70.5 Acres Of Land Situated Within The State Land Use Agricultural District At Pu`unene Maui, Hawai`i, Tax Map Key: 3-8-03: Por. 4, Por. 20, and Por. 21	)	

CERTIFICATE OF SERVICE

I hereby certify that a copy of DECISION AND ORDER APPROVING A THIRD AMENDMENT TO THE LAND USE COMMISSION SPECIAL USE PERMIT was

served upon the following by either hand delivery or depositing the same in the U. S. Postal Service by regular or certified mail as noted:

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REGULAR MAIL: Mr. Mike Munekiyo
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REGULAR MAIL: Cheryl Okuma, Director
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Department of Environmental Management
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Wailuku, Hawaii 96793

CERTIFIED MAIL: Mr. Michael Hopper Esq.,
County of Maui
Department of Environmental Management
200 South High Street, Room 322
Wailuku, Hawaii 96793

Honolulu, Hawaii, MAR 23 2009.

ORLANDO DAVIDSON
Executive Officer

STATE SPECIAL PERMIT SP97-390 FY18 ANNUAL REPORT

APPENDIX A-1

CENTRAL MAUI LANDFILL (CML) EXPANSION
STATE LAND USE COMMISSION
FY 2018 ANNUAL REPORT
SP97-390

Part 1: Project Summary

CML Facilities

Sub-consultant work, including a traffic study, flora and fauna survey, and archaeological assessment, which commenced early in FY 2017, was published in the draft Environmental Assessment for the proposed Central Maui Landfill facilities project in February 2018. Also, published at the same time were the Amendments to State Land Use Commission Special Permit (SP 97-390) and County Special Use Permit (CUP 2008/0003) for the proposed Central Maui Landfill Facilities Project in Pu'unene. These amendments include a time extension for the State Special Use Permit to run concurrent with the County CUP which expires on October 31, 2028, boundary changes, and addition of a 40 acre portion of 3-8-3:019 for landfill diversion activities. Comment letters were received and will be responded to in the final Environmental Assessment (final EA) to be published early in 2019. During FY 2018 mapping clarifications for amendments were made with the Land Use Commission and a cultural impact assessment contracted with Cultural Surveys Hawaii for inclusion in the final EA.

Phase V-B Extension

DOH issued the operating permit for CML in February 2018. Included in the permit requirements were the installation of three additional groundwater monitoring wells before January 1, 2019 and the submission of a Groundwater and Leachate Monitoring Plan. A draft plan was submitted to DOH in May 2018. Construction of the new cell was contracted to Alpha Construction for $3,113,884 in the fall of 2017. An amendment to the contract for $139,841 was made in the spring 2018. The Notice-to-Proceed was issued May 21, 2018 with work scheduled for completion in December 2018.

Construction and Demolition (C&D) Debris Screening Procedures

Following the closure of the Maalaea Construction and Demolition Landfill in FY 2017, Central Maui Landfill became the disposal site for construction and demolition waste. Element Environmental, was contracted for $143,280 for FY 2018 to screen customer waste and a contractor, TJ Gomes Trucking Co., Inc. was contracted for $450,000 to process earthen material and concrete rubble in FY 2018.

Electrical Distribution System Upgrades

Design by Brown & Caldwell continued for electrical upgrades to the leachate tank area. Tasks include design of a new cabinet with a new electrical feed, panelboard, concrete pad, transfer switch, emergency generator, flowmeters between Phase IV-A and IV-B sumps and the tank farm as well as modifications to the Phase IV-B piping and manhole for leachate recirculation from the tank farm back to the leachfield.

SCADA

Work on system control and data acquisition by the electrical consultant continued.

Part 2: Project Compliance

Condition 1: That the Land Use Commission Special Permit shall be valid until October 31, 2018, subject to further time extensions by the Land Use Commission upon a timely request for extension filed at least one-hundred twenty (120) days prior to its expiration. The appropriate Commission shall make a recommendation to the Land Use Commission and may require a public hearing on the time extension.

Report: The request for a time extension of the State SUP was made in February 2018 as part of the application for landfill diversion activities as well as boundary changes. The time extension request is for the State SUP to run concurrently with the County Special Use Permit which expires on October 31, 2028.

Condition 2: That the conditions of this State Land Use Commission Special use Permit shall be enforced pursuant to Sections 205-12 and 205-13, Hawaii Revised Statutes. Failure to comply with one or more of the conditions herein shall result in a notice of violation issued by the appropriate enforcement agency, notifying the permit holder of the violation and providing the permit holder no more than sixty (60) days to cure the violation. If the permit holder fails to cure the violation within sixty (60) days of said notice, the appropriate enforcement agency shall issue an order which may require one or more of the following: that the violative activity cease, that the violative development be removed; that a civil fine by paid not to exceed ONE THOUSAND AND NO/100 DOLLARS ($1,000) per violation; that a civil fine not to exceed FIVE THOUSAND AND NO/100 DOLLARS ($5,000.00) shall be issued if violation not cured within six months of the issuance of the order. The order shall become final thirty (30) days after the date of its mailing or hand-delivery unless written request for a hearing is mailed or delivered to the Planning Department within said thirty (30) days. Upon receipt of a request for a hearing, the Planning Department shall specify a time and place for the permit holder to appear and be heard. The hearing shall be conducted by the Planning Director or the Director's designee in accordance with the provisions of Chapter 91, HRS, as amended.

Report: The County is complying with all conditions.

Condition 3: That the subject Land Use Commission Special Use Permit shall not be transferred without the prior written approval of the Land Use Commission. The appropriate Planning Commission shall make a recommendation to the Land Use Commission. However, in the event that a contested case hearing preceded issuance of said State Land Use Commission Special Use Permit, a public hearing shall be held by the appropriate Planning Commission upon due published notice, including actual written notice to the last known addresses of parties to said contested case and their counsel.

Report: No request for transfer has been made.

Condition 4: That full compliance with all applicable governmental requirements shall be rendered.

Report: The landfill is permitted by DOH and follows the operating criteria of RCRA 40 CFR Part 258 Subpart C-operating criteria and Chapter 58.1 of Title 11, Hawaii Administrative Rules, 11-58.1.1-15—Municipal solid waste landfills—operating criteria.

Condition 5: That the Applicant shall develop the Property in substantial compliance with the representations made to the Land Use Commission in obtaining the State Land Use Commission Special Use Permit. Failure to so develop the Property may result in the revocation of the permit.

Report: The Property has been developed as proposed to the Land Use Commission.

Condition 6: That the Applicant shall begin construction of the landfill expansion within 12 months from issuance of the Land Use Commission's decision and order dated May 13, 2002. Construction shall include any improvements necessary to the operation of the landfill pursuant to all applicable laws and regulations.

Report: The construction of the entrance facility began on March 3, 2003.

Condition 7: That the Applicant shall take appropriate mitigative measures to minimize erosion, and prevent cement products, oil, fuel, and other toxic substances associated with the use of heavy machinery from spilling or leaching into the ground.

Report: Landfill equipment is maintained regularly, replaced or repaired when needed; contractor equipment is in good operating condition with no leaking parts. The Spill Prevention and Containment Plan is updated annually for the NPDES Storm Water Pollution Control Plan. Landfill slopes are regularly inspected for erosion and repaired as necessary.

Condition 8: That the Applicant shall comply with the Department of Health Ambient Air Quality Standards, Hawaii Administrative Rules, Title 11, Chapter 59 and Air Pollution Control, HAR 11-60.

Report: Landfill operations comply with air quality regulations. Dust is controlled by paved roadways around the landfill and with regular spraying by the water truck for the unpaved roadways. Dust from cover soil is controlled by moisture conditioning. Tarp use decreases the use of cover soil which results in less dust. The landfill gas collection system is monitored and maintained regularly. Reporting and notifications to the Department of Health Clean Air Branch and Solid Waste Branch are made as required.

Condition 9: That the Applicant shall comply with the EPA's New Source Performance Standards.

Report: The County continues to sample and monitor the gas wells installed within the landfill. Surface emissions measurements are taken at the landfill. In addition, perimeter gas monitoring probes at Phases I and II and IV and V are sampled and metered. Gas well measurements are compiled in reports submitted to the Hawaii Dept. of Health, Clean Air Branch for review. Perimeter monitoring results are sent to the Hawaii Dept. of Health, Solid Waste Branch. A landfill gas collection system installed in Phases I and II pipes landfill gas to the flare in Phase IV where the landfill gas is flared. Design and construction of a gas collection system for Phase IV was funded in FY2010 for $2M. Cornerstone was the designer; gas well construction was completed by Goodfellow Bros. in June 2011. This work was part of a settlement agreement with the U.S.E.P.A. which also included a Supplemental Environmental Project that designed and installed wind turbines to produce electricity for landfill facilities. Phase V vertical and horizontal wells were installed in FY 2017 and Cornerstone continued to provide compliance and O&M services. In FY 2018 their contract was for $285,272.

Condition 10: That the Applicant shall immediately stop work and contact the State Historic Preservation Division, Department of Land and Natural Resources should any previously unidentified archaeological resources such as artifacts, shell, bone, charcoal deposits, human burial, rock or coral alignments, pavings or wall be encountered during development of the Special Use Permit area.

Report: No archaeological resources such as artifacts, shell, bone, charcoal deposits, human burial, rock or coral alignments have been discovered during any construction.

Condition 11: That provisions shall be enacted to ensure emergency access to the sanitary landfill in case of fire or any other disaster.

Report: Fire Dept. and Police Dept. have keys to the gate to enter the landfill anytime.

Condition 12: That the Applicant shall timely provide without any prior notice, annual reports to the Land Use Commission and the County of Maui Planning Department in connection with the status of the subject project and Applicant's progress in complying with the conditions imposed herein. The annual report shall also include the capacity remaining in the landfill at the time of submission of the annual report. The annual report shall be submitted in a form prescribed the Executive Officer of the Land Use Commission.

Report: This annual report is submitted to meet this condition. With the construction of Phase V in 2012, the landfill has capacity to 2020. Construction of Phase V-B Extension will add three years capacity.

Condition 13: That the Applicant shall utilize non-drinking water, to the extent possible, for grading, dust control, and irrigation of the landfill.

Report:. A non-potable water production well on-site ensures that non-drinking water is used to meet the landfill's operational needs for dust control and grading.

Condition 14: That the Applicant shall reasonably ensure that windblown debris around the perimeter of the landfill, particularly within areas visible from the public right of way, are removed on a daily basis.

Report: The landfill applies leachate to the working face for litter control. Portable litter fences are installed near the working face to catch any litter from the trucks as they unload the municipal solid waste. The landfill staff use a vacuum to collect litter from around the entrance facility while crews from People Who Clean and landfill personnel manually pick up litter along Pulehu Rd. and the grounds not reached by the vacuum. A permanent, 30-foot litter fence is installed between Phases V-A and V-B and Pulehu Rd. New fencing will be installed between Phase V-B Extension and Pulehu Rd.

Condition 15: That full compliance with the requirements of the State's Department of Health for sanitary landfill operation shall be rendered.

Report: Landfill operations are in compliance with the terms and conditions of Permit No. LF-0074-13 issued by the Department of Health and effective to February 2023.

Condition 16: That the Applicant shall clarify the entire acreage that is the subject of LUC Docket No. SP97-390 with the Maui Planning Commission and the LUC by filing an aerial photographic map with overlay and a site map clearly depicting the proper acreage of SP97-390.

Report: The maps were sent to the Maui Planning Commission and the LUC at the time they were requested. Clarifications were sent in FY 2018.

Condition 17: That to the extent practicable, leachate generated at the landfill shall be returned to the landfill.

Report: Leachate, in compliance with the operating permit, generated at the active area was applied to the working face for increased compaction and litter control. A leachate recirculation plan was prepared by the landfill consultant and submitted to the Dept. of Health in 2013. The plan includes placing pipes in the waste to circulate leachate collected at the sump. Piping and trenching was done by Goodfellow Bros. in 2014 at Phase V-A. In FY 2016 a leachate recirculation system for V-B was constructed by Betsill Brothers, which included pump installation, controls, and manifold piping. This work was completed in March 2016 and leachate is recirculated on a regular basis.

LAND USE COMMISSION CORRESPONDENCE REGARDING SP97-390 AERIAL MAP

APPENDIX

A-1(a)

FILE

DAVID Y. IGE
Governor

LUIS P. SALAVERIA
Director
MARY ALICE EVANS
Deputy Director

RECEIVED
2018 AUG 10 PM 4:05
DEPT OF ENVIRONMENTAL MGMT

LAND USE COMMISSION

Department of Business, Economic Development & Tourism
State of Hawai`i

DANIEL E. ORODENKER
Executive Officer

DEM	INFO	ACTION
DIRECTOR		
DEPUTY		
PERS		
WWR		
SW		✓
EP&S		
SECTY		

August 7, 2018

Mr. Stewart Stant, Director
Department of Environmental Management
County of Maui
2050 Main Street, Suite 2B
Wailuku, Hawai`i 96793

Dear Mr. Stant:

Subject: Docket No. SP97-390/Department of Public Works and Waste Management, Solid Waste Division, County of Maui

This is to acknowledge receipt of your letter dated July 30, 2018, transmitting an aerial photograph overlaid with the Central Maui Landfill site, pursuant to Condition No. 16 of the Decision and Order Approving a Third Amendment to the Land Use Commission's Special Use Permit filed March 23, 2009. We understand that this aerial photograph supersedes the previous map that was forwarded by your department by letter dated October 6, 2009, and more accurately depicts the boundaries of the current special permit area consistent with the previous amendments in the docket.

We further understand that your department has filed an application for a Fourth Amendment with the County of Maui Planning Commission requesting, among other things, to include additional lands under the landfill and to delete existing acreage previously approved in the docket. Given that this request will further amend the boundaries of the landfill, we suggest that close coordination continue with our office to ensure that the record reflects the proper area of the special use permit.

Should you have any questions on this matter, please feel free to call Bert Saruwatari of our office at 587-3822.

Sincerely,

DANIEL E. ORODENKER
Executive Officer

235 SOUTH BERETANIA STREET ◎ SUITE 406 ◎ HONOLULU, HAWAI`I 96813 ◎ TEL: (808) 587-3822 ◎ FAX: (808) 587-3827
EMAIL: dbedt.luc.web@hawaii.gov
MAILING ADDRESS: P. O. Box 2359, Honolulu, Hawai`i 96804

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

July 30, 2018

Daniel Orodenker, Executive Officer
State of Hawai'i Land Use Commission
Dept. of Business, Economic Development, and Tourism
P.O. Box 2359
Honolulu, HI 96804-2359

Dear Mr. Orodenker:

SUBJECT: **SP 97-390 FOR THE CENTRAL MAUI LANDFILL**
CORRECTION TO THE THIRD AMENDMENT
PERMIT CONDITION NO. 16

Attached is a corrected aerial map showing the areas of Central Maui Landfill subject to SP97-390 and its amendments according to Condition No. 16 of the Third Amendment "That the Applicant shall clarify the entire acreage that is the subject of LUC Docket No. SP97-390 with the Maui Planning Commission and the LUC by filing an aerial photographic map with overlay and a site map clearly depicting the proper acreage of SP97-390."

Mr. Bert Saruwatari of your staff assisted us with this clarification of the existing permitted acreage as part of the application review in progess for a Fourth Amendment to SP97-390. As a result, we have noted that the setback from Pulehu Rd. was mistakenly included in the landfill boundaries shown on the aerial submitted on October 6, 2009, but was excluded from the acreage calculation. The boundaries shown in yellow are the corrected boundaries.

If you have any questions, please call Elaine Baker, Solid Waste Division Engineer, at 808-270-7875.

Sincerely,

Stewart Stant
Director of Environmental Management

xc: Elaine Baker, Solid Waste Division
Michele McLean, Planning Director
Colleen Suyama, Munekiyo Hiraga
Attach


LOT 1-A
LOT 1
59.686 Acres
NEW LOT 1-A
151.476 Acres
LOT 2-B
SPECIAL USE PERMIT SP97-390
70.5 Acres
NEW LOT 1-B
29.340 Acres
(1997)
41.2 Acres
(2009)
1.395 Acres (2004)
6,352 SQ. FT. (2002)
CENTRAL MAUI LANDFILL
THIRD AMENDMENT TO STATE
SPECIAL USE PERMIT SP97-390
COUNTY OF MAUI
DEPARTMENT OF ENVIRONMENTAL
MANAGEMENT
SOLID WASTE DIVISION

METES AND BOUNDS DESCRIPTIONS AND MAP

APPENDIX A-2

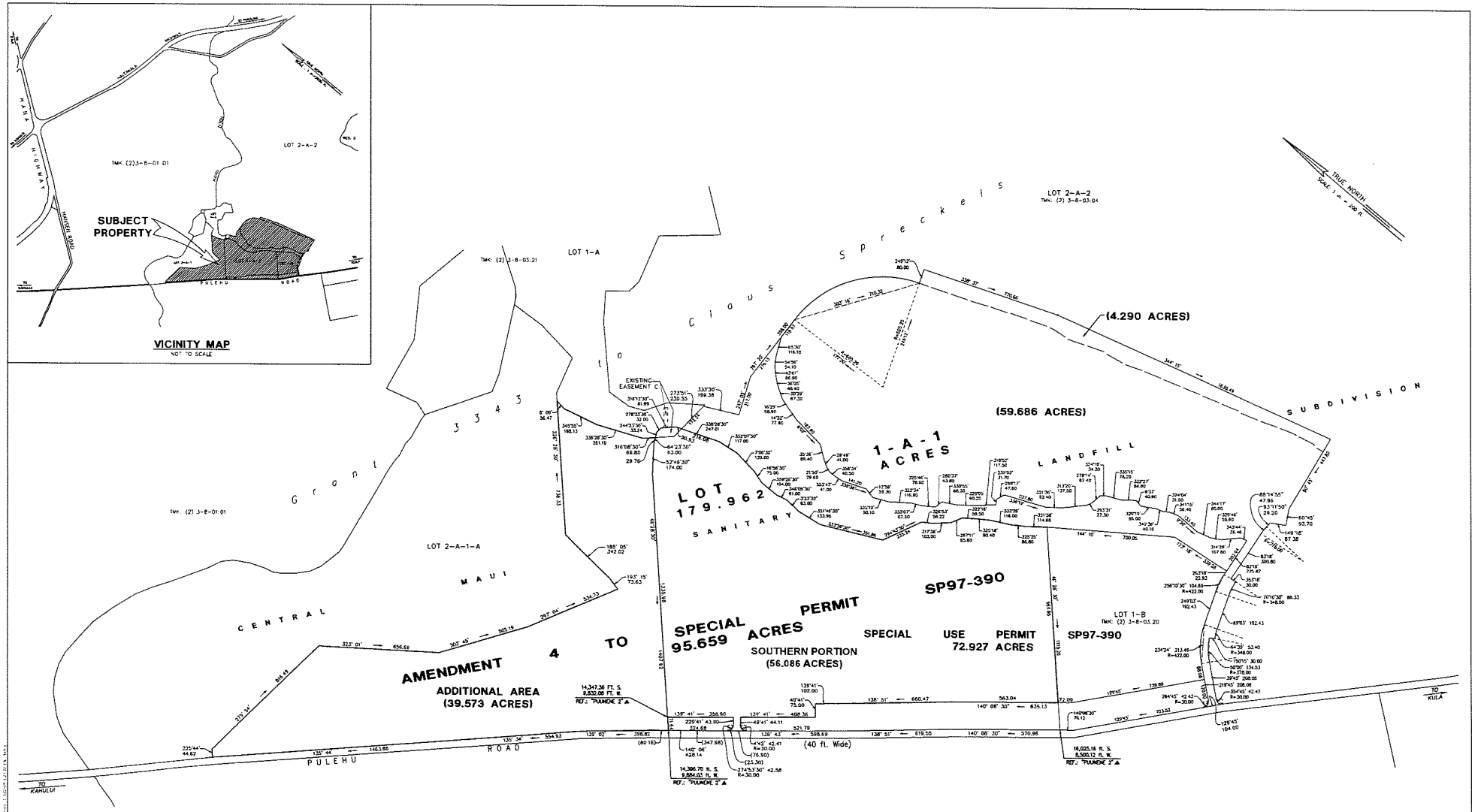

EXHIBIT MAP SHOWING

AMENDMENT 4 TO SPECIAL PERMIT SP97-390

BEING A PORTION OF LOT 1-A-1, CENTRAL MAUI SANITARY LANDFILL SUBDIVISION
BEING, ALSO, A PORTION OF GRANT 3343 TO CLAUS SPRECKELS

AT PUUNENE, WAILUKU, MAUI, HAWAII

200 100 0 200 400
GRAPHIC SCALE IN FEET

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

KIRK T. TANAKA
LICENSED PROFESSIONAL LAND SURVEYOR
No. 7223-LS
HAWAII, U.S.A.

KIRK T. TANAKA
Licensed Professional Land Surveyor
Certificate No. 7223
License Expires: APRIL 30, 2020

07/02/19
DATE

REVISED: JULY 01, 2019
REVISED: MARCH 19, 2019
REVISED: MAY 9, 2018
APRIL 19, 2018
JOB NO. 18-022

Tax Map Key (2) 3-8-03: 19 (Portion)

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS - CIVIL & STRUCTURAL ENGINEERS

SOUTHERN PORTION

OF

AMENDMENT 4 TO SPECIAL PERMIT SP97-390

BEING A PORTION OF LOTS 1-A-1 AND 1-A,

CENTRAL MAUI SANITARY LANDFILL SUBDIVISION

BEING ALSO A PORTION OF GRANT 3343 TO CLAUS SPRECKELS

SITUATED ON THE EASTERLY SIDE OF PULEHU ROAD

AT PUUNENE, WAILUKU, MAUI, HAWAII

Beginning at the Northwest corner of this Area on the Easterly side of Pulehu Road, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUUNENE 2" being 14,347.36 feet South and 9,832.08 feet West and running by azimuths measured clockwise from True South:

1.	226° 28' 30"	1,335.98 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
2.	232° 49' 30"	174.00 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
3.	244° 23' 30"	63.00 feet	along the remainder of Lots 1-A-1 and 1-A, Central Maui Sanitary Landfill Subdivision;
4.	278° 33' 30"	32.00 feet	along the remainder of Lot 1-A, Central Maui Sanitary Landfill Subdivision;
5.	316° 12' 30"	81.99 feet	along the remainder of Lot 1-A, Central Maui Sanitary Landfill Subdivision;
6.	338° 28' 30"	247.01 feet	along the remainder of Lot 1-A and 1-A-1, Central Maui Sanitary Landfill Subdivision;
7.	352° 07' 30"	117.00 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
8.	7° 06' 30"	139.00 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
9.	16° 58' 30"	75.00 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
10.	359° 26' 30"	104.00 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;

11.	346° 05' 30"	61.00 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
12.	3° 23' 30"	93.00 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
13.	351° 46' 30"	133.96 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
14.	333° 39' 30"	351.86 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
15.	294° 43' 30"	235.24 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
16.	326° 53'	58.22 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
17.	317° 36'	103.00 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
18.	297° 11'	65.60 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
19.	322° 18'	59.50 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
20.	325° 18'	90.40 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
21.	332° 26'	116.00 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
22.	325° 35'	86.80 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
23.	321° 38'	114.68 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
24.	46° 28' 30"	964.96 feet	along Lot 1-B, Central Maui Sanitary Landfill Subdivision;
25.	140° 08' 30"	563.04 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
26.	138° 51'	660.47 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
27.	139° 41'	102.00 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
28.	49° 41'	75.00 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;

29.	139° 41'	408.36 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
30.	49° 41'	44.11 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;

31. Thence, along the remainder of 1-A-1, Central Maui Sanitary Landfill Subdivision on a curve to the left with a radius of 30.00 feet, the chord azimuth and distance being:

4° 42' 42.41 feet;

32.	139° 43'	76.90 feet	along Pulehu Road;
33.	140° 06'	23.30 feet	along Pulehu Road;

34. Thence, along Lot 1-A-1, Central Maui Sanitary Landfill Subdivision on a curve to the left with a radius of 30.00 feet, the chord azimuth and distance being:

274° 53' 30" 42.58 feet;

35.	229° 41'	43.90 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
36.	139° 41'	358.90 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision to the point of beginning and containing an area of 56.086 Acres.



R. T. TANAKA ENGINEERS, INC.

Kirk T. Tanaka
Licensed Professional Surveyor
Certificate No. 7223-LS
License Expires: April 30, 2020

871 Kolu Street, Suite 201
Wailuku, Hawaii 96793

July 2, 2019

ADDITIONAL AREA

AMENDMENT 4 TO SPECIAL PERMIT SP97-390

BEING A PORTION OF LOT 1-A-1,

CENTRAL MAUI SANITARY LANDFILL SUBDIVISION

BEING ALSO A PORTION OF GRANT 3343 TO CLAUS SPRECKELS

SITUATED ON THE EASTERLY SIDE OF PULEHU ROAD

AT PUUNENE, WAILUKU, MAUI, HAWAII

Beginning at the Southwest corner of this Additional Area on the Easterly side of Pulehu Road, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUUNENE 2" being 14,396.70 feet South and 9,884.03 feet West and running by azimuths measured clockwise from True South:

1.	140° 06'	80.16 feet	along Pulehu Road;
2.	139° 02'	398.82 feet	along Pulehu Road;
3.	135° 34'	554.93 feet	along Pulehu Road;
4.	135° 44'	1,463.88 feet	along Pulehu Road;
5.	225° 44'	44.62 feet	along Lot 2-A-1-A, Central Maui Sanitary Landfill Subdivision;
6.	275° 54'	816.49 feet	along Lot 2-A-1-A, Central Maui Sanitary Landfill Subdivision;
7.	323° 01'	656.69 feet	along Lot 2-A-1-A, Central Maui Sanitary Landfill Subdivision;
8.	303° 45'	505.19 feet	along Lot 2-A-1-A, Central Maui Sanitary Landfill Subdivision;
9.	297° 04'	534.73 feet	along Lot 2-A-1-A, Central Maui Sanitary Landfill Subdivision;
10.	193° 15'	73.63 feet	along Lot 2-A-1-A, Central Maui Sanitary Landfill Subdivision;
11.	185° 05'	342.02 feet	along Lot 2-A-1-A, Central Maui Sanitary Landfill Subdivision;
12.	226° 28' 30"	736.33 feet	along Lot 2-A-1-A, Central Maui Sanitary Landfill Subdivision;

13.	8° 09'	56.47 feet	along Lot 1-A, Central Maui Sanitary Landfill Subdivision;
14.	345° 55'	198.13 feet	along Lot 1-A, Central Maui Sanitary Landfill Subdivision;
15.	336° 28' 30"	261.19 feet	along Lot 1-A, Central Maui Sanitary Landfill Subdivision;
16.	316° 08' 30"	69.80 feet	along Lot 1-A, Central Maui Sanitary Landfill Subdivision;
17.	64° 23' 30"	29.76 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
18.	52° 49' 30"	174.00 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision;
19.	46° 28' 30"	1,407.62 feet	along the remainder of Lot 1-A-1, Central Maui Sanitary Landfill Subdivision to the point of beginning and containing an area of 39.573 Acres.



R. T. TANAKA ENGINEERS, INC.

Kirk T. Tanaka
Licensed Professional Surveyor
Certificate No. 7223-LS
License Expires: April 30, 2020

871 Kolu Street, Suite 201
Wailuku, Hawaii 96793

May 2, 2018

COUNTY SPECIAL USE PERMIT

APPENDIX

B

CHARMAINE TAVARES
Mayor

JEFFREY S. HUNT
Director

KATHLEEN ROSS AOKI
Deputy Director

COUNTY OF MAUI
DEPARTMENT OF PLANNING

November 28, 2008

CERTIFIED MAIL - #7006 2760 0000 7127 4494

Ms. Erin Mukai
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Ms. Mukai:

SUBJECT: **COUNTY SPECIAL USE PERMIT AND LAND USE COMMISSION SPECIAL PERMIT FOR THE CENTRAL MAUI LANDFILL AT TMK'S: 3-8-003:004, 020 (POR), & 025 (POR), PUUNENE, MAUI, HAWAII; (SUP1 960009) (CUP 2008/0003) (SP 97-390)**

At its regular meeting on October 28, 2008, the Maui Planning Commission (Commission) reviewed the above requests and after due deliberation and receipt of testimony and exhibits, hereby orders approval of the County Special Use Permit, subject to the following conditions:

1. That the County Special Use Permit shall be valid until October 31, 2028, subject to extension by the Commission upon a timely request for extension filed at least ninety (90) days prior to its expiration. The Commission may require a public hearing on the time extension.

2. That the County Special Use Permit shall not be transferred without the prior written approval of the Commission.

3. That full compliance with all applicable governmental requirements shall be rendered.

4. That the applicant shall submit to the Department of Planning (Department) five (5) copies of a detailed report addressing its compliance with the conditions established with the subject County Special Use Permit. Said compliance report shall be submitted with a time-extension request or request to amendment the County Special Use Permit

5. That the applicant shall develop the property in substantial compliance with the representations made to the Commission in obtaining the County Special Use Permit. Failure to so develop the property may result in the revocation of the permit.

6. That the Applicant shall begin construction of the landfill expansion within six (6) months from issuance of the Land Use Commission's decision and order on the amendment. Construction shall include any improvements necessary to operate the landfill pursuant to all applicable laws and regulations.

7. That the Applicant shall take appropriate mitigative measures to minimize erosion, and prevent cement products, oil, fuel, and other toxic substances associated with the use of heavy machinery from spilling or leaching into the ground.

8. That the Applicant shall comply with Department of Health Ambient Air Quality Standards, Hawaii Administrative Rules, Title 11, Chapter 59 and Air Pollution Control, HAR 11-60.

9. That the Applicant shall comply with the EPA's New Source Performance Standards.

10. That the Applicant shall immediately stop work and contact the State Historic Preservation Division, Department of Land and Natural Resources should any previously unidentified archaeological resources such as artifacts, shells, bone, charcoal deposits, human burial, rock or coral alignments, pavings or wall be encountered during development of the Special Permit area.

11. That provisions shall be enacted to ensure emergency access to the sanitary landfill in case of fire or any other disaster.

12. That the Applicant shall utilize non-potable water, to the extent possible, for grading, dust control, and irrigation of the landfill.

13. That the Applicant shall ensure that windblown debris around the perimeter of the landfill, particularly within areas visible from the public right-of-way, are removed in a timely manner.

14. That full compliance with the requirements of the State's Department of Health for sanitary landfill operations shall be rendered.

15. That the Applicant shall clarify the entire acreage that is the subject of LUC Docket No. SP97-390 with the Maui Planning Commission and the

LUC by filing an aerial photographic map with overlay and a site map clearly depicting the proper acreage of SP97-390.

16. That to the extent practicable, leachate generated at the landfill shall be returned to the landfill.

Further, the Commission adopted the enclosed Report and Recommendation prepared by the Department for the October 28, 2008, meeting as its Findings of Fact, Conclusions of Law, and Decision and Order. Parties to proceedings before the Commission may obtain judicial review of decision and orders issued by the Commission in the manner set forth in Chapter 91-14, Hawaii Revised Statutes.

Additionally, the Commission voted to recommend to the State Land Use Commission approval of the Second Amendment to the Land Use Commission Special Permit subject to the following conditions:

1. That the State Land Use Commission Special Permit shall be valid until October 31, 2028, subject to further time extensions by the Land Use Commission upon a timely request for extension filed at least one-hundred twenty (120) days prior to its expiration. The appropriate Commission shall make a recommendation to the Land Use Commission and may require a public hearing on the time extension.

2. That the conditions of this State Land Use Commission Special Permit shall be enforced pursuant to Section 205-12 and 205-13, Hawaii Revised Statutes. Failure to comply with one or more of the conditions herein shall result in a notice of violation issued by the appropriate enforcement agency, notifying the permit holder of the violation and providing permit holder no more than sixty (60) days to cure the violation. If the permit holder fails to cure the violation within sixty (60) days of said notice, the appropriate enforcement agency shall issue an order which may require one or more of the following: that the violative activity cease; that the violative development be removed; that a civil fine be paid not to exceed ONE THOUSAND AND NO/100 DOLLARS ($1,000.00) per violation; that a civil fine not to exceed FIVE THOUSAND AND NO/100 DOLLARS ($5,000.00) shall be issued if violation not cured within six months of the issuance of the order. The order shall become final thirty (30) days after the date of its mailing or hand-delivery unless written request for a hearing is mailed or delivered to the Department within said thirty (30) days. Upon receipt of a request for a hearing, the Planning Director shall specify a time and place for the permit holder to appear and be heard. The hearing shall be conducted by the Planning Director or the Director's designee in accordance with the provisions of Chapter 91, HRS, as amended.

3. That the subject State Land Use Commission Special Permit shall not be transferred without the prior written approval of the Land Use Commission. The appropriate Planning Commission shall make a recommendation to the Land Use Commission. However, in the event that a contested case hearing preceded issuance of said State Land Use Commission Special Permit, a public hearing shall be held by the appropriate Planning Commission upon due published notice, including actual written notice to the last known addresses of parties to said contested case and their counsel.

4. That full compliance with all applicable governmental requirements shall be rendered.

5. That the Applicant shall develop the Property in substantial compliance with the representations made to the Land Use Commission in obtaining the State Land Use Commission Special Permit. Failure to develop the Property may result in the revocation of the permit.

6. That the Applicant shall begin construction of the landfill expansion within six months from issuance of the Land Use Commission's decision and order on the amendment. Construction shall include any improvements necessary to operate the landfill pursuant to all applicable laws and regulations.

7. That the Applicant shall take appropriate mitigative measures to minimize erosion, and prevent cement products, oil, fuel, and other toxic substances associated with the use of heavy machinery from spilling or leaching into the ground.

8. That the Applicant shall comply with Department of Health Ambient Air Quality Standards, Hawaii Administrative Rules, Title 11, Chapter 59 and Air Pollution Control, HAR 11-60.

9. That the Applicant shall comply with the EPA's New Source Performance Standards.

10. That the Applicant shall immediately stop work and contact the State Historic Preservation Division, Department of Land and Natural Resources should any previously unidentified archaeological resources such as artifacts, shells, bone, charcoal deposits, human burial, rock or coral alignments, pavings or wall be encountered during development of the Special Permit area.

11. That provisions shall be enacted to ensure emergency access to the sanitary landfill in case of fire or any other disaster.

12. That the Applicant shall timely provide without any prior notice, annual reports to the Land Use Commission and the County of Maui Planning Department in connection with the status of the subject project and the Applicant's progress in complying with the conditions imposed herein. The annual report shall also include the capacity remaining in the landfill at the time of submission of the annual report. The annual report shall be submitted in a form prescribed by the Executive Officer of the Land Use Commission.

13. That the Applicant shall utilize non-potable water, to the extent possible, for grading, dust control, and irrigation of the landfill.

14. That the Applicant shall reasonably ensure that windblown debris around the perimeter of the landfill, particularly within areas visible from the public right-of-way, are removed in a timely manner.

15. That full compliance with the requirements of the State's Department of Health for sanitary landfill operations shall be rendered.

16. That the Applicant shall clarify the entire acreage that is the subject of LUC Docket No. SP97-390 with the Maui Planning Commission and the LUC by filing an aerial photographic map with overlay and a site map clearly depicting the proper acreage of SP97-390.

17. That to the extent practicable, leachate generated at the landfill shall be returned to the landfill.

Thank you for your cooperation. If additional clarification is required, please contact Staff Planner Robyn Loudermilk at robyn.loudermilk@mauicounty.gov or at 270-7180.

Sincerely,

JEFFREY S. HUNT, AICP
Planning Director

Attachment
xc: Clayton I. Yoshida, AICP, Planning Program Administrator
Aaron H. Shinmoto, PE, Planning Program Administrator
Robyn L. Loudermilk Staff Planner
Development Services Administration
Department of Health, Maui District
Project File
General File
JSH:RLL:bg
K:\WP_DOCS\PLANNING\SUP1\1996\0009_CentralMauiLandfill_Expansion\2007_txt\CUPApproval.doc

LETTER DATED AUGUST 10, 2016 FROM OFFICE OF ENVIRONMENTAL QUALITY CONTROL

APPENDIX C

OFFICE OF ENVIRONMENTAL QUALITY CONTROL

DAVID Y. IGE
GOVERNOR

SCOTT GLENN
DIRECTOR

DEPARTMENT OF HEALTH | 235 South Beretania Street, Suite 702, Honolulu, HI 96813 | oeqchawaii@doh.hawaii.gov

(808) 586-4185

August 10, 2016

Colleen Suyama, Senior Associate
Munekiyo Hiraga
305 High Street, Suite 104
Wailuku, HI 96793

Dear Ms. Suyama,

SUBJECT: Proposed Central Maui Landfill Facilities Project, Pu'unēnē, Maui, Hawai'i

In correspondence dated August 3, 2016, you requested confirmation that the County of Maui Department of Environmental Management is the appropriate proposing and determining agency for the subject environmental assessment (EA).

Hawai'i Administrative Rules (HAR) section 11-200-4(b), referenced in your letter, specifically applies to applicant actions. Based on the information you provided, the proposed action is an agency action. Hawai'i Revised Statutes chapter 343-5(b) states:

> *Whenever an agency proposes an action in subsection (a) ... the agency shall prepare an environmental assessment for the action at the earliest practicable time to determine whether an environmental impact statement shall be required ...*

Additionally, the Office of Environmental Quality Control recommends coordinating with the State Land Use Commission during the early consultation process, pursuant to HAR section 11-200-9(b)(1), to identify concerns to address in the EA to inform subsequent permitting.

Thank you for your inquiry. If you have any questions, please contact our office at (808) 586-4185.

Sincerely,

Scott J. Glenn

Scott Glenn, Director

cc: Daniel Orodenker, Executive Director, State Land Use Commission
Clayton Yoshida, County of Maui, Department of Planning
Kurt Wollenhaupt, County of Maui, Department of Planning
Elaine Baker, County of Maui, Department of Environmental Management

17-057

APPENDIX

DECLARATORY ORDER
DOCKET NO. DR09-38

D

LAND USE COMMISSION
STATE OF HAWAII

2015 FEB 20 A 9:51

THE ORIGINAL OF THE DOCUMENT
RECORDED AS FOLLOWS:
STATE OF HAWAII
BUREAU OF CONVEYANCES
Doc A-55290649
February 20, 2015 8:02 AM

LAND COURT SYSTEM | REGULAR SYSTEM

AFTER RECORDATION: RETURN BY MAIL ( ) PICK UP (X)

BENJAMIN M. MATSUBARA, ESQ.
Matsubara - Kotake
888 Mililani Street, Eighth Floor
Honolulu, Hawai`i 96813
Telephone: (808) 526-9566

TITLE OF DOCUMENT: DECLARATION OF IMPORTANT AGRICULTURAL LANDS; EXHIBITS "A" AND "B"

Total Pages: 58

DECLARATION OF IMPORTANT AGRICULTURAL LANDS

ALEXANDER & BALDWIN, LLC, a Hawai`i limited liability company, the business address of which is 822 Bishop Street, Honolulu, Hawai`i, 96813, does hereby certify as follows:

THAT Alexander & Baldwin, Inc. was the Petitioner of that certain Petition for Declaratory Order to Designate Important Agricultural Lands in Docket No. DR09-38 of the Land Use Commission of the State of Hawai`i, affecting those certain lands,

approximately 27,102 acres at Wailuku and Makawao, Maui, Hawai`i, Tax Map Key Nos. 2-5-01: portion of 01, 2-5-01: 05, 2-5-01: 08, 2-5-02: portion of 01, 2-5-02: portion of 02, 2-5-03: 06, 2-5-03: 07, 2-5-03: 08, 2-5-03: 09, 2-5-04: 13, 2-5-04: portion of 39, 2-5-05: portion of 19, 2-5-05: portion of 20, 3-8-01: portion of 01, 3-8-01: 05, 3-8-01: 06, 3-8-01: portion of 07, 3-8-01: 11, 3-8-01: 12, 3-8-01: 14, 3-8-01: 15, 3-8-01: 33, 3-8-01: 135, 3-8-03: 01, 3-8-03: 02, 3-8-03: 03, 3-8-03: portion of 04, 3-8-03: 05, 3-8-03: 06, 3-8-03: 07, 3-8-04: portion of 01, 3-8-04: portion of 2, 3-8-04: portion of 22, 3-8-05: portion of 01, 3-8-05: portion of 02, 3-8-05: 18, 3-8-06: portion of 01, 3-8-06: portion of 02, 3-8-06: portion of 03, 3-8-06: 15, 3-8-06: 29, and 3-8-08: 06 as shown in the Findings of Fact, Conclusions of Law, and Decision and Order entered June 29, 2009, in Docket No. DR09-38 (the "Decision and Order") that was recorded as Exhibit "A" to that certain Declaration of Important Agricultural Lands recorded on July 6, 2009 at 10:00 am at the Bureau of Conveyances, State of Hawai`i as Document Number 2009-103676, marked as Exhibit "A" which is attached hereto and incorporated herein by reference.

THAT on June 7, 2012 Alexander & Baldwin, Inc. was converted to Alexander & Baldwin, LLC as recorded in that certain Certificate of Conversion recorded on June 19, 2012 at 3:29 pm at the Bureau of Conveyances, State of Hawai`i as Document No. A-45531116.

THAT as a result of the conversion, Alexander & Baldwin, LLC is the successor Petitioner in the Land Use Commission Docket No. DR09-38 and the Decision and Order.

THAT Exhibit "A" to the Decision and Order includes maps showing the location of lands that were designated as Important Agricultural Lands, however, those maps used a color scheme to specify the location of the Important Agricultural Lands and those colors are not reproducible when black-and-white copies are printed from the recorded copies obtained from the Bureau of Conveyances.

THAT Petitioner hereby records as Exhibit "B" which is attached hereto and incorporated herein by reference, the same maps contained in Exhibit "A" which are attached hereto, showing the correct areas of land designated as Important Agricultural Lands using cross-hatching to ensure that the designated areas are shown in black-and-white copies.

[The remainder of this page is intentionally left blank.]

THAT the maps contained in Exhibit "B" which are attached hereto are identical to the maps contained in Exhibit "A" which are attached hereto, except that the maps contained in Exhibit "B" which are attached hereto use cross-hatching to show those areas of land designated as Important Agricultural Lands.

Dated: Honolulu, Hawai`i, February 18, 2015.

ALEXANDER & BALDWIN, LLC

By _____
MEREDITH J. CHING
Its SENIOR VICE PRESIDENT

By _____
CHARLES W. LOOMIS
Its ASST. SECRETARY

STATE OF HAWAI`I)
) SS:
CITY & COUNTY OF HONOLULU)

On this 18th day of February, 2015, before me personally appeared MEREDITH J. CHING, to me known, who, being by me duly sworn, did say that she is the SENIOR VICE PRESIDENT of ALEXANDER & BALDWIN, LLC, and that said instrument was signed on behalf of said limited liability company by authority of its Board of Directors, and said officer acknowledged said instrument to be the free act and deed of said limited liability company.

Name: PAMELA J. IWAMOTO
Notary Public, State of Hawai`i
My Commission Expires: SEP 14 2018

PAMELA J. IWAMOTO NOTARY 14-310 PUBLIC STATE OF HAWAII

STATE OF HAWAI`I NOTARY CERTIFICATION

Doc. Description: Declaration of Important Agricultural Lands; Exhibits "A" and "B"
Date of Document: (undated) # Pages: 58
Date of Notarization: 3/18/15

Notary Public Signature
Print Name: PAMELA J. IWAMOTO
Notary Public, State of Hawai`i, First Circuit
Notary Commission No. 14-310

PAMELA J. IWAMOTO NOTARY 14-310 PUBLIC STATE OF HAWAII

(Stamp or Seal)

STATE OF HAWA`II)
) SS:
CITY & COUNTY OF HONOLULU)

On this 18th day of February, 2015, before me personally appeared CHARLES W. LOOMIS, to me known, who, being by me duly sworn, did say that: he is the ~~ASST. SECRETARY~~ of ALEXANDER & BALDWIN, LLC, and that said instrument was signed on behalf of said limited liability company by authority of its Board of Directors, and said officer acknowledged said instrument to be the free act and deed of said limited liability company.

Name: PAMELA J. IWAMOTO
Notary Public, State of Hawai`i
My Commission Expires: ~~SEP 14 2018~~

PAMELA J. IWAMOTO NOTARY 14-310 PUBLIC STATE OF HAWAII

STATE OF HAWAI`I NOTARY CERTIFICATION

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Notary Public Signature
Print Name: PAMELA J. IWAMOTO
Notary Public, State of Hawai`i, First Circuit
Notary Commission No. 14-310

PAMELA J. IWAMOTO NOTARY 14-310 PUBLIC STATE OF HAWAII
(Stamp or Seal)

430
18 I

R-589 STATE OF HAWAII
BUREAU OF CONVEYANCES
RECORDED
JUL 06, 2009 10:00 AM
Doc No(s) 2009-103676

/s/ NICKI ANN THOMPSON
REGISTRAR

38 1/1 Z9

LAND COURT SYSTEM | REGULAR SYSTEM

AFTER RECORDATION: RETURN BY MAIL ( ) PICK UP (X)

BENJAMIN M. MATSUBARA, ESQ.
Matsubara - Kotake
888 Mililani Street, Eighth Floor
Honolulu, Hawai`i 96813
Telephone: (808) 526-9566

TITLE OF DOCUMENT: DECLARATION OF IMPORTANT AGRICULTURAL LANDS; EXHIBIT "A"

Total Pages: 38

DECLARATION OF IMPORTANT AGRICULTURAL LANDS

ALEXANDER & BALDWIN, INC., a Hawai`i corporation, the business address of which is 822 Bishop Street, Honolulu, Hawai`i, 96813, as Petitioner of that certain Petition For Declaratory Order to Designate Important Agricultural Lands in Docket No. DR09-38 of the Land Use Commission of the State of Hawai`i, affecting those certain lands, approximately 27,102 acres at Wailuku and Makawao, Maui, Hawai`i, Tax Map Key Nos. 2-5-01: portion of 01, 2-5-01: 05, 2-5-01: 08, 2-5-02: portion of

EXHIBIT "A"

01, 2-5-02: portion of 02, 2-5-03: 06, 2-5-03: 07, 2-5-03: 08, 2-5-03: 09, 2-5-04: 13, 2-5-04: portion of 39, 2-5-05: portion of 19, 2-5-05: portion of 20, 3-8-01: portion of 01, 3-8-01: 05, 3-8-01: 06, 3-8-01: portion of 07, 3-8-01: 11, 3-8-01: 12, 3-8-01: 14, 3-8-01: 15, 3-8-01: 33, 3-8-01: 135, 3-8-03: 01, 3-8-03: 02, 3-8-03: 03, 3-8-03: portion of 04, 3-8-03: 05, 3-8-03: 06, 3-8-03: 07, 3-8-04: portion of 01, 3-8-04: portion of 2, 3-8-04: portion of 22, 3-8-05: portion of 01, 3-8-05: portion of 02, 3-8-05: 18, 3-8-06: portion of 01, 3-8-06: portion of 02, 3-8-06: portion of 03, 3-8-06: 15, 3-8-06: 29, and 3-8-08: 06 as shown in the Findings of Fact, Conclusions of Law, and Decision and Order entered June 29, 2009, in Docket No. DR09-38 (the "Decision and Order") marked as Exhibit "A" attached hereto and incorporated herein by reference, does hereby certify as follows:

THAT by Decision and Order, the Land Use Commission designated approximately 27,102 acres of land in Wailuku and Makawao, Maui, Hawai`i, as shown in Exhibit "A", as important agricultural lands.

AND THAT pursuant to the Decision and Order, Petitioner hereby records the Decision and Order, as set forth in Exhibit "A", with the Bureau of Conveyances.

Dated: Honolulu, Hawai`i, July 2, 2009.

ALEXANDER & BALDWIN, INC.

By _____
NELSON N. S. CHUN
Its Senior Vice President

By _____
ALYSON J. NAKAMURA
Its Secretary

STATE OF HAWAII)
) SS:
CITY & COUNTY OF HONOLULU)

On this 2nd day of July, 2009, before me personally appeared NELSON N. S. CHUN, to me known, who, being by me duly sworn, did say that: he is the Senior Vice President of ALEXANDER & BALDWIN, INC., and that said instrument was signed on behalf of said corporation by authority of its Board of Directors, and said officer acknowledged said instrument to be the free act and deed of said corporation.

Aileen S. Miyahara

Name: AILEEN S. MIYAHARA
Notary Public, State of Hawaii
My Commission Expires: 7/15/10

AILEEN S. MIYAHARA NOTARY 82-517 PUBLIC STATE OF HAWAII

STATE OF HAWAII NOTARY CERTIFICATION

Doc. Description: Declaration of Important Agricultural Lands
Date of Document: July 2, 2009 # Pages: 38
Date of Notarization: July 2, 2009

Aileen S. Miyahara
Notary Public Signature
Print Name: AILEEN S. MIYAHARA
Notary Public, State of Hawaii, First Circuit
Notary Commission No. 82-517

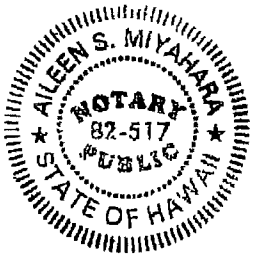
AILEEN S. MIYAHARA NOTARY 82-517 PUBLIC STATE OF HAWAII (Stamp or Seal)

STATE OF HAWAII)
) SS:
CITY & COUNTY OF HONOLULU)

On this 2nd day of July, 2009, before me personally appeared ALYSON J. NAKAMURA, to me known, who, being by me duly sworn, did say that she is the Secretary of ALEXANDER & BALDWIN, INC., and that said instrument was signed on behalf of said corporation by authority of its Board of Directors, and said officer acknowledged said instrument to be the free act and deed of said corporation.

Aileen S. Miyahara

Name: AILEEN S. MIYAHARA
Notary Public, State of Hawaii
My Commission Expires: 7/15/10

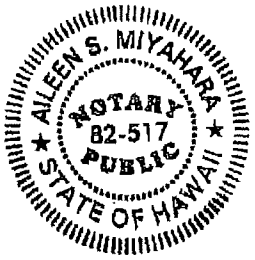


STATE OF HAWAII NOTARY CERTIFICATION

Doc. Description: Declaration of Important Agricultural Lands
Date of Document: July 2, 2009 # Pages: 38
Date of Notarization: July 2, 2009

Aileen S. Miyahara

Notary Public Signature
Print Name: AILEEN S. MIYAHARA
Notary Public, State of Hawaii, First Circuit
Notary Commission No. 82-517



(Stamp or Seal)

RECEIVED
30 JUN 2009

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI'I

In the Matter of the Petition of	)	DOCKET NO. DR09-38
	)	
ALEXANDER & BALDWIN, INC.	)	FINDINGS OF FACT,
	)	CONCLUSIONS OF LAW,
For Declaratory Order to Designate	)	AND DECISION AND ORDER
Important Agricultural Lands	)	
for approximately 27,102 acres at Wailuku	)	
and Makawao, Maui, Hawai'i,	)	
TMK: 2-5-01: portion of 01, 05 and 08; 2-5-02:	)	
portion of 01 and portion of 02; 2-5-03: 06, 07,	)	
08 and 09; 2-5-04: 13 and portion of 39;	)	
2-5-05: portion of 19 and portion of 20;	)	
3-8-01: portion of 01, 05, 06, portion of 07, 11,	)	
12, 14, 15, 33 and 135; 3-8-03: 01, 02, 03,	)	
portion of 04, 05, 06 and 07; 3-8-04: portion of	)	
01, portion of 02 and portion of 22; 3-8-05:	)	
portion of 01, portion of 02 and 18; 3-8-06:	)	
portion of 01, portion of 02, portion of 03, 15	)	
and 29; 3-8-08: 06	)	

FINDINGS OF FACT, CONCLUSIONS
OF LAW, AND DECISION AND ORDER

THIS IS TO CERTIFY THAT THIS IS A TRUE AND CORRECT COPY OF THE DOCUMENT ON FILE IN THE OFFICE OF THE STATE LAND USE COMMISSION, HONOLULU, HAWAII.

JUN 29 2009 by _____
DATE

EXECUTIVE DIRECTOR

EXHIBIT "A"

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI'I

In the Matter of the Petition of	)	DOCKET NO. DR09-38
	)	
ALEXANDER & BALDWIN, INC.	)	FINDINGS OF FACT,
	)	CONCLUSIONS OF LAW,
For Declaratory Order to Designate	)	AND DECISION AND ORDER
Important Agricultural Lands	)	
for approximately 27,102 acres at Wailuku	)	
and Makawao, Maui, Hawai`i,	)	
TMK: 2-5-01: portion of 01, 05 and 08; 2-5-02:	)	
portion of 01 and portion of 02; 2-5-03: 06, 07,	)	
08 and 09; 2-5-04: 13 and portion of 39;	)	
2-5-05: portion of 19 and portion of 20;	)	
3-8-01: portion of 01, 05, 06, portion of 07, 11,	)	
12, 14, 15, 33 and 135; 3-8-03: 01, 02, 03,	)	
portion of 04, 05, 06 and 07; 3-8-04: portion of	)	
01, portion of 02 and portion of 22; 3-8-05:	)	
portion of 01, portion of 02 and 18; 3-8-06:	)	
portion of 01, portion of 02, portion of 03, 15	)	
and 29; 3-8-08: 06	)	

FINDINGS OF FACT, CONCLUSIONS OF LAW, AND DECISION AND ORDER

ALEXANDER & BALDWIN, INC. ("Petitioner"), filed a Petition for Declaratory Order to Designate Important Agricultural Lands on April 6, 2009, pursuant to Hawai`i Revised Statutes ("HRS") §§ 205-44 and 45, and Hawai`i Administrative Rules ("HAR") chapter 15-15, to designate as Important Agricultural Lands ("IAL") approximately 27,133[1] acres at Wailuku and Makawao, Maui, Hawai'i ("Property"), more particularly described below, as Important Agricultural Lands ("IAL") pursuant to §§205-44 and 45

[1] The acreage was subsequently reduced to 27, 102 acres.

of the Hawaii Revised Statutes ("HRS") and §§15-15-98 and 99 of the Hawaii Administrative Rules ("HAR"). Tax Map Key Nos.: 2-5-01:portion of 01, 05, and 08; 2-5-02: portion of 01 and portion of 02; 2-5-03: 06, 07, 08, 09; 2-5-04: 13 and portion of 39; 2-5-05: portion of 19 and portion of 20; 3-8-01: portion of 01, 05, 06 portion of 07, 11, 12, 14, 15, 33 and 135; 3-8-03: 01, 02, 03, portion of 04, 05, 06, and 07; 3-8-04: portion of 01, portion of 02 and portion of 22; 3-8-05: portion of 01, portion of 02 and 18; 3-8-06: portion of 01, portion of 02, portion of 03, 15 and 29; 3-8-08:06. ("Petition Area").

The Land Use Commission ("Commission"), having heard and examined the testimony, evidence, and argument of counsel presented during the hearings, along with the pleadings filed herein, hereby makes the following Findings of Fact, Conclusions of Law, and Decision and Order.

I. PROCEDURAL MATTERS

1. On April 6, 2009 the Commission received Petitioner's Petition for Declaratory Order to designate Important Agricultural Lands ("Petition"), and Exhibits "A" through "D" of the Petition.

2. On April 9, 2009, the LUC sent letters to the State Department of Agriculture, the State Office of Planning, and the County of Maui, Department of Planning; requesting comments regarding the suitability of the Petition.

3. On May 19, 2009 the Commission received the State of Hawaii, Office of Planning ("OP") comments to the Petition.

4. On May 15, 2009 the Commission received the State of Hawaii, Department of Agriculture ("DOA") comments to the petition.

5. On May 13, 2009, the Commission received County of Maui's ("County") comments to the Petition.

6. On May 22, 2009, pursuant to discussions with LUC staff concerning a minor mapping revision to the Petition area, the Petitioner submitted a correction to the acreage of the Petition Area to reflect a reduction of 28.5 acres in Tax Map Key parcels: 3-8-03:04 and 3-8-04: 01. Subsequently, the Petition Area was reduced by an additional 2.5 acres to account for another mapping revision in Tax Map Key Nos. 3-8-06:02 and 3-8-06:03.

7. On May 26, 2009, the Commission received Petitioner's response to comments from OP, DOA, and the County of Maui.

8. On June 3, 2009, the Commission held a site visit to view the Petition Area in Wailuku and Makawao, Maui, Hawaii.

9. On June 4, 2009, the Commission held an action hearing on the Petition in Makena, Maui, Hawaii. Benjamin Matsubara, Esq. appeared on behalf of the Petitioner. Jeffrey Hunt of the County of Maui, Planning Department and Abe Mitsuda of the Office of Planning appeared and provided public testimony. Irene Bowie, on behalf of Maui Tomorrow and Lucienne de Naie, on behalf of Sierra Club Maui Group, also provided public testimony.

10. The written comments of OP, DOA, and County, and Petitioner's response to the comments of DOA, county and OP, were made a part of the record in this proceeding.

11. Petitioner is not seeking to reclassify any agricultural lands to the urban, rural or conservation land use district.

12. Petitioner has represented that it is not claiming and will not claim any credits described in HRS § 205-45(h).

II. FINDINGS OF FACT

13. The Petition Area consists of approximately approximately 27,102 acres at Wailuku and Makawao, Maui, Hawai'i. Tax Map Key Nos. 2-5-01: portion of 01, 2-5-01: 05, 2-5-01: 08, 2-5-02: portion of 01, 2-5-02: portion of 02, 2-5-03: 06, 2-5-03: 07, 2-5-03: 08, 2-5-03: 09, 2-5-04: 13, 2-5-04: portion of 39, 2-5-05: portion of 19, 2-5-05: portion of 20, 3-8-01: portion of 01, 3-8-01: 05, 3-8-01: 06, 3-8-01: portion of 07, 3-8-01: 11, 3-8-01: 12, 3-8-01: 14, 3-8-01: 15, 3-8-01: 33, 3-8-01: 135, 3-8-03: 01, 3-8-03: 02, 3-8-03: 03, 3-8-03: portion of 04, 3-8-03: 05, 3-8-03: 06, 3-8-03: 07, 3-8-04: portion of 01, 3-8-04: portion of 2, 3-8-04: portion of 22, 3-8-05: portion of 01, 3-8-05: portion of 02, 3-8-05: 18, 3-8-06: portion of 01, 3-8-06: portion of 02, 3-8-06: portion of 03, 3-8-06: 15, 3-8-06: 29, and 3-8-08: 06 ("Petition Area").

14. The description of the Petition Area acreage by Tax Map Key Numbers and Tax Maps depicting the Petition Area is shown in Petitioner's Exhibit B, which is attached hereto and incorporated herein by reference as Exhibit "A".

15. The Petition Area is owned in fee simple by Alexander & Baldwin Inc, who has provided its written authorization to file the Petition.

16. Petitioner seeks a determination from the Commission as to whether the lands identified by Petitioner in this Petition should be designated as IAL pursuant to HRS §§ 205-44 and 45.

17. It is Petitioner's position that the Petition Area meets the qualifications for designation as IAL under HRS § 205-44, and that the Commission should issue a declaratory order designating the Property as IAL pursuant to HRS § 205-45.

18. The majority of the Petition Area is being actively utilized for the cultivation and processing of sugar cane by the Hawaiian Commercial & Sugar Co. ("HC&S"), a division of the Petitioner. Also, portions of the Property located in Waikapu and Hamakauapoko are used for the cultivation of seed corn, pineapple and pasture.

19. Of the 27,102 acres proposed to be designated IAL, approximately 87% is in sugarcane cultivation, and 6% is used for the cultivation of seed corn , pineapple and pasture. The remaining 7% of the lands is not in cultivation, however, are essential components of the agricultural operation, such as gulches and steep slopes which serve a drainage function or other key agricultural infrastructure, such as reservoirs and irrigation distribution infrastructure.

20. There are a total of four pasture leases for ranching operations in the area identified as Tax Map Key No. 2-5-01:08.

21. The University of Hawaii, Land Study Bureau ("LSB") developed the Overall Productivity Rating, which classified soils according to five (5) levels, with "A" representing the class of highest productivity soils and "E" representing the lowest. These letters are followed by numbers which further classify the soil types by conveying such information as texture, drainage and stoniness. Based on this, approximately 59% of the Petition Area is rated "A" and approximately 14% of the Petition Area is rated "B". Approximately 27% of the Petition Area is rated "C", "D", and "E". Less than 1% of the

Petition Area is not classified by the LSB, but includes drainage gulches and reservoirs that are essential elements of the active agricultural operations.

22. Based on the Sunshine Maps prepared in 1985 by the Department of Business, Economic Development and Tourism, formerly known as the State Department of Planning and Economic Development, Energy Division, approximately 84% of the Petition Area receives an annual average of 450 calories of solar energy per square centimeter per day.

23. In 1977, the State Department of Agriculture developed a classification system to identify Agricultural Lands of Importance to the State of Hawaii ("ALISH"). The classification system is based primarily, though not exclusively, upon the soil characteristics of the lands. The three (3) classes of ALISH lands are: "Prime", "Unique", and "Other", with all remaining lands termed "Unclassified". When utilized with modern farming methods, "Prime" agricultural lands have a soil quality, growing season, and moisture supply necessary to produce sustained crop yields economically. "Unique" agricultural lands possess a combination of soil quality, growing season, and moisture supply to produce sustained high yields of a specific crop. "Other" agricultural lands include those that have not been rated as "Prime" or "Unique". The ALISH system classifies approximately 76% of the Petition Area as "Prime" and 13% as "Other". The balance of the Petition Area is farmed or includes essential elements of the active agricultural operation including gulches, and reservoirs that are not classified under ALISH.

24. The majority of the Petition Area has been in active sugarcane cultivation for at least a century. Portions of the Petition Area are used for the cultivation of seed corn, pineapple and pasture.

25. To conserve water, all sugar cane fields in the Petition Area are served by HC&S' existing drip irrigation systems. Currently, irrigation water is derived from a combination of sources consisting of brackish water wells, reservoirs and two surface water ditch systems. The irrigation system also includes ditches, pipelines and reservoirs for the transport and storage of water. The cultivated areas within the Petition Area have historically relied upon these water sources to sufficiently meet their irrigation needs.

26. The Petition Area is provided water by the East Maui Irrigation Ditch (EMI) which is owned, operated/maintained by the East Maui Irrigation Company, a wholly owned subsidiary of the Petitioner and the West Maui Ditch system which is co-owned, operated and maintained by HC&S and the Wailuku Water Company, formerly Wailuku Sugar Company. The delivery capacity of the East and West Maui systems totals approximately 570 million gallons per day (East Maui Irrigation system: 450 mgd; West Maui ditch system: 120 mgd). The long-term average water delivery from the two systems is approximately 195 mgd, which includes only the water delivered from the West Maui systems used by HC&S, not the total delivery of the system. In addition, HC&S owns and operates 15 brackish water wells with a total pumping capacity of approximately 228 mgd which are used to supplement ditch flows as needed.

27. In addition to the existing wells, reservoirs and irrigation system, the Petition Area receives an average of 15.8 to 59.1 inches of rain annually. Therefore, the Petition Area has sufficient quantities of water to support viable agricultural production.

28. The Draft Maui Island Plan (April 2008) is a part of the County's on-going effort to prepare the General Plan 2030 of the County of Maui. Intended to provide a long-term comprehensive strategic planning document for the physical, economic, environmental development and cultural identity of the County, it encompasses goals, polices, programs and actions that are recommended based on an assessment of current and future needs and available resources. According to the Land Use Policy Map published within the Draft Maui Island Plan, the entire Petition Area is outside of the proposed Urban Growth Boundary, Resort Areas, and Developed Areas.

29. As a more detailed land use element of the County's General Plan, the Maui Community Plans are land use planning documents that guide government action and decision-making for the total of nine community planning districts within the County. The documents are district specific and include planning goals, objectives, policies and implementation considerations that provide for optimum planning effectiveness and benefits for the residents in the respective community districts.

30. Three of the Community Plans Land Use Maps contain portions of the Petition Area: the 1990 Wailuku-Kahului Community Plan Land Use Map, the 1998 Kihei-Makena Community Plan Land Use Map, and the 1995 Paia-Haiku Community Plan Land Use Map.

31. Petition Area lands within the 1990 Wailuku-Kahului Community Plan Land Use Map are designated Agriculture. Petition Area lands within the 1998 Kihei-Makena Community Plan Land Use Map are designated Agriculture, with the Waikapu Stream and a few small areas outside Kealia Pond National Wildlife Refuge designated as Open

Space. Petition Areas lands within the 1995 Paia-Haiku Community Plan Land Use Map are designated as Agriculture.

32. The portions of the Petition Area that are designated as "Open Space" in the County of Maui's Kihei Makena Community Plan and designated as "Sensitive Lands" in the County of Maui's Draft Maui Island Plan are consistent with said designations. These designated areas are principally internal gulches within cultivated fields of the plantation, where agricultural use is permitted. The management of these gulches is part of an overall stewardship program for HC&S, which includes prudent agricultural practices (mitigation of soil erosion, runoff and impacts to water quality). This conservation program is administered in consultation with the USDA Natural Resources Conservation Service, whose primary mission is the conservation of natural resources. The intent of the "Open Space" designation is to limit development on lands which may be inappropriate due to environmental, physical or scenic constraints, while "Sensitive Lands" are characterized by native habitat, natural floodways and steep slopes where future growth should be discouraged. The designation of the Petition Area as IAL is consistent with the intent and purpose of these respective County land use designations.

33. The Petition Area is situated within the State Agricultural District.

34. The Petition Area contributes to maintaining a critical land mass important to agricultural operating productivity.

35. Lands containing high to steep slopes which include gulches, valleys, ravines and drainage ways provide critical infrastructure support of the adjacent highly productive lands by providing and preserving the necessary natural drainage ways for adjacent lands which have been identified as highly productive.

36. Lands containing natural and/or man-made water ways and features such as streams, reservoirs, wetlands, and drainage basins provide critical infrastructure support for adjacent highly productive lands by providing and preserving the necessary water source for existing as well as potential future irrigation systems necessary to assure agriculture productivity for the Petition Area.

37. Additional lands proposed for inclusion, although not identified as "Prime" agricultural lands, nor characteristic of , or containing elements which may provide critical infrastructure support for highly productive lands being proposed, are necessary to provide the overall critical "contiguous" land mass necessary for the agricultural operating productivity of the overall approximately 27,102 acres of land being proposed by the Petitioner.

38. The Petition Area is fully integrated with the infrastructure necessary to support intensive agricultural production, harvesting, processing, and shipping of product.

III. CONCLUSIONS OF LAW

1. The Commission has jurisdiction over the Petition pursuant to HRS §§ 91-8, 205-44 and 205-45 and HAR § 15-15-98.

2. The entire Petition Area is currently used for agricultural production and ninety-three percent of the Petition Area is in active cultivation in accordance with HRS § 205-44(c)(1).

3. The Petition Area has soil qualities and growing conditions that support agricultural production in accordance with HRS § 205-44(c)(2).

4. Seventy-six percent of the Petition Area is rated as Prime under ALISH in accordance with HRS § 205-44(c)(3).

5. Eighty-seven percent of the Petition Area is currently in sugar cane cultivation in accordance with HRS § 205-44(c)(4).

6. The Petition Area has sufficient quantities of water to support viable agricultural production in accordance with HRS § 205-44(c)(5).

7. The Petition Area's designation as IAL is consistent with the general, development, and community plans of the County in accordance with HRS § 205-44(c)(6).

8. The entire Petition Area, including those areas comprised of gulches, streams and reservoirs, that are not actively cultivated constitute a critical land mass that is important to agricultural operating productivity in accordance with HRS § 205-44(c)(7).

9. The Petition Area is within close proximity to or is near support infrastructure conducive to agricultural productivity, such as transportation to markets, water, or power in accordance with HRS § 205-44(c)(8).

10. The entire Petition Area, including those areas that are not actively cultivated comprised of gulches, streams and reservoirs, constitute a contiguous, intact, and functional land unit large enough to allow flexibility in agricultural production and management and is consistent with the policies of HRS § 205-43(1).

11. The Petition Area meets the requirements of HRS § 205-45(c) for designation as important agricultural land.

12. Any conclusion of law herein improperly designated as a finding of fact should be deemed or construed as a conclusion of law; any finding of fact herein

improperly designated as a conclusion of law should be deemed or construed as a finding of fact.

IV. DECISION AND ORDER

IT IS HEREBY ORDERED that the Petition Area, consisting of approximately designate approximately 27,102 acres at Wailuku and Makawao, Maui, Hawai'i ("Property"), more particularly described below, as Important Agricultural Lands ("IAL") pursuant to §§205-44 and 45 of the Hawaii Revised Statutes ("HRS") and §§15-15-98 and 99 of the Hawaii Administrative Rules ("HAR"). Tax Map Key Nos. 2-5-01: portion of 01, 2-5-01: 05, 2-5-01: 08, 2-5-02: portion of 01, 2-5-02: portion of 02, 2-5-03: 06, 2-5-03: 07, 2-5-03: 08, 2-5-03: 09, 2-5-04: 13, 2-5-04: portion of 39, 2-5-05: portion of 19, 2-5-05: portion of 20, 3-8-01: portion of 01, 3-8-01: 05, 3-8-01: 06, 3-8-01: portion of 07, 3-8-01: 11, 3-8-01: 12, 3-8-01: 14, 3-8-01: 15, 3-8-01: 33, 3-8-01: 135, 3-8-03: 01, 3-8-03: 02, 3-8-03: 03, 3-8-03: portion of 04, 3-8-03: 05, 3-8-03: 06, 3-8-03: 07, 3-8-04: portion of 01, 3-8-04: portion of 2, 3-8-04: portion of 22, 3-8-05: portion of 01, 3-8-05: portion of 02, 3-8-05: 18, 3-8-06: portion of 01, 3-8-06: portion of 02, 3-8-06: portion of 03, 3-8-06: 15, 3-8-06: 29, and 3-8-08: 06, and shown approximately on Exhibit "A," attached hereto and incorporated by reference herein, shall be and is hereby designated as Important Agricultural Lands as governed by HRS Chapter 205.

IT IS HEREBY FURTHER ORDERED that the designation of the Petition Area as Important Agricultural Lands shall be subject to the following conditions:

1. Petitioner shall comply with representations made to the Commission with respect to not claiming any credits described in HRS § 205-45(h) with respect to the Petition Area.

2. Within seven days of the issuance of the Commission's Decision and Order, Petitioner shall record it with the Bureau of Conveyances.

ADOPTION OF ORDER

The undersigned Commissioners, being familiar with the record and proceedings, hereby adopt and approve the foregoing ORDER this 26 day of June, 2009. This ORDER may be executed in counterparts. This ORDER and its ADOPTION shall take effect upon the date this ORDER is certified and filed by this Commission.

Done at Honolulu, Hawai`i, this 26 day of June 2009.

APPROVED AS TO FORM

Deputy Attorney General

LAND USE COMMISSION
STATE OF HAWAI`I

By
DUANE KANUHA
Chairperson and Commissioner

By
RANSOM PILTZ
Vice Chairperson and Commissioner

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APPROVED AS TO FORM

Deputy Attorney General

LAND USE COMMISSION
STATE OF HAWAI'I

By
DUANE KANUHA
Chairperson and Commissioner

By
RANSOM PILTZ
Vice Chairperson and Commissioner

By ABSENT
VLADIMIR PAUL DEVENS
Vice Chairperson and Commissioner

By
KYLE CHOCK
Commissioner

By
THOMAS CONTRADES
Commissioner

By
NORMAND LEZY
Commissioner

By
LISA JUDGE
Commissioner

By ABSENT
NICHOLAS W. TEVES, JR.
Commissioner

Filed and effective on:
June 29, 2009

By ABSENT
REUBEN S.F. WONG
Commissioner

Certified by:
Orlando Davidson, Executive Officer

EXHIBIT A

(Consisting of 15 pages)

Petitioner's Exhibit B to Petition
DR09-38

June 2009

EXHIBIT B

Proposed Important Agricultural Lands
Tax Map Key Parcels
for
Alexander & Baldwin, Inc.
Maui Lands

June 2009

Exhibit B: Tax Map Key Description

Approximately 27,102 acres of land owned by Alexander & Baldwin, Inc. on Maui are proposed to be designated as IAL, including 42 Tax Map Key (TMK) parcels (entire parcel or portions thereof). The parcels are specifically described as TMK numbers: 2-5-01: 01 (portion), 05, and 08; 2-5-02: 01 (portion), and 02 (portion); 2-5-03: 06, 07, 08, and 09; 2-5-04: 13, and 39 (portion); 2-5-05: 19 (portion), and 20 (portion); 3-8-01: 01 (portion), 05, 06, 07 (portion), 11, 12, 14, 15, 33, and 135; 3-8-03: 01, 02, 03, 04 (portion), 05, 06, and 07; 3-8-04: 01 (portion), 02 (portion), and 22 (portion); 3-8-05: 01 (portion), 02 (portion), and 18; 3-8-06: 01 (portion), 02 (portion), 03 (portion), 15, and 29; and 3-8-08: 06.

The following table shows a summary of TMK numbers and approximate acreage for proposed IAL lands:

	TMK NUMBER	APPROXIMATE ACREAGE		TMK NUMBER	APPROXIMATE ACREAGE
1	2-5-01:01 (POR.)	1,269.2	24	3-8-03:01	1,005.2
2	2-5-01:05	2.2	25	3-8-03:02	1,538.7
3	2-5-01:08	1,815.5	26	3-8-03:03	23.5
4	2-5-02:01 (POR.)	954.4	27	3-8-03:04 (POR.)	2,334.3
5	2-5-02:02 (POR.)	1,316.0	28	3-8-03:05	1,078.6
6	2-5-03:06	0.9	29	3-8-03:06	5.7
7	2-5-03:07	4.8	30	3-8-03:07	323.9
8	2-5-03:08	9.0	31	3-8-04:01 (POR.)	1,717.6
9	2-5-03:09	538.9	32	3-8-04:02 (POR.)	1,002.5
10	2-5-04:13	0.8	33	3-8-04:22 (POR.)	589.7
11	2-5-04:39 (POR.)	2,150.5	34	3-8-05:01 (POR.)	223.1
12	2-5-05:19 (POR.)	214.8	35	3-8-05:02 (POR.)	3,224.8
13	2-5-05:20 (POR.)	643.8	36	3-8-05:18	0.1
14	3-8-01:01 (POR.)	1,194.0	37	3-8-06:01 (POR.)	359.0
15	3-8-01:05	83.5	38	3-8-06:02 (POR.)	739.1
16	3-8-01:06	1,198.2	39	3-8-06:03 (POR.)	1,038.6
17	3-8-01:07 (POR.)	25.6	40	3-8-06:15	0.5
18	3-8-01:11	0.2	41	3-8-06:29	11.5
19	3-8-01:12	0.6	42	3-8-08:06	101.5
20	3-8-01:14	141.2			
21	3-8-01:15	49.7			
22	3-8-01:33	5.6			
23	3-8-01:135	164.7			
	TOTAL:				27,102.0

Exhibit B illustrates the proposed IAL lands and the related Tax Map Key parcels. To illustrate the individual TMK parcels, Exhibits B-1 to B-11 identify the individual TMK parcels and portions thereof that are proposed to be designated IAL.

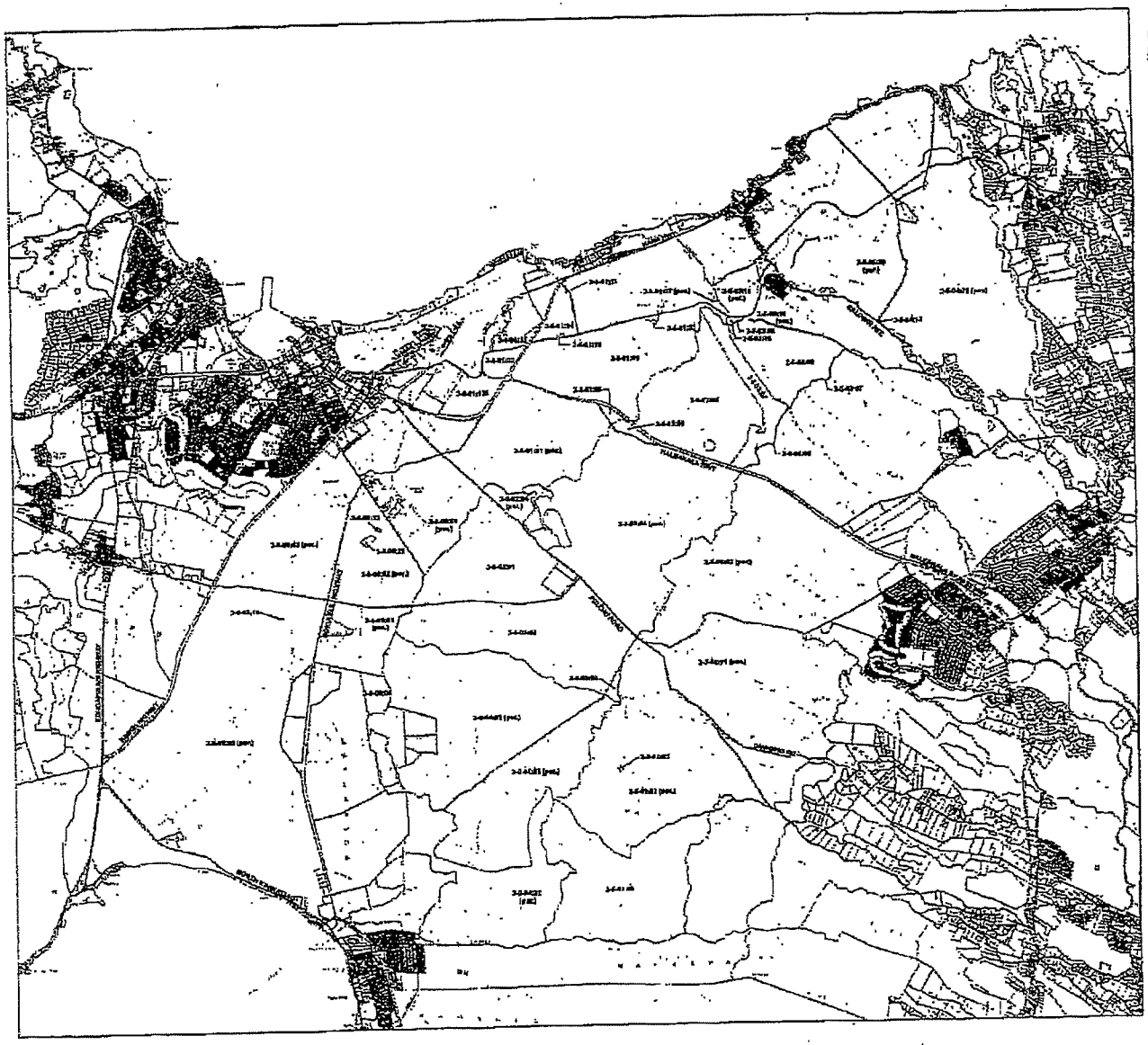
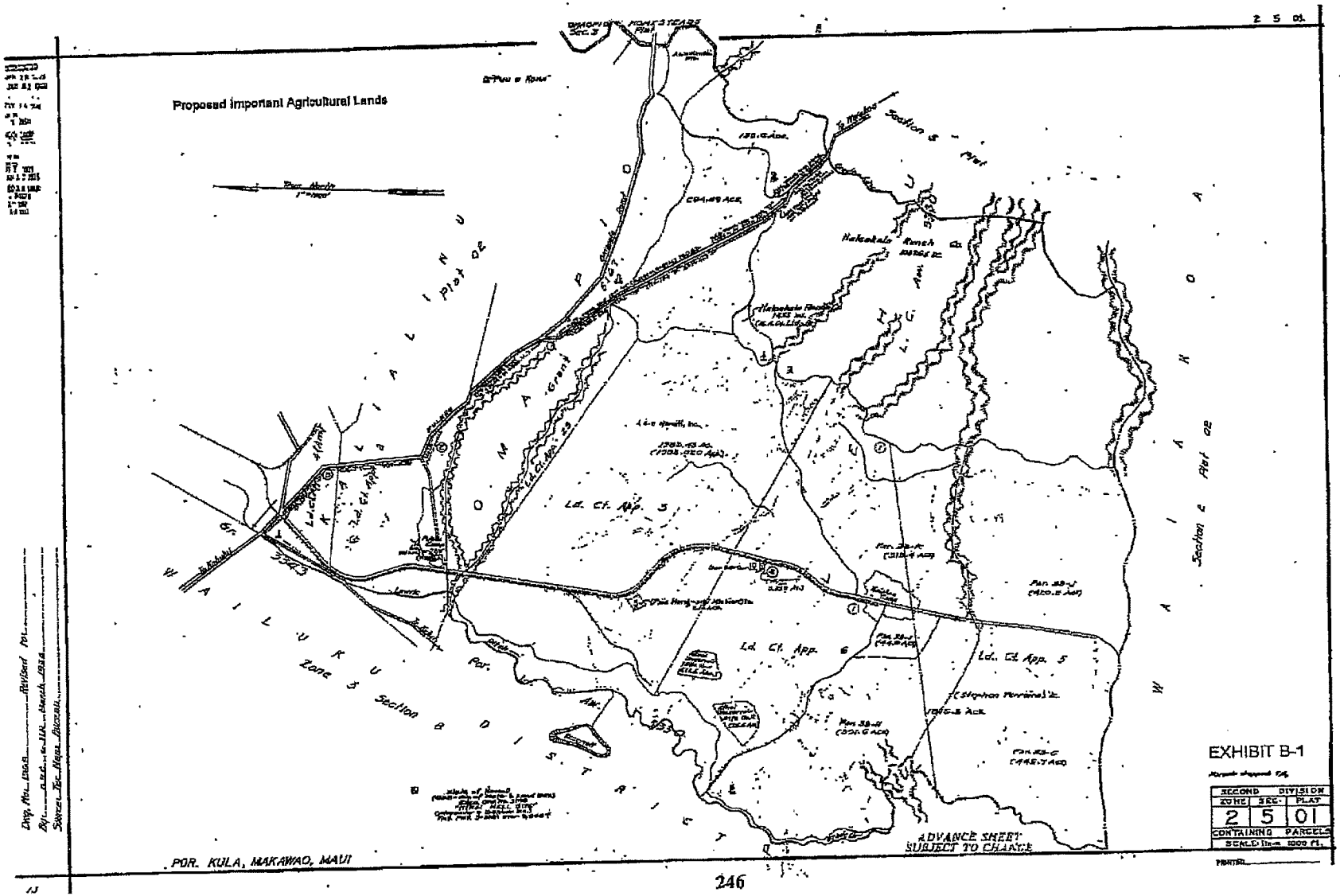
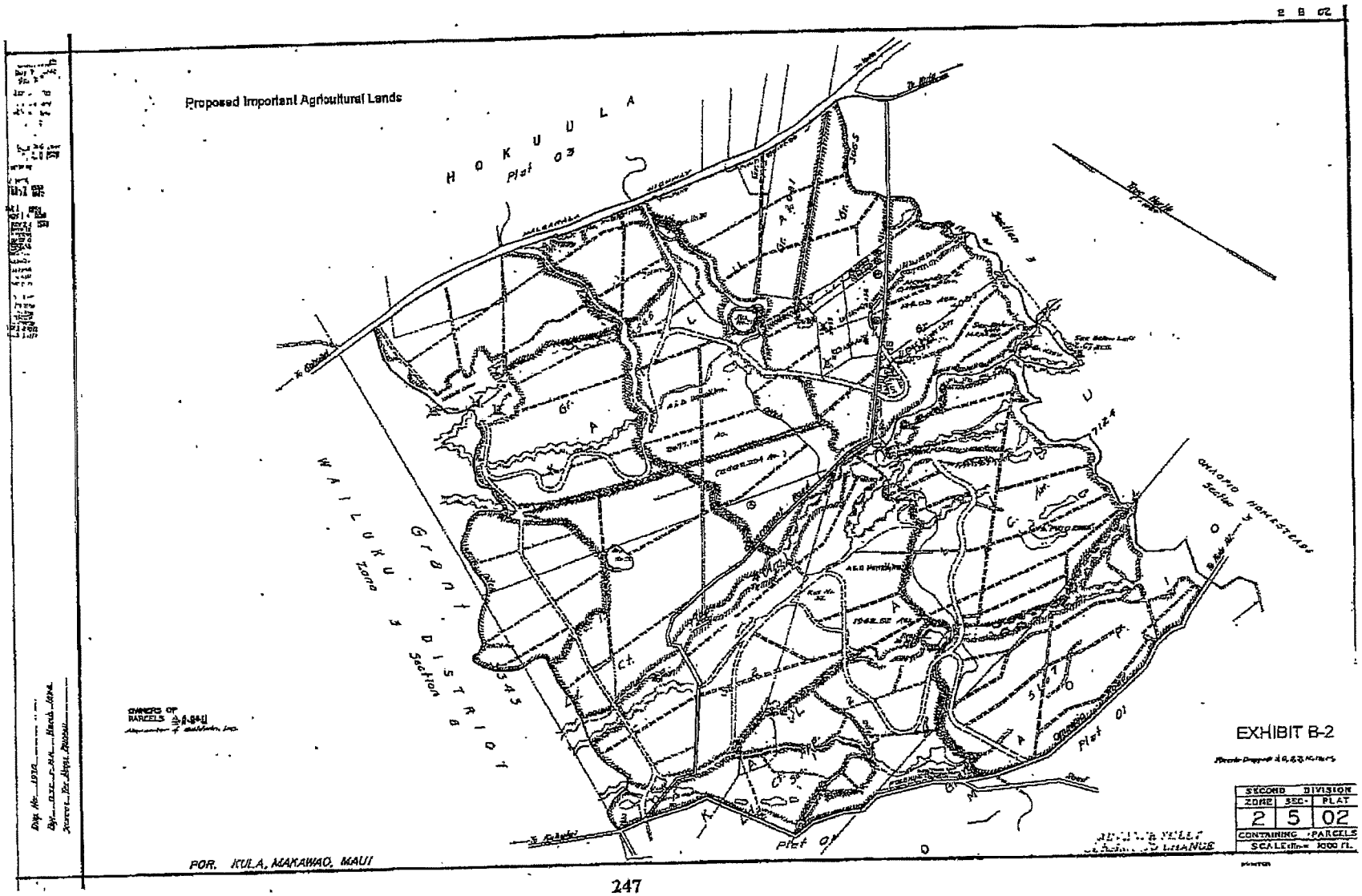


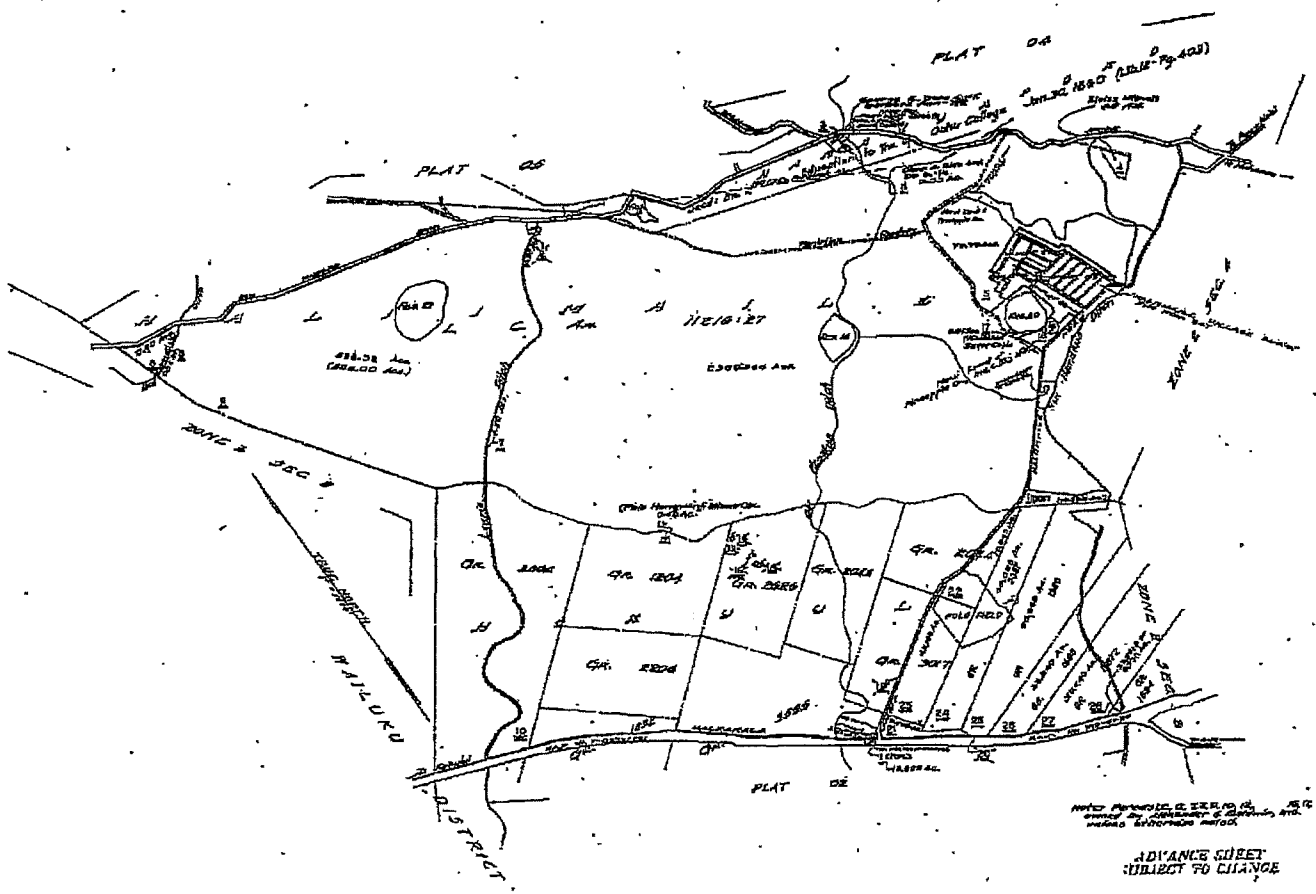
EXHIBIT B
Tax Map Key
A&B IAL Maui

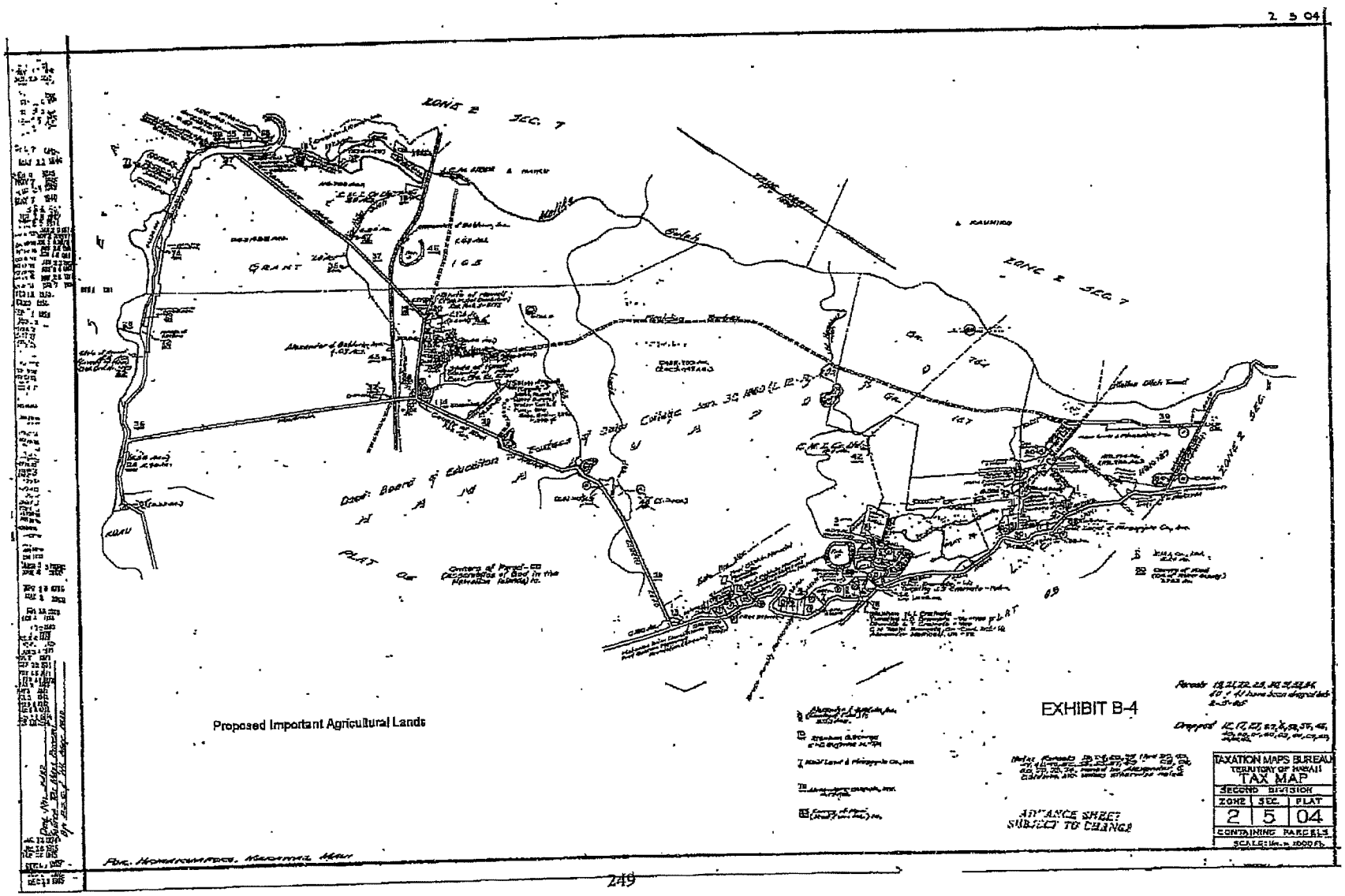
June 2009

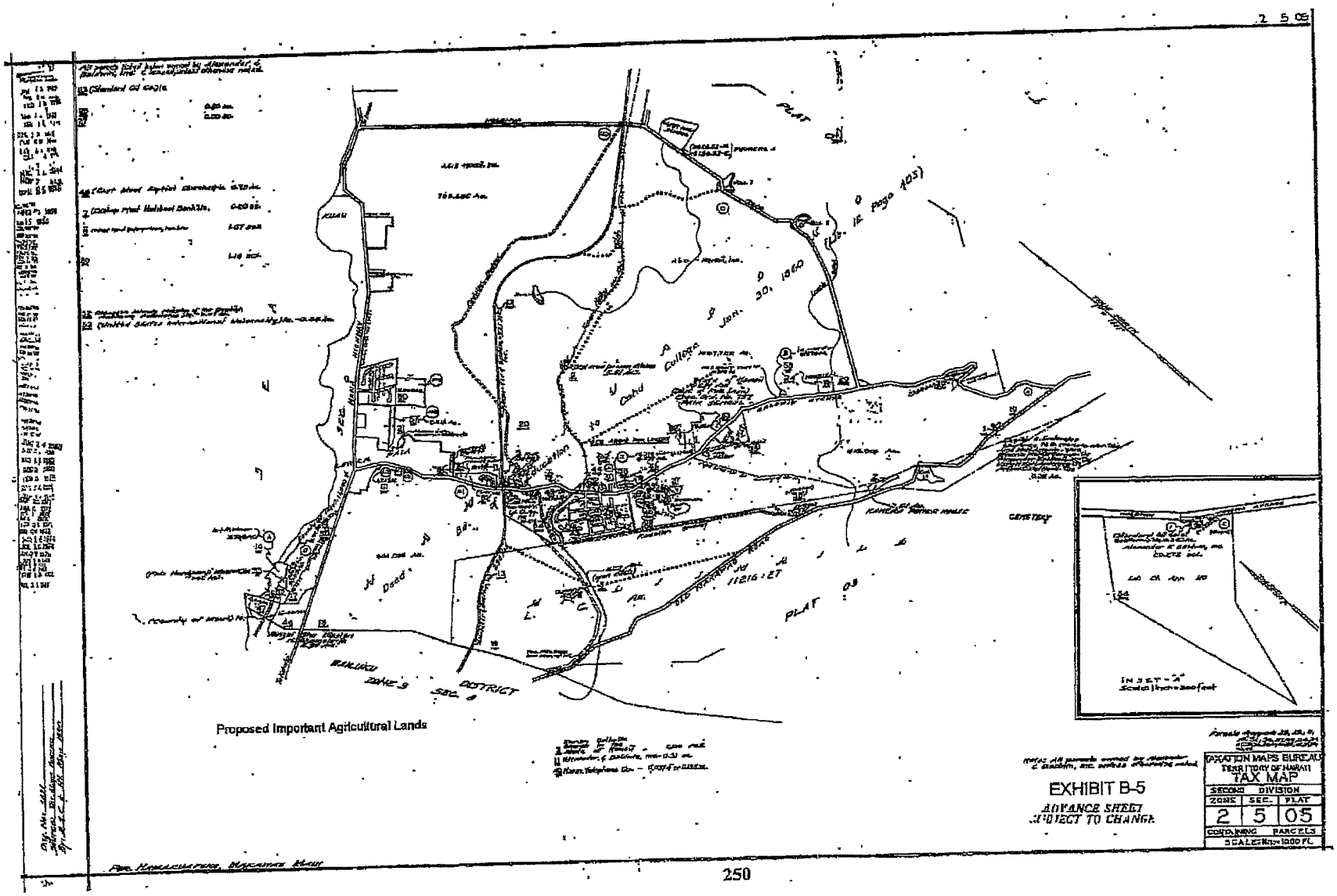

Proposed Important Agricultural Lands
EXHIBIT B-1
SECOND DIVISION
ZONE 2 SEC. 5 PLAT 01
CONTAINING PARCELS
ADVANCE SHEET
SUBJECT TO CHANGE
POR. KULA, MAKAWAO, MAUI


Proposed Important Agricultural Lands
EXHIBIT B-2
SECOND DIVISION
ZONE 2 SEC. 5 PLAT 02
POR. KULA, MAKAWAO, MAUI

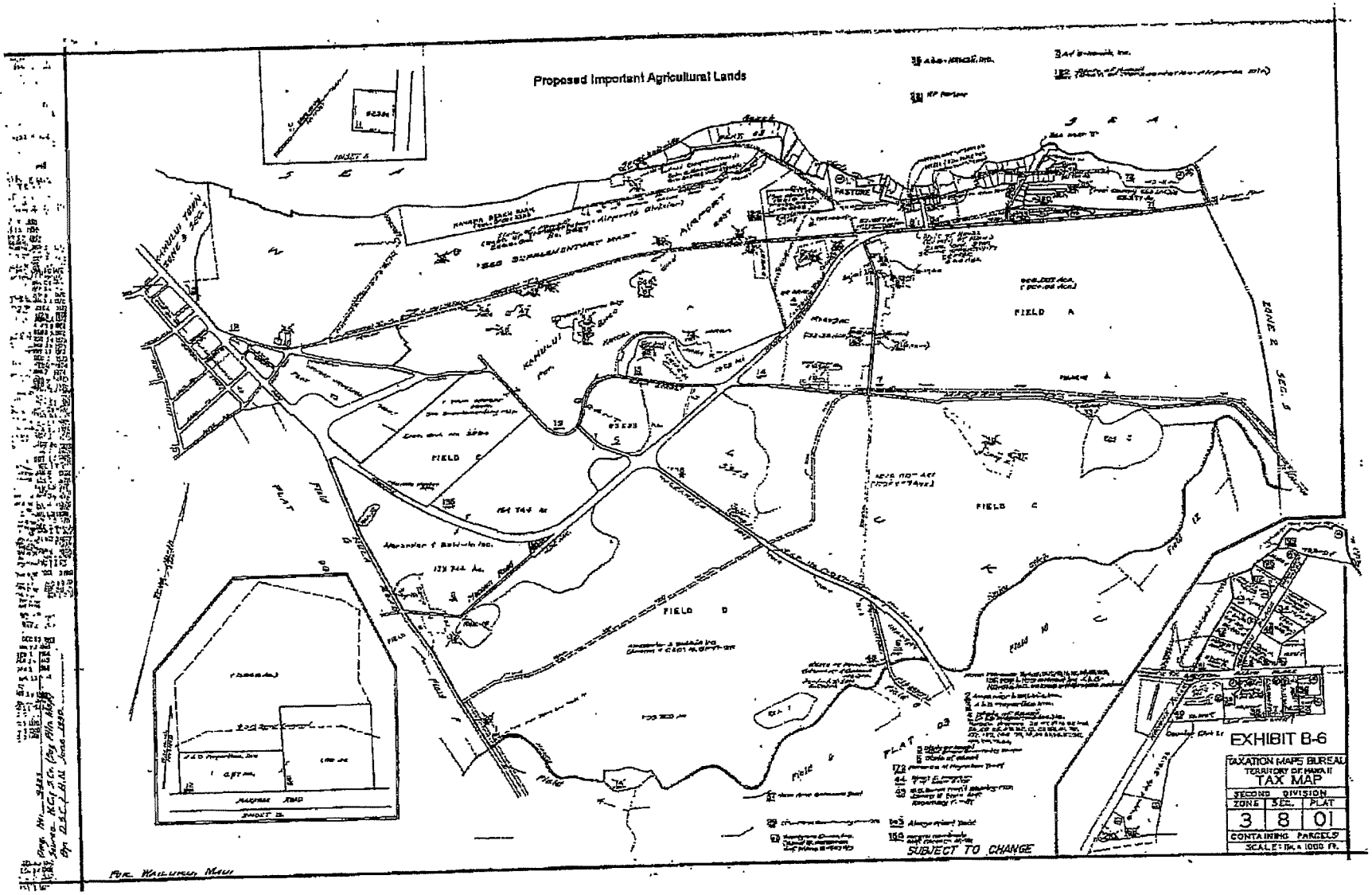
Proposed Important Agricultural Lands

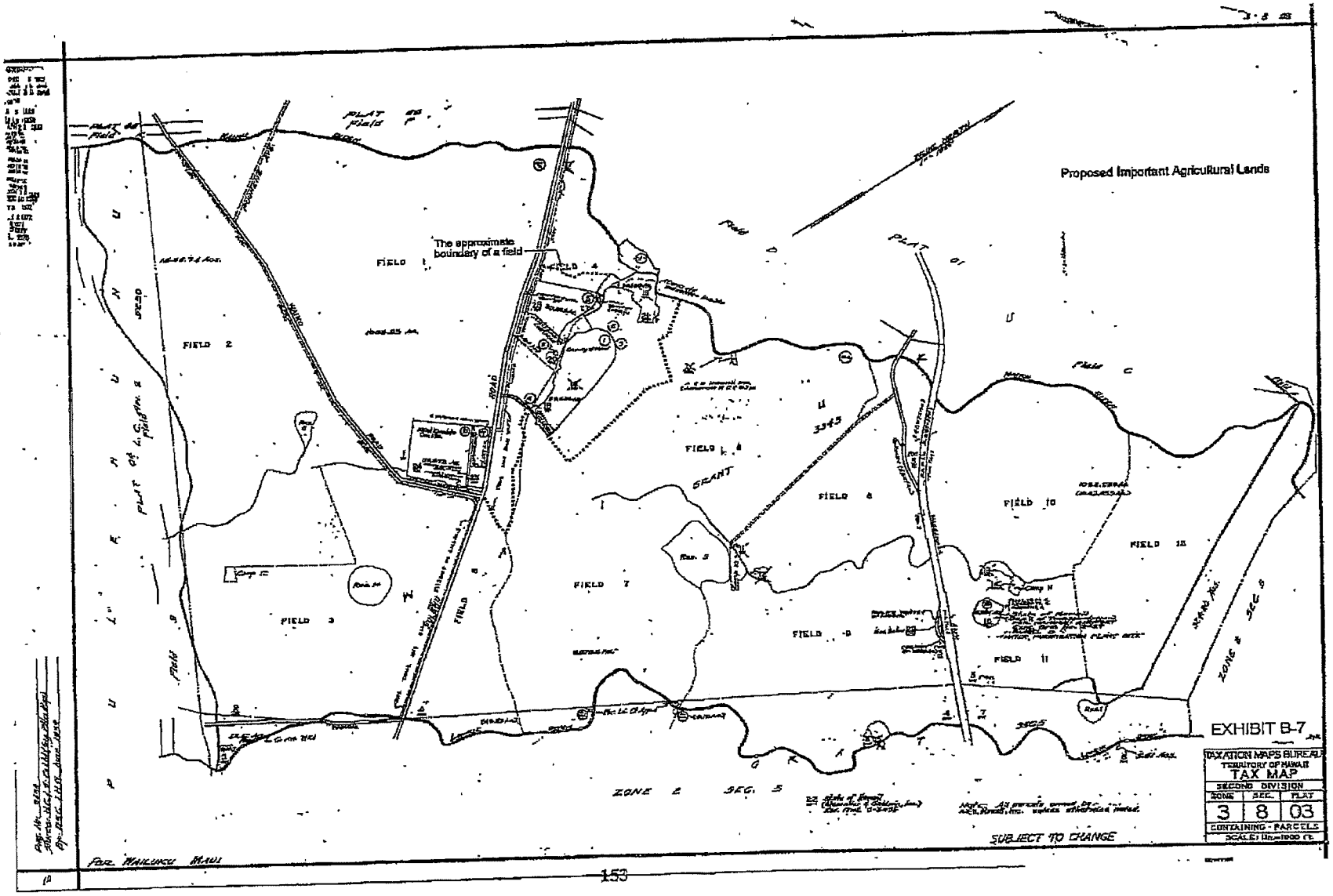


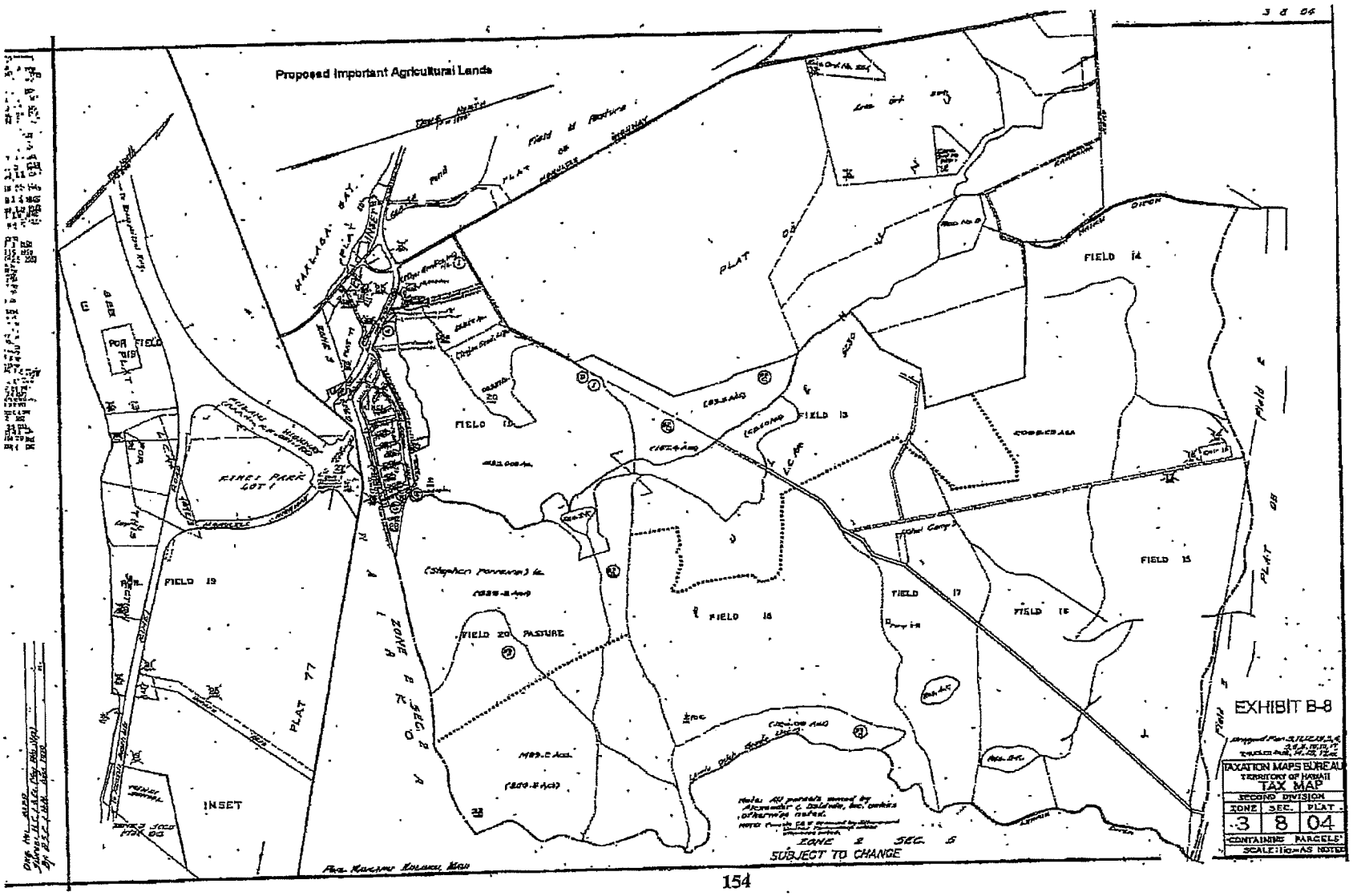

2 5 04
ZONE 2 SEC. 7
GRANT
ZONE 2 SEC. 7
Proposed Important Agricultural Lands
EXHIBIT B-4
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 2 | SEC. 5 | PLAT 04
CONTAINING PARCELS
ADVANCE SHEET
SUBJECT TO CHANGE

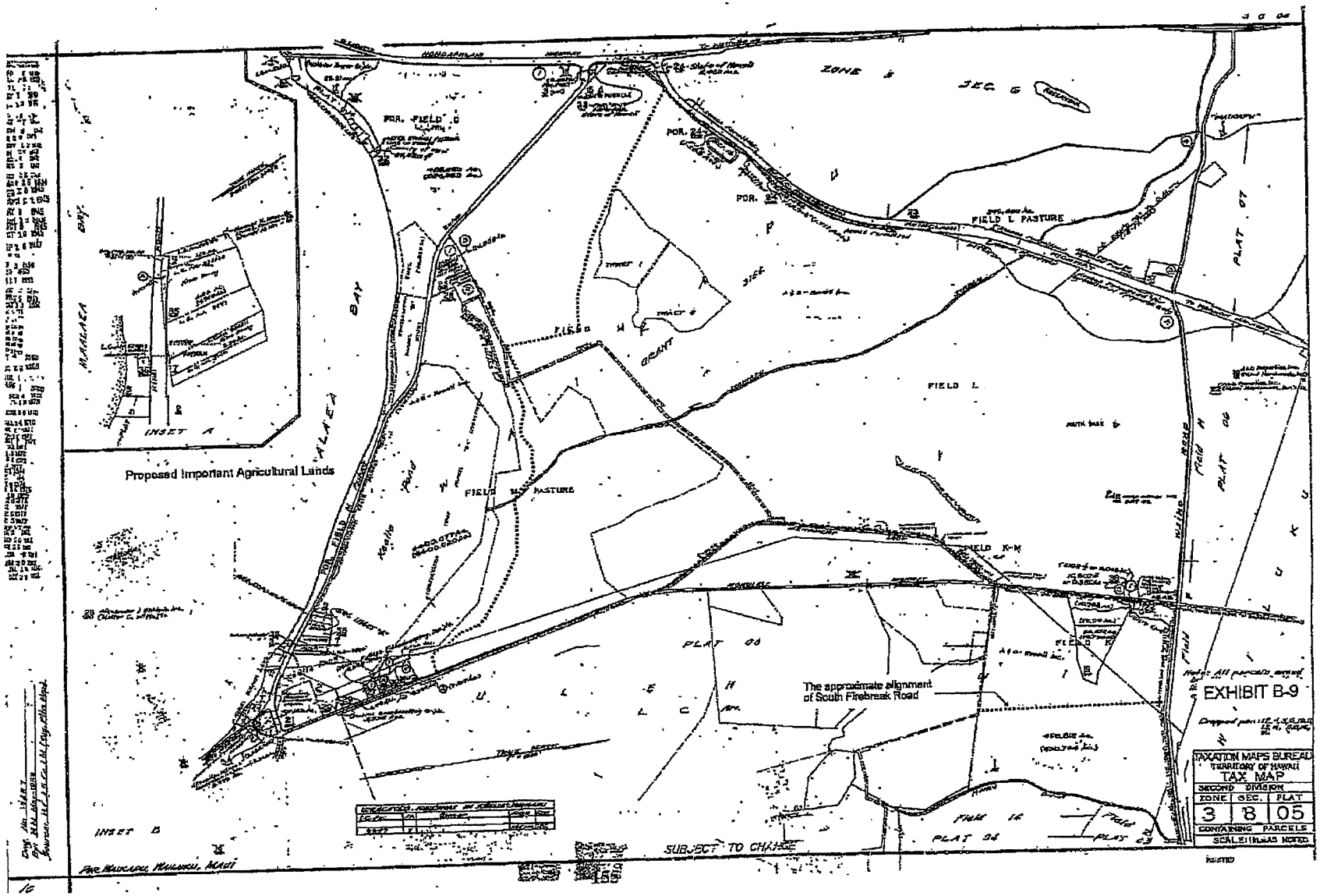


Proposed Important Agricultural Lands
EXHIBIT B-5
ADVANCE SHEET
SUBJECT TO CHANGE
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 2
SEC. 5
PLAT 05
CONTAINING PARCELS
SCALE: 1"=1000 FT.
PLAT 03
PLAT 05
Cahu College
Jan. 30, 1860
CEMETERY
KAHEKA POWER HOUSE
DISTRICT
ZONE 9
SEC. 8

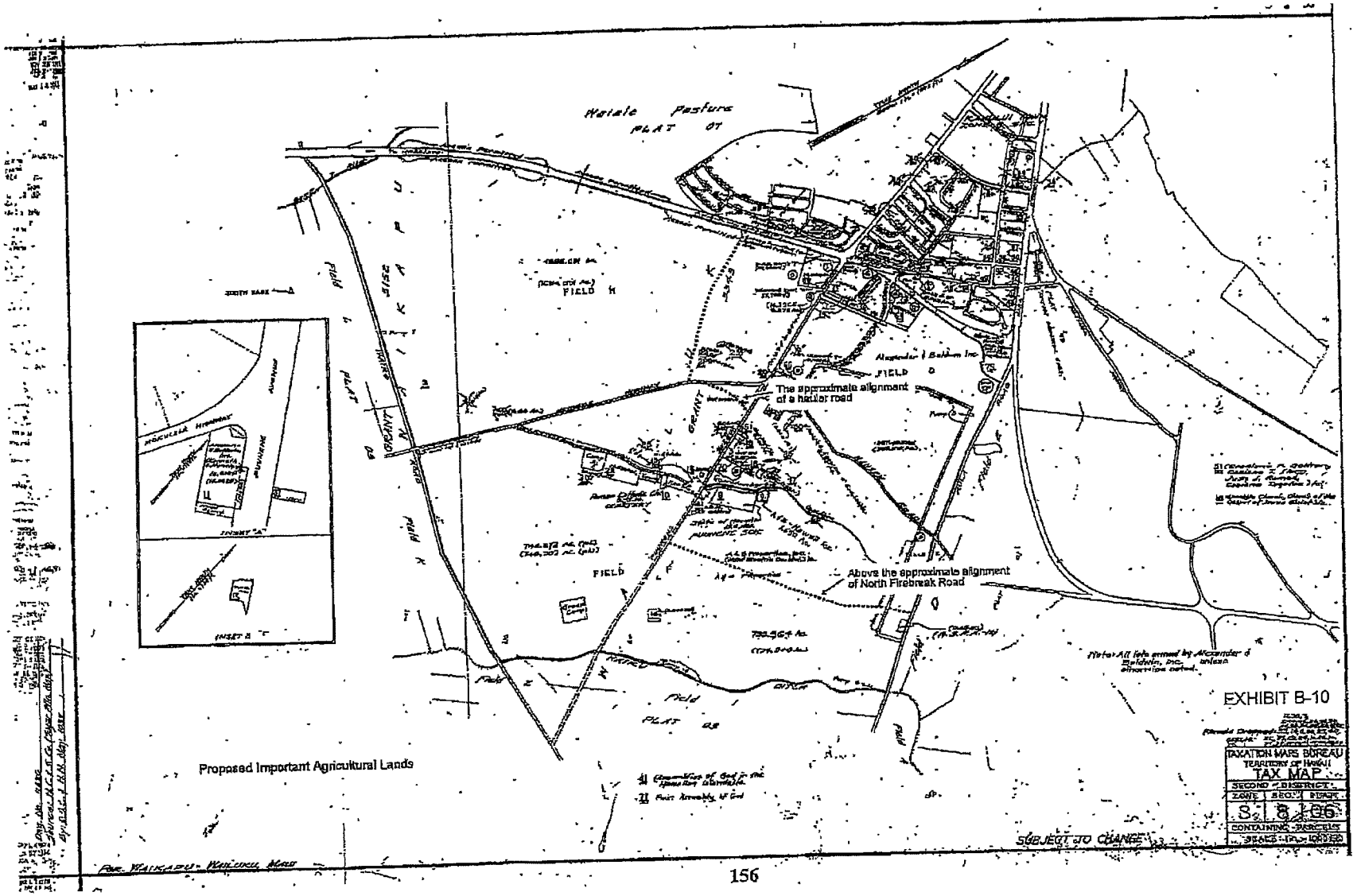

Proposed Important Agricultural Lands
FIELD A
FIELD C
FIELD D
SUBJECT TO CHANGE
EXHIBIT B-6
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 3 SEC. 8 PLAT 01
CONTAINING PARCELS
SCALE: 1IN. = 1000 FT.
FOR WAILUKU, MAUI


Proposed Important Agricultural Lands
The approximate boundary of a field
FIELD 1
FIELD 2
FIELD 3
FIELD 4
FIELD 5
FIELD 6
FIELD 7
FIELD 8
FIELD 9
FIELD 10
FIELD 11
FIELD 12
PLAT 01
PLAT 02
ZONE 2 SEC. 5
ZONE 2 SEC. 5
SUBJECT TO CHANGE
EXHIBIT B-7
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 3
SEC. 8
PLAT 03
CONTAINING - PARCELS
SCALE: 1in.=1000 ft.
FOR WAILUKU MAUI


Proposed Important Agricultural Lands
FIELD 14
FIELD 13
FIELD 19
FIELD 20 PASTURE
FIELD 16
FIELD 17
FIELD 18
FIELD 15
KING'S PARK LOT 1
INSET
PLAT 77
ZONE 2 SEC. 8
ZONE 2 SEC. 5
SUBJECT TO CHANGE
EXHIBIT B-8
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 3 SEC. 8 PLAT 04



Proposed Important Agricultural Lands
The approximate alignment of South Firebreak Road
EXHIBIT B-9
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 3
SEC. 8
PLAT 05
CONTAINING PARCELS
SCALE: 1 INCH AS NOTED
SUBJECT TO CHANGE
FIELD L PASTURE
FIELD L
FIELD M PASTURE
FIELD K-M
FIELD K
PLAT 07
PLAT 06
PLAT 05
PLAT 04
PLAT 03
INSET A
INSET B
MAALAEA BAY


Proposed Important Agricultural Lands
The approximate alignment of a haulur road
Above the approximate alignment of North Firebreak Road
EXHIBIT B-10
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DISTRICT
SUBJECT TO CHANGE

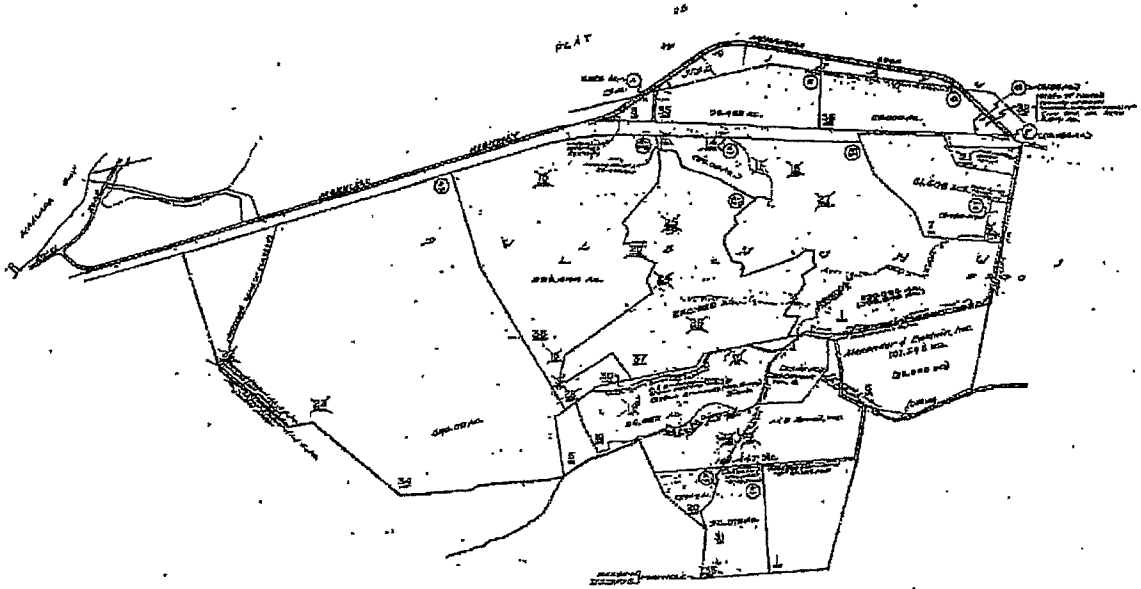


EXHIBIT B-11

Proposed Important Agricultural Lands

SUBJECT TO CHANGE

TAXATION MAPS BUREAU
DEPARTMENT OF HAWAII
TAX MAP
SECOND DIVISION

ZONE	SEC.	PLAT
3	8	08

CONTAINING PARCELS

SCALE: 1in. = 1000 ft.

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI'I

In the Matter of the Petition of	)	DOCKET NO. DR09-38
	)	
ALEXANDER & BALDWIN, INC.	)	CERTIFICATE OF SERVICE
	)	
For Declaratory Order to Designate Important Agricultural Lands for approximately 27,102 acres at Wailuku and Makawao, Maui, Hawai'i, TMK: 2-5-01: portion of 01, 05 and 08; 2-5-02: portion of 01 and portion of 02; 2-5-03: 06, 07, 08 and 09; 2-5-04: 13 and portion of 39; 2-5-05: portion of 19 and portion of 20; 3-8-01: portion of 01, 05, 06, portion of 07, 11, 12, 14, 15, 33 and 135; 3-8-03: 01, 02, 03, portion of 04, 05, 06 and 07; 3-8-04: portion of 01, portion of 02 and portion of 22; 3-8-05: portion of 01, portion of 02 and 18; 3-8-06: portion of 01, portion of 02, portion of 03, 15 and 29; 3-8-08: 06	)	

CERTIFICATE OF SERVICE

I hereby certify that a certified copy of the FINDINGS OF FACT, CONCLUSIONS OF LAW, AND DECISION AND ORDER was served upon the following by either hand delivery or depositing the same in the U. S. Postal Service by regular or certified mail as noted:

DEL. ABBEY SETH MAYER, Director
State Office of Planning
P. O. Box 2359
Honolulu, Hawai'i 96804-2359

REGULAR MAIL: BRYAN C. YEE, Esq.
Deputy Attorney General
425 Queen Street
Honolulu, Hawai'i 96813
Attorney for State Office of Planning

REGULAR MAIL: JEFF HUNT, Director of Planning
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793

REGULAR MAIL: BRIAN MOTO, Esq.
Corporation Counsel
County of Maui
250 South High Street
Wailuku, Hawaii 96793

CERTIFIED MAIL: BENJAMIN M. MATSUBARA
CURTIS T. TABATA
888 Mililani Street, 8th Floor
Honolulu, HI 96813

Dated:Honolulu,Hawai'i, JUN 29 2009

ORLANDO DAVIDSON
Executive Officer

EXHIBIT B

Proposed Important Agricultural Lands
Tax Map Key Parcels
for
Alexander & Baldwin, Inc.
Maui Lands

June 2009

EXHIBIT "B"

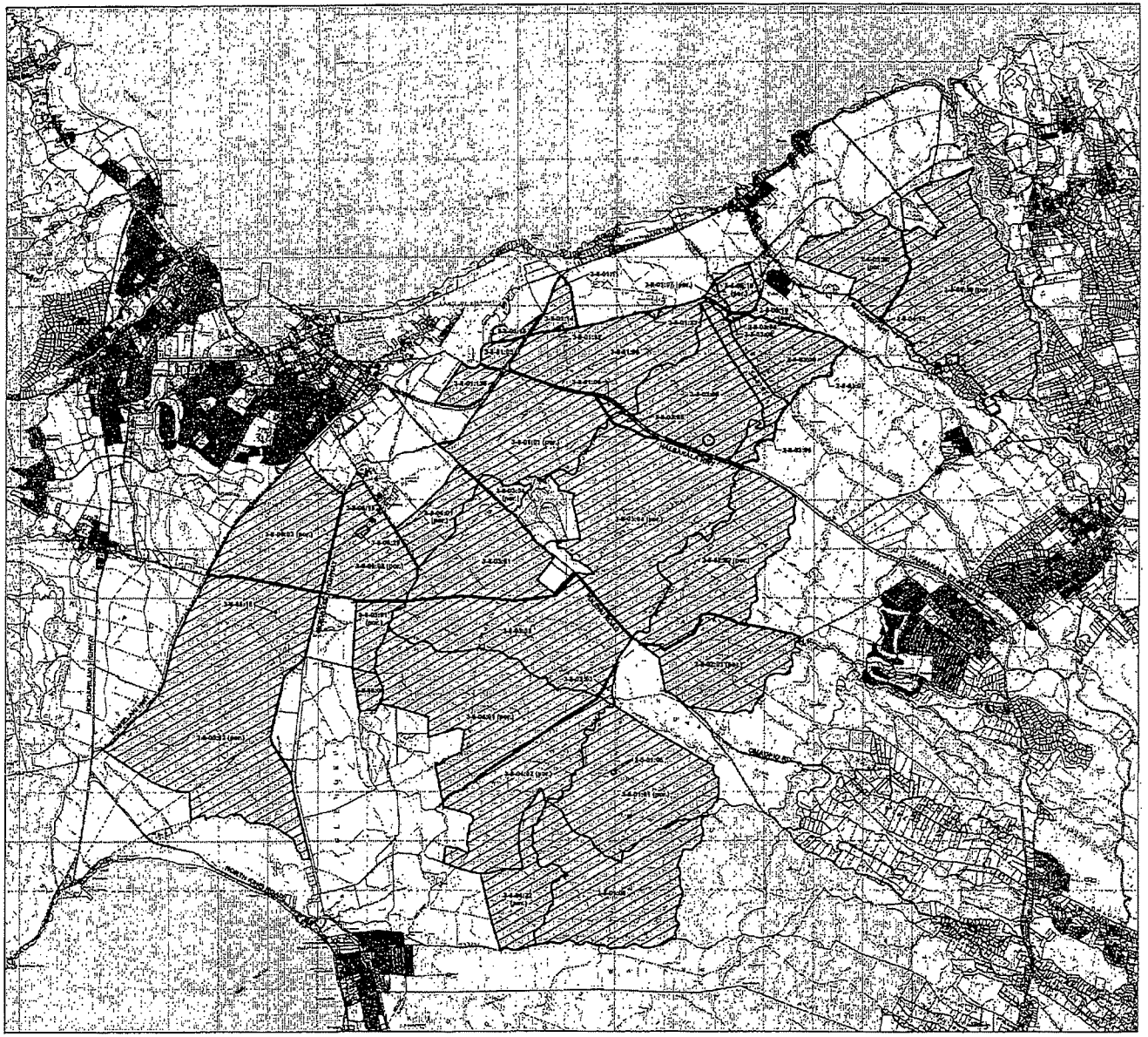
Exhibit B: Tax Map Key Description

Approximately 27,102 acres of land owned by Alexander & Baldwin, Inc. on Maui are proposed to be designated as IAL, including 42 Tax Map Key (TMK) parcels (entire parcel or portions thereof). The parcels are specifically described as TMK numbers: 2-5-01: 01 (portion), 05, and 08; 2-5-02: 01 (portion), and 02 (portion); 2-5-03: 06, 07, 08, and 09; 2-5-04: 13, and 39 (portion); 2-5-05: 19 (portion), and 20 (portion); 3-8-01: 01 (portion), 05, 06, 07 (portion), 11, 12, 14, 15, 33, and 135; 3-8-03: 01, 02, 03, 04 (portion), 05, 06, and 07; 3-8-04: 01 (portion), 02 (portion), and 22 (portion); 3-8-05: 01 (portion), 02 (portion), and 18; 3-8-06: 01 (portion), 02 (portion), 03 (portion), 15, and 29; and 3-8-08: 06.

The following table shows a summary of TMK numbers and approximate acreage for proposed IAL lands:

	TMK NUMBER	APPROXIMATE ACREAGE		TMK NUMBER	APPROXIMATE ACREAGE
1	2-5-01:01 (POR.)	1,269.2	24	3-8-03:01	1,005.2
2	2-5-01:05	2.2	25	3-8-03:02	1,538.7
3	2-5-01:08	1,815.5	26	3-8-03:03	23.5
4	2-5-02:01 (POR.)	954.4	27	3-8-03:04 (POR.)	2,334.3
5	2-5-02:02 (POR.)	1,316.0	28	3-8-03:05	1,078.6
6	2-5-03:06	0.9	29	3-8-03:06	5.7
7	2-5-03:07	4.8	30	3-8-03:07	323.9
8	2-5-03:08	9.0	31	3-8-04:01 (POR.)	1,717.6
9	2-5-03:09	538.9	32	3-8-04:02 (POR.)	1,002.5
10	2-5-04:13	0.8	33	3-8-04:22 (POR.)	589.7
11	2-5-04:39 (POR.)	2,150.5	34	3-8-05:01 (POR.)	223.1
12	2-5-05:19 (POR.)	214.8	35	3-8-05:02 (POR.)	3,224.8
13	2-5-05:20 (POR.)	643.8	36	3-8-05:18	0.1
14	3-8-01:01 (POR.)	1,194.0	37	3-8-06:01 (POR.)	359.0
15	3-8-01:05	83.5	38	3-8-06:02 (POR.)	739.1
16	3-8-01:06	1,198.2	39	3-8-06:03 (POR.)	1,038.6
17	3-8-01:07 (POR.)	25.6	40	3-8-06:15	0.5
18	3-8-01:11	0.2	41	3-8-06:29	11.5
19	3-8-01:12	0.6	42	3-8-08:06	101.5
20	3-8-01:14	141.2			
21	3-8-01:15	49.7			
22	3-8-01:33	5.6			
23	3-8-01:135	164.7			
	TOTAL:				27,102.0

Exhibit B illustrates the proposed IAL lands and the related Tax Map Key parcels. To illustrate the individual TMK parcels, Exhibits B-1 to B-11 identify the individual TMK parcels and portions thereof that are proposed to be designated IAL.



Legend

- TMK Parcel Boundary
- Proposed Important Agricultural Lands

Source:
County of Maui
U.S. Geological Survey

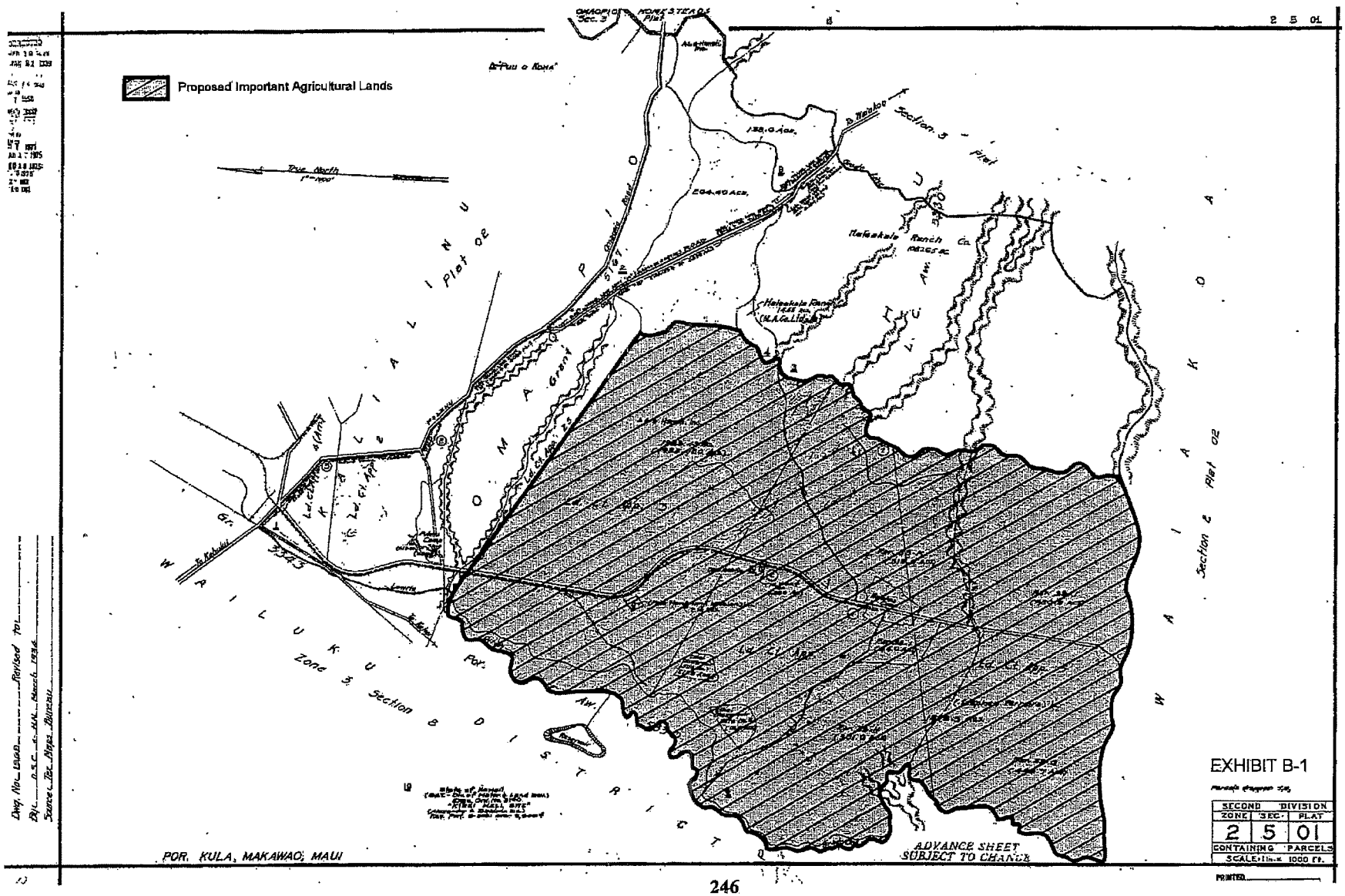
Disclaimer:
This map has been prepared for general planning purposes only.

EXHIBIT B
Tax Map Key
A&B IAL-Maui

A&B INC. BOARD OF MAUI

NORTH LINEAR SCALE (FEET) 0 1,000 2,000 4,000 8,000

June 2009


Proposed Important Agricultural Lands
EXHIBIT B-1
SECOND DIVISION
ZONE 2 SEC. 5 PLAT 01
CONTAINING PARCELS
SCALE: 1 in. = 1000 ft.
PRINTED
POR. KULA, MAKAWAO, MAUI
ADVANCE SHEET SUBJECT TO CHANGE
Zone 3 Section 8
Section 5 Plat 01
Section 6 Plat 02
Section 5 Plat
Waiakoa
Waiakoa Grant
Waiakoa Ahupuaa
Waiakoa Kuleana
Waiakoa Homesteads
Waiakoa Ranch
Waiakoa Ranch Co.
Waiakoa Ranch Co. Ltd.
Waiakoa Ranch Co. Ltd. Aupuni Lease
Waiakoa Ranch Co. Ltd. Aupuni Lease (M.A.G.Ltd.)
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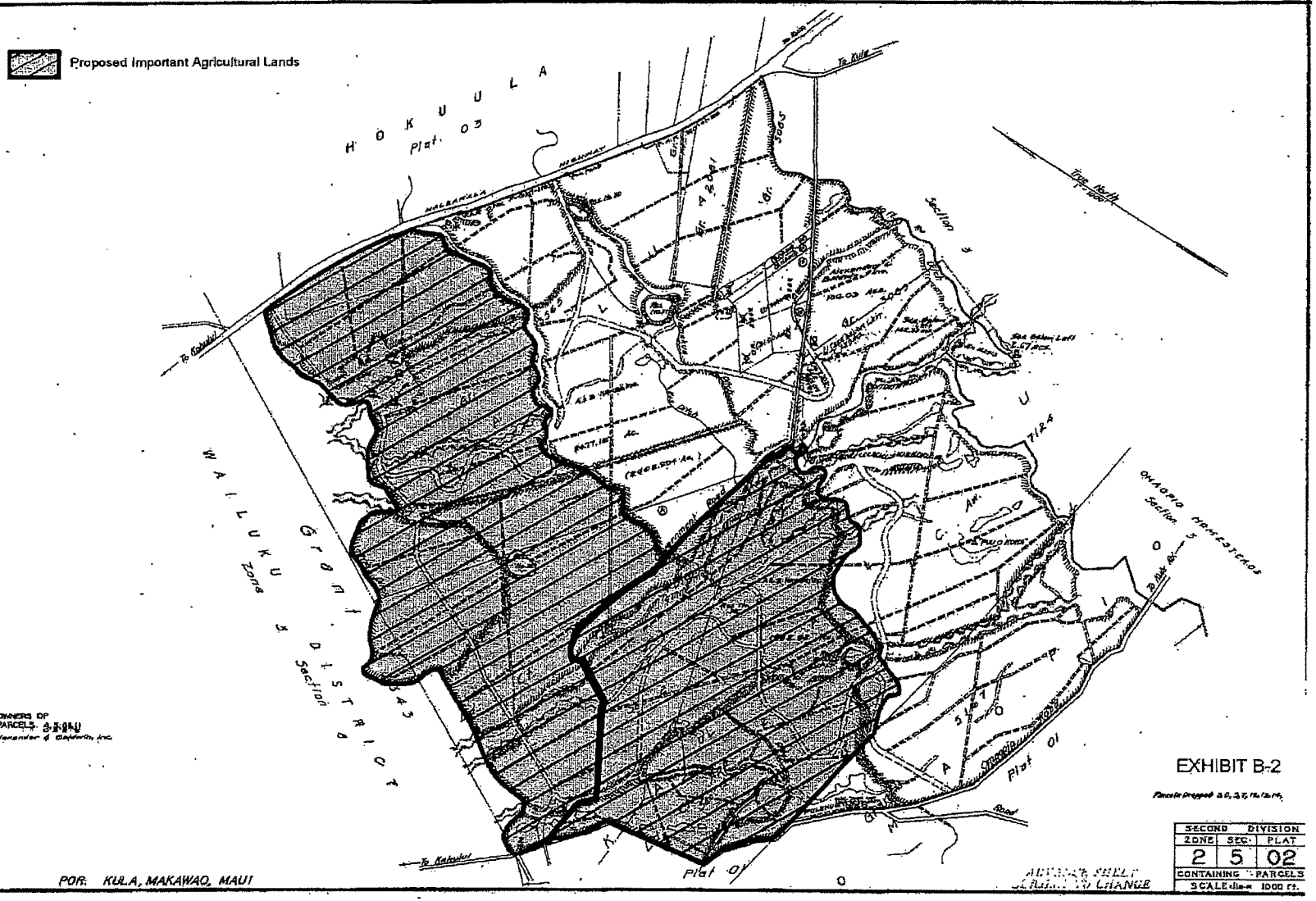
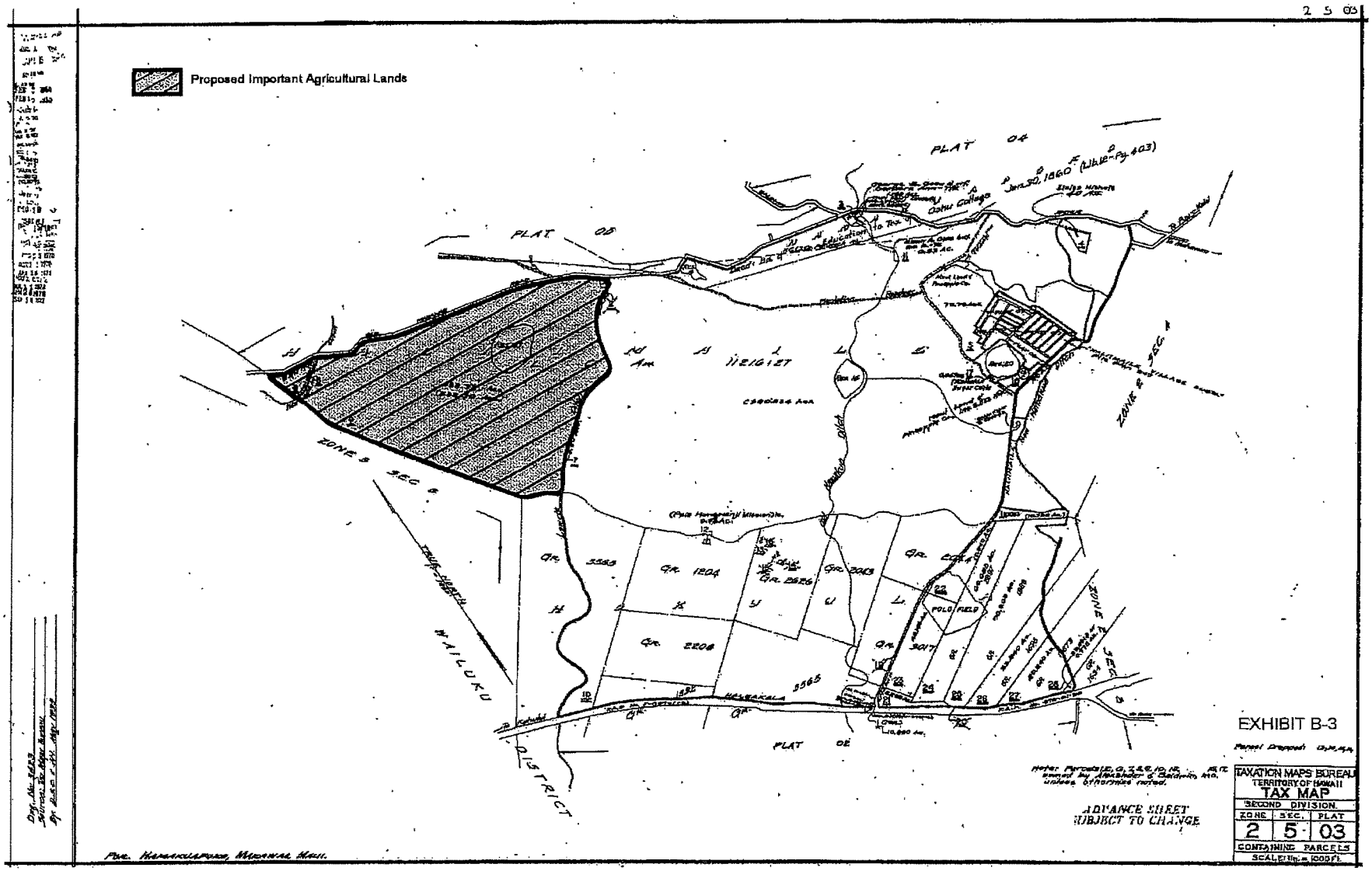
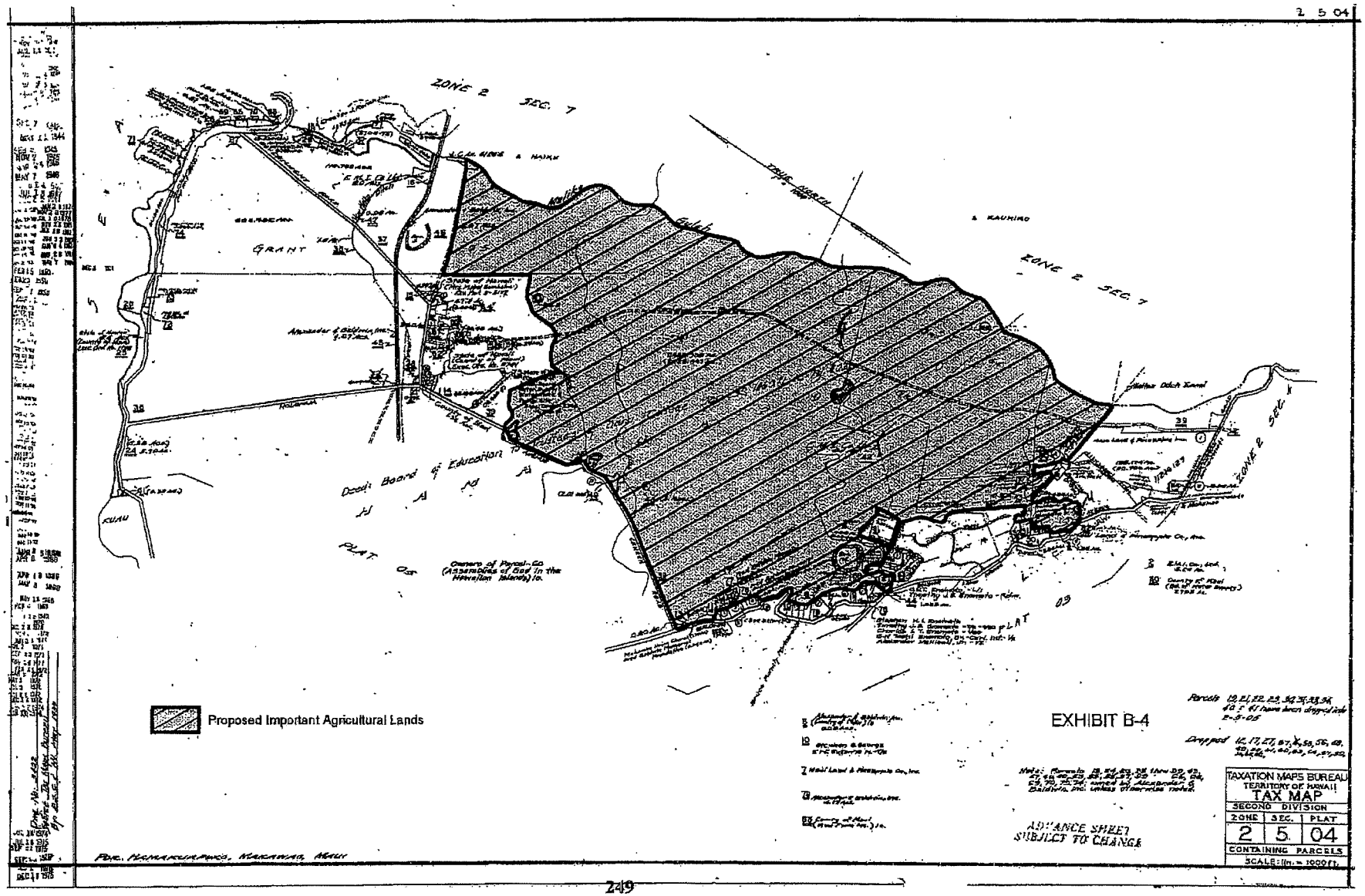
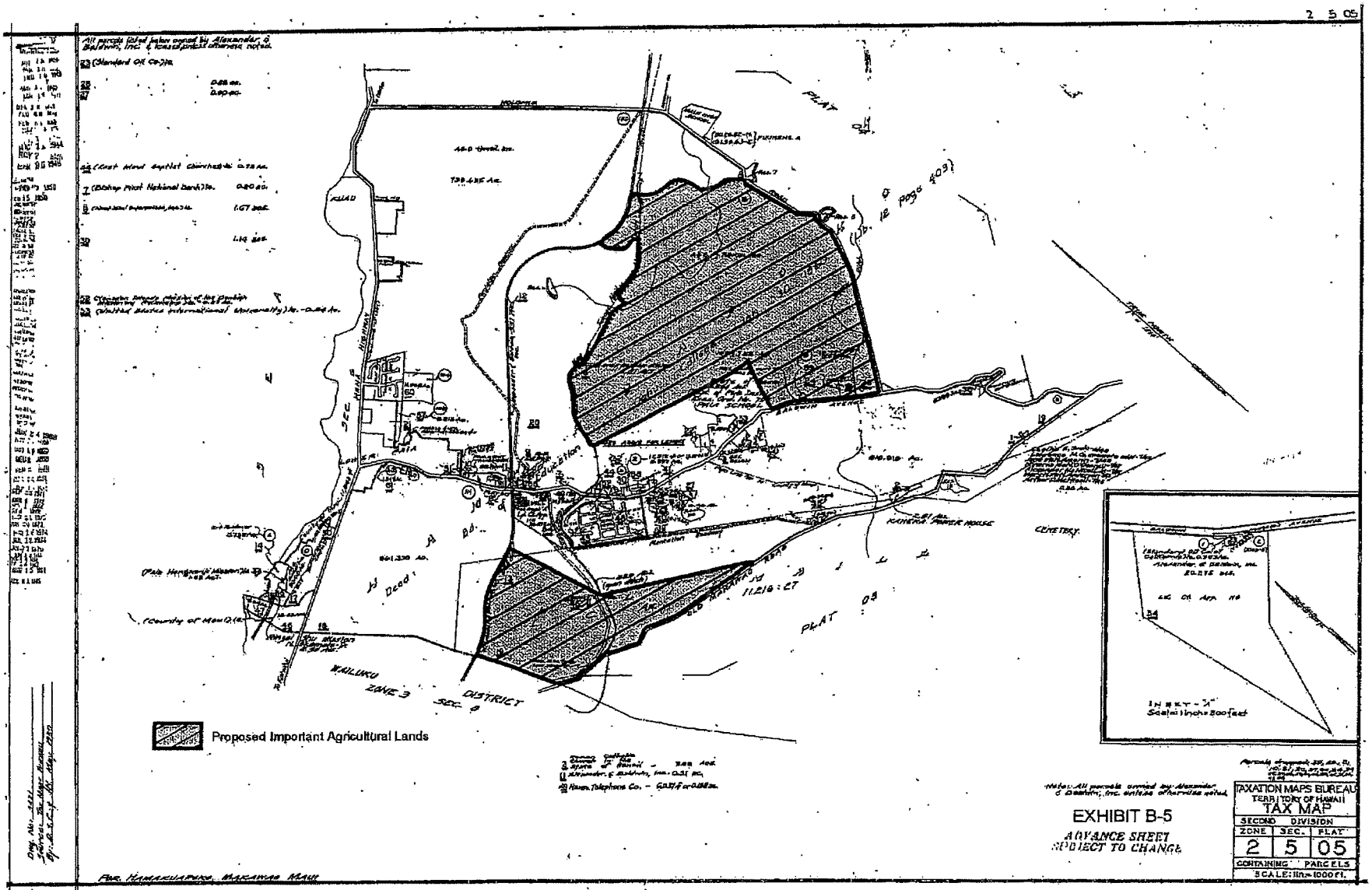
2 5 02

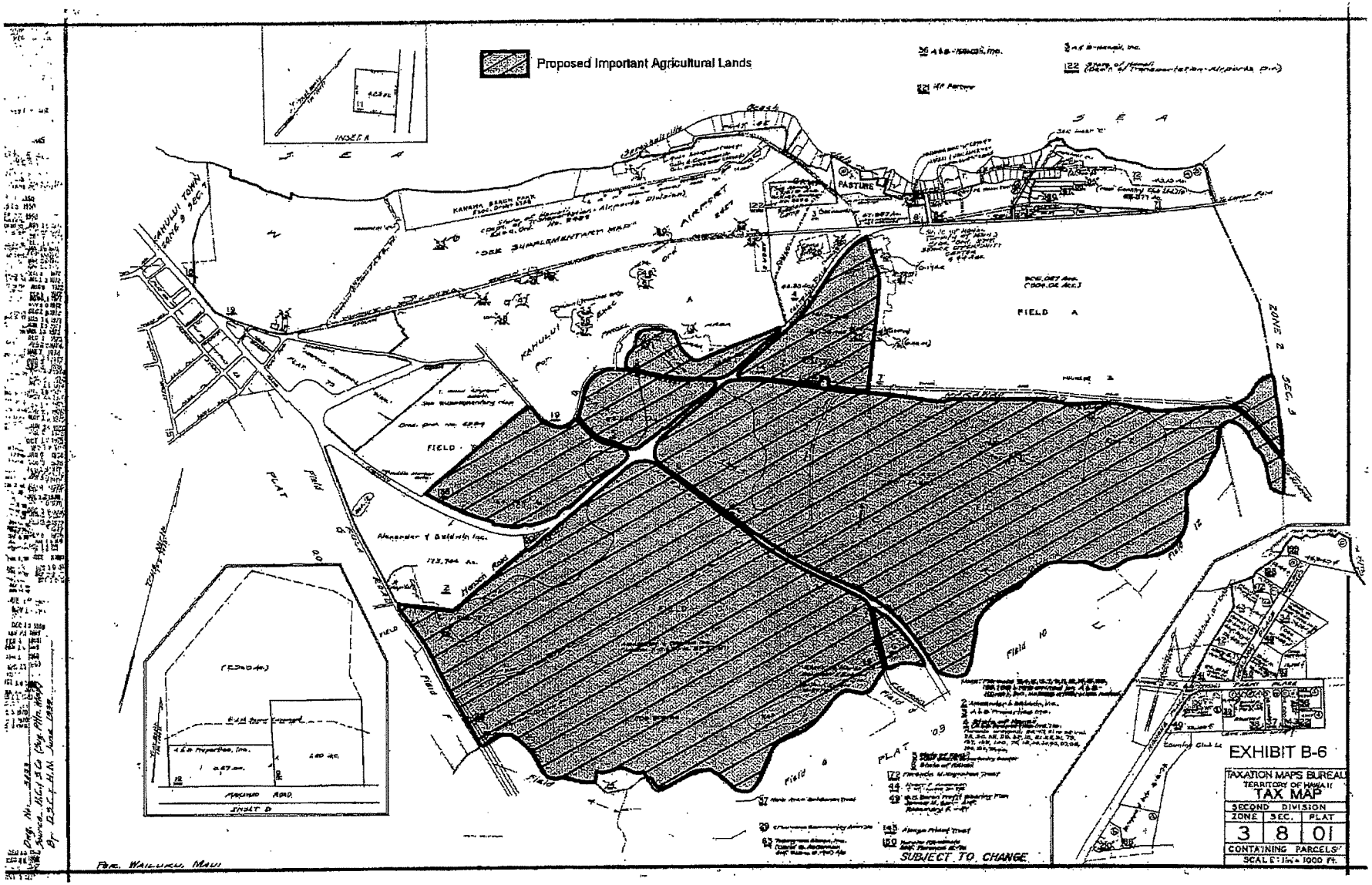

Proposed Important Agricultural Lands
H O K U U L A
Plat 03
To Kahului
To Kula
Section 3
Grant 1005
Grant 3
Grant 1005
Grant 1005
Grant 1005

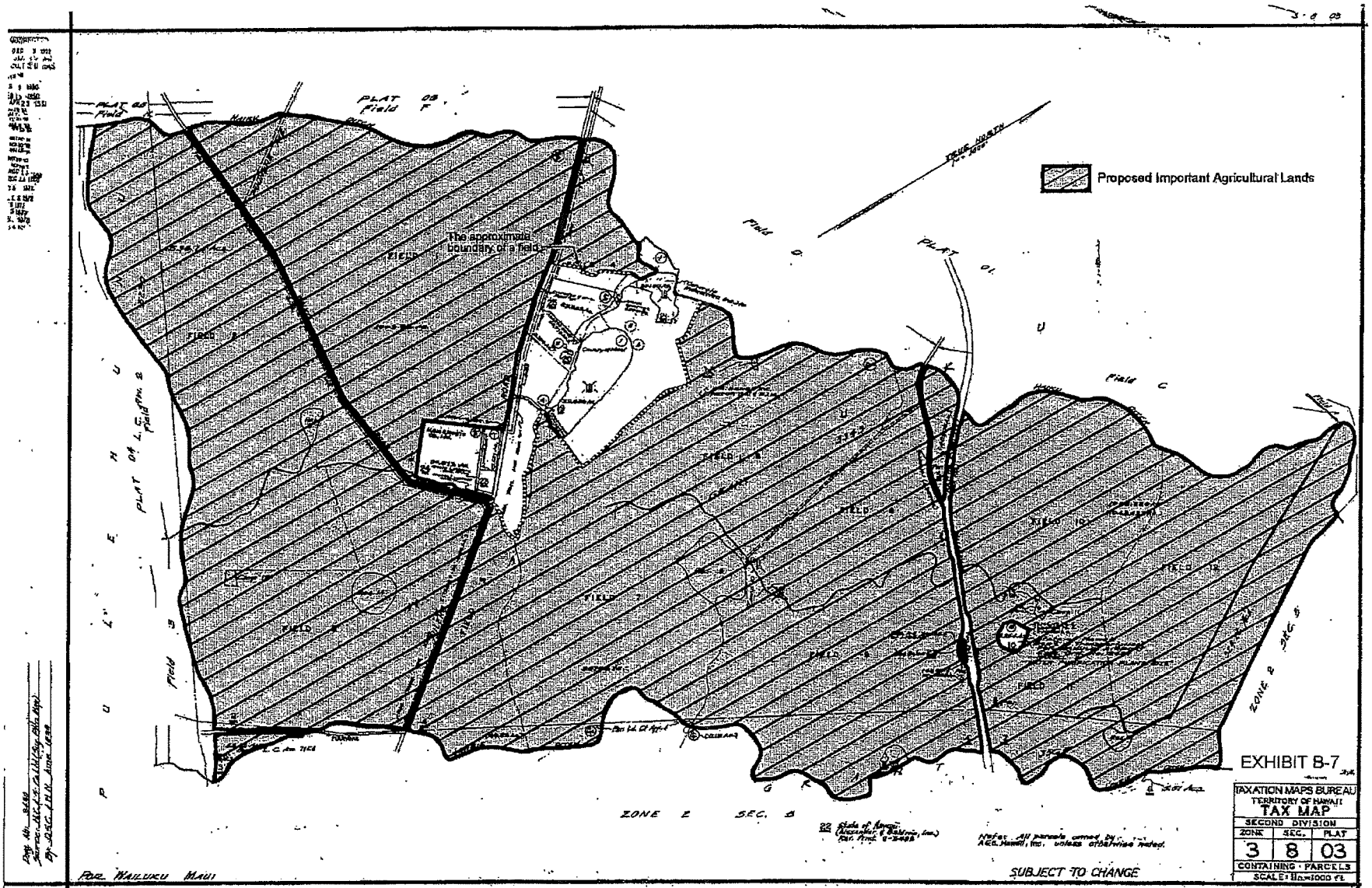

2 5 03
Proposed Important Agricultural Lands
PLAT 04
PLAT 05
PLAT 02
ZONE 2 SEC 4
ZONE 3 SEC 6
WAILUKU DISTRICT
POLO FIELD
EXHIBIT B-3
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 2 SEC. 5 PLAT 03
CONTAINING PARCELS
ADVANCE SHEET
SUBJECT TO CHANGE

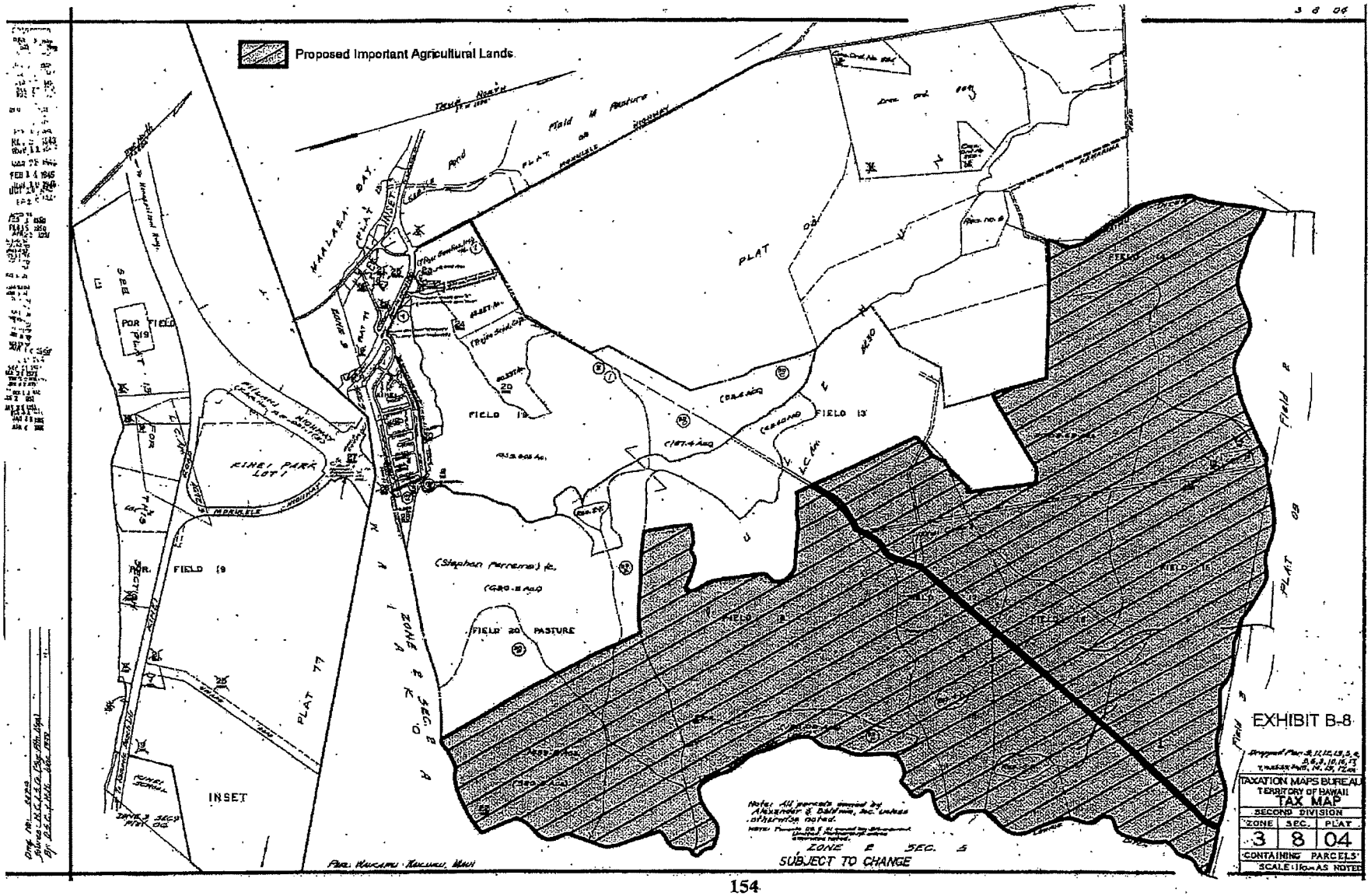

2 5 04
ZONE 2 SEC. 7
ZONE 2 SEC. 7
ZONE 2 SEC. 4
GRANT
Deed Board of Education
PLAT 05
PLAT 03
Proposed Important Agricultural Lands
EXHIBIT B-4
ADVANCE SHEET
SUBJECT TO CHANGE
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 2
SEC. 5
PLAT 04
CONTAINING PARCELS
SCALE: 1 in. = 1000 ft.
PDR. HAMAKUAPOKO, MAKAWAO, MAUI

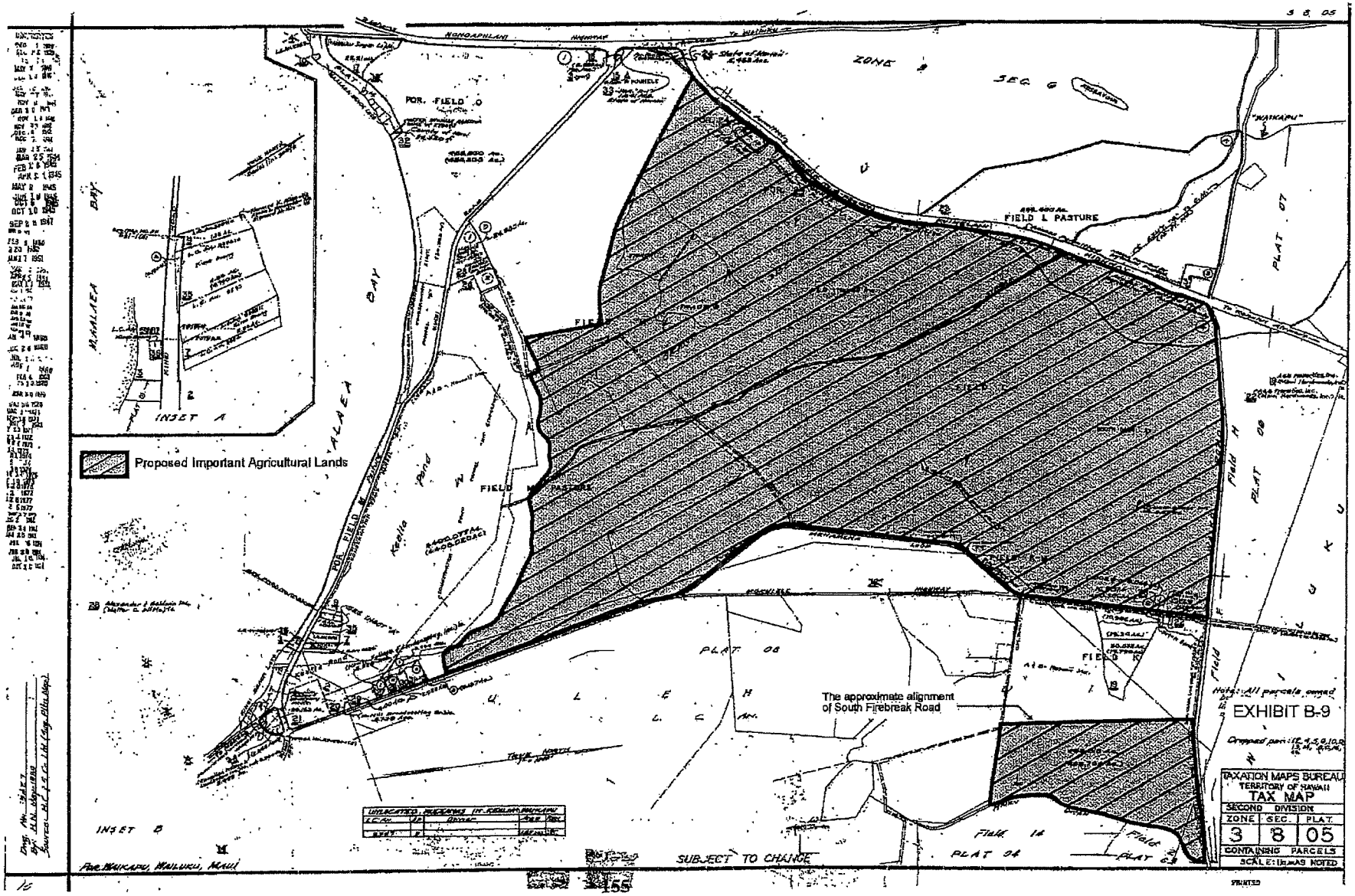


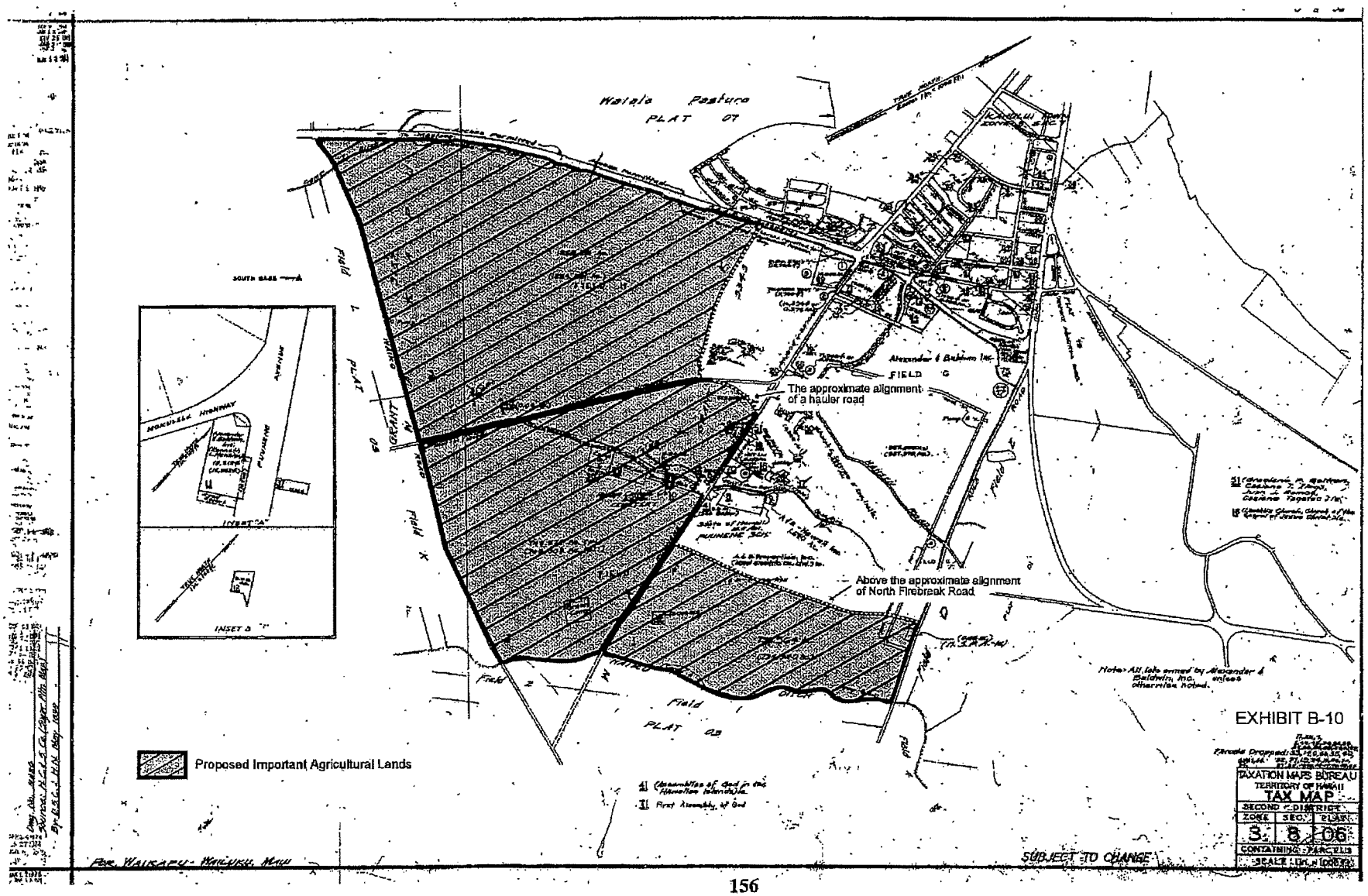
2 5 05
PLAT 04
PLAT 05
KUAU
WAILUKU
ZONE 3
SEC. 6
DISTRICT
CEMETERY
Proposed Important Agricultural Lands
EXHIBIT B-5
ADVANCE SHEET
SUBJECT TO CHANGE
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 2
SEC. 5
PLAT 05
CONTAINING PARCELS
SCALE: 1in.=1000 ft.

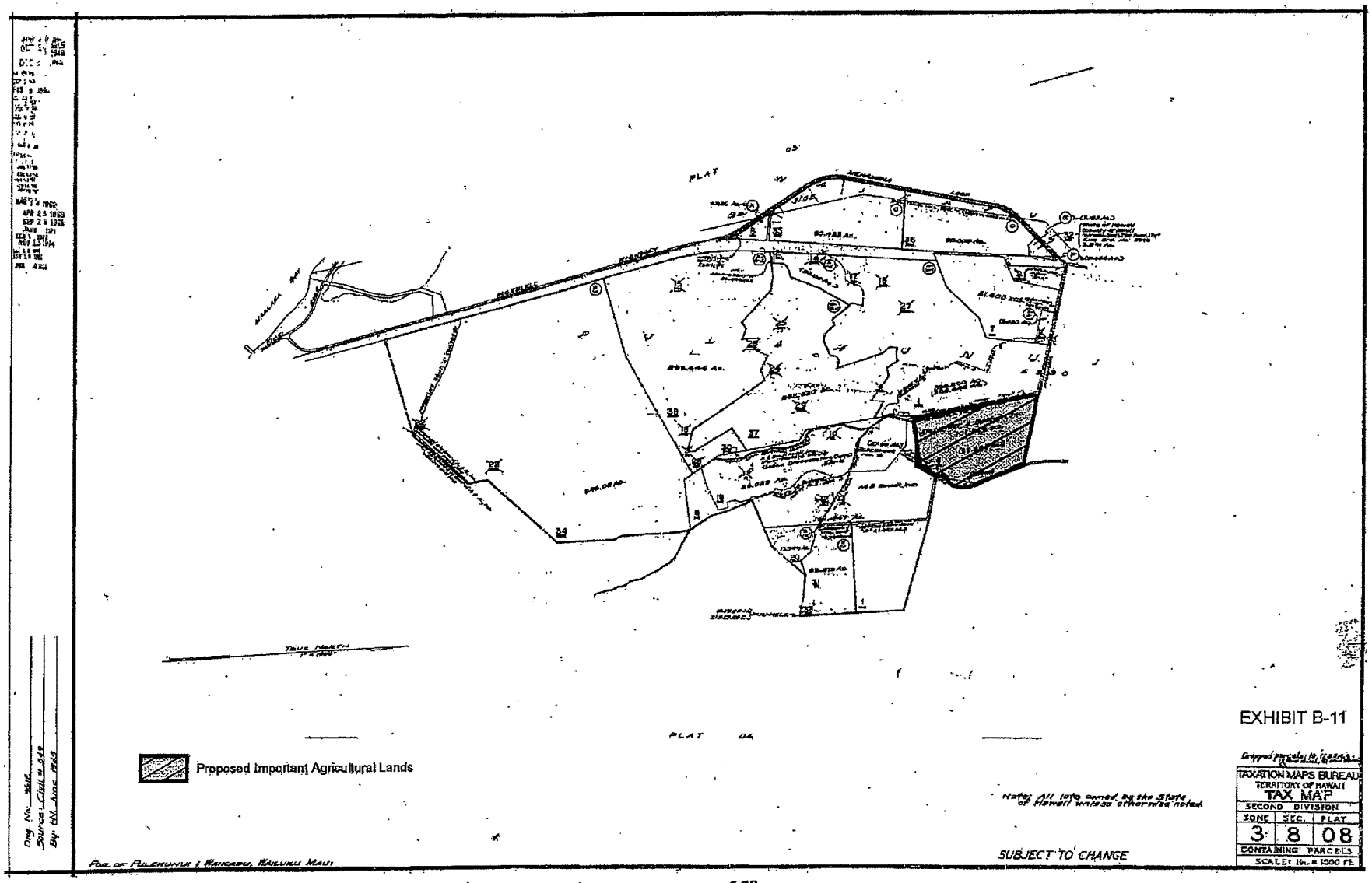

Proposed Important Agricultural Lands
INSET A
KAHULUI TOWN ZONE 3 SEC 7
KANAPA BEACH PARK
AIRPORT
PASTURE
FIELD A
FIELD B
FIELD C
FIELD 10
ZONE 2 SEC 3
KAHULUI TOWN ZONE 3 SEC 8
PLAT 73
PLAT 109
PLAT 10
Alexander & Baldwin Inc.
113,744 Ac.
Hawaii Road
(2.240 Ac.)
Airport Road
Street D
SUBJECT TO CHANGE
EXHIBIT B-6
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 3 SEC. 8 PLAT 01
CONTAINING PARCELS
SCALE: 1in = 1000 Ft.
Por. Wailuku, Maui


Proposed Important Agricultural Lands
The approximate boundary of a field
PLAT 03
Field F
Field D
PLAT 01
Field C
PLAT 04
Field 3
ZONE 2 SEC. 5
ZONE 2 SEC. 5
TRUE NORTH
EXHIBIT B-7
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 3
SEC. 8
PLAT 03
CONTAINING · PARCELS
SCALE: 1in.=1000 ft.
SUBJECT TO CHANGE
POR. WAILUKU MAUI


Proposed Important Agricultural Lands
EXHIBIT B-8
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 3
SEC. 8
PLAT 04
CONTAINING PARCELS
SCALE: 1/16 AS NOTED
ZONE 2 SEC. 5
SUBJECT TO CHANGE
INSET
FIELD 19
FIELD 20 PASTURE
FIELD 13
PLAT 77
PLAT 08
KINEI PARK LOT 1
MAALAEA BAY
Field M Pasture
Note: All parcels owned by Alexander & Baldwin, Inc. unless otherwise noted.


Proposed Important Agricultural Lands
The approximate alignment of South Firebreak Road
EXHIBIT B-9
SUBJECT TO CHANGE
INSET A
INSET B
MAALAEA BAY
FIELD L PASTURE
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE 3 SEC. 8 PLAT 05
CONTAINING PARCELS
SCALE: 1 INCH AS NOTED


Waiale Pasture
PLAT 07
The approximate alignment of a hauler road
Above the approximate alignment of North Firebreak Road
Proposed Important Agricultural Lands
EXHIBIT B-10
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DISTRICT
ZONE
SEC.
PLAT
3
8
06
CONTAINING PARCELS
SUBJECT TO CHANGE
FOR WAIKAPU-WAILUKU, MAUI


PLAT 05
PLAT 06
TRUE NORTH
Proposed Important Agricultural Lands
Note: All lots owned by the State of Hawaii unless otherwise noted.
SUBJECT TO CHANGE
EXHIBIT B-11
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
SECOND DIVISION
ZONE SEC. PLAT
3 8 08
CONTAINING PARCELS
SCALE: 1in. = 1000 ft.
Dwg. No. 3612
Source: Civil W. 540
By: HL June 1963
POR. OF PULEHUNUI & WAIKAPU, WAILUKU MAUI

COUNCIL OF THE COUNTY OF MAUI, POLICY COMMITTEE, COMMITTEE REPORT NO. 12-143

APPENDIX

D-1

COUNCIL OF THE COUNTY OF MAUI

POLICY COMMITTEE

December 7, 2012

Committee Report No. 12-143

Honorable Chair and Members
of the County Council
County of Maui
Wailuku, Maui, Hawaii

Chair and Members:

Your Policy Committee, having met on November 20, 2012, and November 26, 2012, makes reference to County Communication 12-225, from the Director of Environmental Management, transmitting a proposed resolution entitled "AUTHORIZING THE PURCHASE OF LAND LOCATED AT PULEHU ROAD, KAHULUI, ISLAND AND COUNTY OF MAUI, PURSUANT TO CHAPTER 3.44, MAUI COUNTY CODE".

The purpose of the proposed resolution is to authorize the purchase of approximately 28.486 acres ("28 acres") described as Lot 2-A-1 of the Central Maui Sanitary Landfill Subdivision (TMK: (2) 3-8-003:019 (portion)), located at Pulehu Road, Kahului, Maui, for $813,000, pursuant to Chapter 3.44, Maui County Code. The Department of Environmental Management is considering the land as a possible location for the expansion of the Central Maui Landfill.

Your Committee notes that the purchase agreement for the property is attached as Exhibit "1" to the proposed resolution. The proposed resolution also attaches a preliminary title report, an appraisal dated August 25, 2011, and a License Agreement. The License Agreement would allow Alexander & Baldwin, LLC ("A&B") to harvest any crop being grown on the property until the harvest is completed (estimated at March 2014).

Your Committee notes that the appraised value of the property is $713,000. Your Committee questioned the $100,000 differential in the appraised value and the purchase price. The Deputy Director of Environmental Management noted that the price was negotiated with A&B to compensate the company for its anticipated expenses in relocating an access roadway, interior roadways, gates, water facilities, and other infrastructure onto other adjacent properties owned by A&B. The Deputy Director also advised that an updated appraisal as of November 2012 valued the property at $752,000.

The Deputy Director further noted that the Department is considering the possibility of using the property to warehouse materials, handle green waste, and accommodate a materials recovery facility and abandoned vehicle storage yard.

Grant Chun, Vice President, A&B Properties, Inc., informed your Committee that the proposed transaction had been initiated by the County, and that A&B has agreed to sell the land to assist the County in its efforts to address the County's solid waste needs. He described the historical efforts to identify land in the vicinity of the existing Central Maui Landfill for expansion purposes.

Your Committee noted that an approximately 22-acre portion of the 28 acres is designated as Important Agricultural Lands ("IAL"). Your Committee discussed how that designation may impact the use of the property for landfill expansion purposes. Your Committee was satisfied with the options presented to pursue use of the 28 acres for the public purpose of landfill expansion.

Your Committee also questioned the references to a "remainder parcel" in the purchase agreement. Your Committee was advised that the 28 acres had been subdivided and consolidated with County-owned land in anticipation of the sale, and that the County and A&B are, therefore, co-tenants of approximately 179.962 acres now known as Lot 1-A-1.

At the request of the Chair of your Committee, the Department of the Corporation Counsel transmitted a revised proposed resolution, approved as to form and legality, to clarify these issues and incorporate nonsubstantive revisions. The revised proposed resolution describes the consolidation of lots and the subsequent designation of the 28 acres as a portion of Lot 1-A-1. It also clarifies that the intent of the purchase agreement is to sell all of A&B's interest in Lot 1-A-1, which includes the 28 acres, to the County.

A Deputy Corporation Counsel noted that if the Council approves the purchase, that approval would extend to the consolidation and resubdivision process outlined in the proposed resolution.

As a result of concerns expressed with the subdivision process, the Chair of your Committee stated that all departments in the future should seek the advice of the Department of the Corporation Counsel before signing documents, to ensure that no legislative action is required before departments are authorized to sign.

COUNCIL OF THE COUNTY OF MAUI

POLICY COMMITTEE

Committee Report No. 12-143

Your Committee voted 5-0 to recommend adoption of the revised proposed resolution and filing of the communication. Committee Chair Hokama and members Baisa, Mateo, Victorino, and White voted "aye". Committee Vice-Chair Carroll and members Cochran, Couch, and Pontanilla were excused.

Your Policy Committee RECOMMENDS the following:

1. That Resolution 12-122, as revised herein and attached hereto, entitled "AUTHORIZING THE PURCHASE OF LAND LOCATED AT PULEHU ROAD, KAHULUI, ISLAND AND COUNTY OF MAUI, PURSUANT TO CHAPTER 3.44, MAUI COUNTY CODE", be ADOPTED; and

2. That County Communication 12-225 be FILED.

This report is submitted in accordance with Rule 8 of the Rules of the Council.

G. RIKI HOKAMA, Chair

pol:cr:12060aa:cmn

COUNCIL OF THE COUNTY OF MAUI

WAILUKU, HAWAII 96793

CERTIFICATION OF ADOPTION

It is HEREBY CERTIFIED that the recommendations contained in COMMITTEE REPORT NO. 12-143 were adopted by the Council of the County of Maui, State of Hawaii, on the 7th day of December, 2012, by the following vote:

MEMBERS	Dennis A. MATEO Chair	Joseph PONTANILLA Vice-Chair	Gladys C. BAISA	Robert CARROLL	Eleanora COCHRAN	Donald G. COUCH, JR.	G. Riki HOKAMA	Michael P. VICTORINO	Michael B. WHITE
ROLL CALL	Aye	Excused	Aye	Aye	Aye	Aye	Excused	Excused	Aye

COUNTY CLERK

Resolution

No. 12-122

AUTHORIZING THE PURCHASE OF LAND LOCATED AT PULEHU ROAD, KAHULUI, ISLAND AND COUNTY OF MAUI, PURSUANT TO CHAPTER 3.44, MAUI COUNTY CODE

WHEREAS, by way of the Fiscal Year 2012 Budget Ordinance, the Maui County Council appropriated $1,500,000 from the Bond fund to the Wailuku-Kahului Community Plan Area for purposes of the capital improvement project known as the "Central Maui Solid Waste Facility", with Phase I of said project being the acquisition of 25 acres of land near the Central Maui Landfill, located on Pulehu Road in Kahului, Island of Maui; and

WHEREAS, on November 9, 2010, the County of Maui's Department of Public Works received an application for a limited subdivision, pursuant to Section 18.12.050, Maui County Code, and assigned said application Subdivision File No. 3.2253. Said application was submitted by the County of Maui and Alexander & Baldwin, Inc. (now known and hereafter referred to as Alexander & Baldwin, LLC, a Hawaii limited liability company), requesting the consolidation of two parcels of real property located within the Central Maui Sanitary Landfill Subdivision, specifically Lot 1-A (being approximately 151.476 acres owned by the County of Maui) and Lot 2-A-1 (being approximately 91 acres owned by Alexander & Baldwin, LLC). Said application further requested the resubdivision of said lots into Lot 1-A-1 (approximately 179.962 acres owned by Alexander & Baldwin, LLC, and the County of Maui) and Lot 2-A-1-A (approximately 63 acres owned by Alexander & Baldwin, LLC). Said Subdivision File No. 3.2253 was given final approval on June 27, 2011; and

WHEREAS, Alexander & Baldwin, LLC, has agreed to sell all of its fee simple interest in Lot 1-A-1, to the County of Maui and has entered into a Real Property Purchase and Sale Agreement to that effect, attached hereto as Exhibit "1" ("Agreement"); and

Resolution No. 12-122

WHEREAS, an appraisal by ACM Consultants, Inc., completed August 23, 2011, for the County, shows that the appraised value of Alexander & Baldwin, LLC's fee simple interest in Lot 1-A-1 is $713,000; and

WHEREAS, the agreed-to price for all of Alexander & Baldwin, LLC's fee simple interest in Lot 1-A-1 is $813,000, plus expenses as set forth in Section 4.4(b) of the Agreement; and

WHEREAS, Maui County Code Section 3.44.015.B, provides that, in the case of real property with a purchase price that exceeds $100,000, the County Council shall authorize the acquisition by passage of a resolution; and

WHEREAS, the Council finds that acquisition of all of Alexander & Baldwin, LLC's fee simple interest in Lot 1-A-1 is in the public interest; now therefore,

BE IT RESOLVED by the Council of the County of Maui:

1. That, pursuant to Section 3.44.015.B, Maui County Code, the Council hereby approves the acquisition of all of Alexander & Baldwin, LLC's fee simple interest in Lot 1-A-1 of the Central Maui Sanitary Landfill Subdivision for $813,000, plus expenses as set forth in Section 4.4(b) of the Agreement; and

2. That certified copies of this Resolution be transmitted to the Mayor, the Director of Finance, the Director of Environmental Management, and Alexander & Baldwin, LLC.

APPROVED AS TO FORM
AND LEGALITY:

RICHELLE M. THOMSON
Deputy Corporation Counsel
County of Maui
S:\ALL\RMT\Resos\3.44 CML 28.5 acres 11-23-12.doc

REAL PROPERTY PURCHASE AND SALE AGREEMENT

This Real Property Purchase and Sale Agreement ("**Agreement**") made this _____ day of _____, 2012, by and between **ALEXANDER & BALDWIN, LLC**, a Hawaii limited liability company, formerly known as Alexander & Baldwin, Inc. (hereinafter referred to as "**Owner**" and/or "**Seller**"), and **COUNTY OF MAUI**, a political subdivision of the State of Hawaii (hereinafter referred to as "**County**" and/or "**Buyer**").

RECITALS

(a) Seller's Lot 2-A-1 of the Central Maui Sanitary Landfill Subdivision was consolidated with the County's Lot 1-A, and subsequently resubdivided (Subdivision File No. 3.2253), such that Seller and the County are owners of fee simple interests in that certain parcel of land described as Lot 1-A-1, located at Pulehu Road in Kahului, Maui, Hawaii; Tax Map Key No. (2) 3-8-03:019. Said Lot 1-A-1 contains a total area of approximately 179.962 acres, with Seller's ownership interest in said Lot 1-A-1 equivalent to an area of approximately 28.486 acres, such fee simple interest being more particularly described below and within the attached Legal Description and Survey, Title Report, and Appraisal attached hereto as Exhibit "AA", "A", and "B".

(b) Seller desires to sell, and Buyer desires to purchase said fee simple interest for the consideration and on the terms set forth in this Agreement.

AGREEMENT

The parties, intending to be legally bound, agree as follows:

1. DEFINITIONS.

For purposes of this Agreement, the following terms have the meanings specified or referred to in this Section 1:

"**ALTA Insurance**" means American Land Title Association title insurance.

"**Buyer**" is defined in the first paragraph of this Agreement.

"**Buyer's Closing Documents**" is defined in Section 4.3.

"**Closing**" is defined in Section 4.1.

"**Closing Date**" means the date and time as of which the Closing actually takes place.

"**Closing Payment**" is defined in Section 2.1(d).

"**Consent**" means any approval, consent, ratification, waiver, or other authorization (including any Governmental Authorization).

"DCCA" means the Department of Commerce and Consumer Affairs of the State of Hawaii.

"**Effective Date**" shall mean the date when this Agreement has been signed by Buyer and Seller.

"**Encumbrance**" means any charge, claim, condition, equitable interest, lien, option, pledge, security interest, right of first refusal, or restriction of any kind, including any restriction on use, transfer, receipt of income, or exercise of any other attribute of ownership.

"**Escrow Agent**" means Title Guaranty Escrow Services, Inc. – Kahului Branch, 80 South Puunene Avenue, Kahului, HI 96732: Attention: Michael Gamberdell, Branch Manager.

"**Governmental Authorization**" means any approval, consent, license, permit, waiver, or other authorization issued, granted, given, or otherwise made available by or under the authority of any Governmental Body (defined below) or pursuant to any Legal Requirement (defined below).

"**Governmental Body**" means any: (a) federal, state, local, or municipal government; or (b) body exercising, or entitled to exercise, any administrative, executive, judicial, legislative, police, regulatory, or taxing authority or power of any nature over the Property.

"**Hazardous Materials**" means and includes any and all radioactive materials, asbestos, organic compounds known as polychlorinated biphenyls, chemicals known to cause cancer or reproductive toxicity, pollutants, contaminants, hazardous wastes, toxic substances, and any and all other substances or materials defined as or included in the definition of "hazardous substances," "hazardous wastes," "hazardous materials," or "toxic substances" under, or for the purposes of, the Hazardous Materials Laws.

"**Hazardous Materials Laws**" means and includes all federal, state or local laws, ordinances or regulations, now or hereafter in effect, relating to environmental conditions, industrial hygiene or Hazardous Materials, including, without limitation, the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C. Section 9601, et seq., the Resource Conservation and Recovery Act, 42 U.S.C. Section 6901, et seq., the Hazardous Materials Transportation Act, 49 U.S.C. Section 1801, et seq., the Clean Water Act, 33 U.S.C. Section 1251 et seq. the Clean Air Act, 42 U.S.C. Section 7401 et seq., the Toxic Substances Control Act, 15 U.S.C. Sections 2601 through 2629, the Safe Drinking Water Act, 42 U.S.C. Sections 300f through 300j, and any similar state or local laws or ordinances and the regulations now or hereafter adopted, published and or promulgated pursuant thereto.

"**Knowledge**" means an individual is actually aware of a particular fact or other matter, without imposing any duty of inquiry or investigation.

"**Legal Requirement(s)**" means any federal, state, local or municipal administrative order, constitution, law, ordinance, regulation, statute, or treaty.

"**New Encumbrance**" is defined in Section 3.4.

"**Order**" means any award, decision, injunction, judgment, order, ruling, subpoena, or verdict entered, issued, made, or rendered by any court, administrative agency, or other Governmental Body or by any arbitrator.

"**Person**" means any individual, corporation (including any non-profit corporation), general or limited partnership, limited liability company, joint venture, estate, trust, association, organization, or other entity or Governmental Body.

"**Proceeding**" means any action, arbitration, hearing, litigation, or suit (whether civil, criminal, or administrative) commenced, brought, conducted, or heard by or before, or otherwise involving, any Governmental Body.

"**Property**" is defined in Section 2.1.

"**Purchase Price**" is defined in Section 2.1(d).

"**Real Property**" is defined in Section 2.1(a).

"**Remainder Parcel**" is defined as the remaining portion of Lot 1-A-1 that does not include the Property.

"**Seller**" is defined in the first paragraph of this Agreement.

"**Seller's Closing Documents**" is defined in Section 4.2.

"**Title Company**" means Title Guaranty of Hawaii, Inc., or such other title company authorized to do business in the State of Hawaii chosen by Seller and acceptable to Buyer.

"**Title Report**" is defined in Section 3.3.

"**Title Policy**" is defined in Section 7.3.

2. SALE OF PROPERTY.

2.1 Sale of Property. Subject to the terms and conditions of this Agreement, at the Closing, Seller agrees to sell to Buyer and Buyer agrees to purchase from Seller all of Seller's interest in the following described Property (collectively the "**Property**"):

(a) Real Property. The fee simple estate described in the Legal Description and Survey, Title Report, and Appraisal, attached hereto as Exhibits "AA,"

"A," and "B" respectively, together with the improvements, fixtures, appurtenant easements, and other real Property interests appurtenant to such fee simple estate but expressly reserving unto the Seller and Seller's affiliates, a waterline easement in the general location shown on Exhibit "E" attached hereto and made a part hereof (the "**Waterline Easement**"), which will be specifically located and designated prior to Closing (the "**Real Property**");

(b) Personal Property. All development rights and permits for the Property, to the extent Seller has the right to assign the same.

(c) Subdivision. The Property, which was originally a portion of Lot 2-A-1 of the Central Maui Sanitary Landfill Subdivision (the "**Landfill**"), has been subdivided from said Lot 2-A-1 and consolidated with other real property owned by Buyer identified as Lot 1-A of the Landfill such that Lot 1-A and the Property now comprise new Lot 1-A-1 of the Landfill. Final approval of said subdivision and consolidation (the "**Subdivision**") is evidenced by that letter from David C. Goode, County of Maui Department of Public Works, dated June 27, 2011, attached hereto as Exhibit "D." To the extent that Seller has acquired an interest in the Remainder Parcel, Seller shall quitclaim its interest in the Remainder Parcel to Buyer at Closing. To the extent that Buyer has acquired an interest in Lot 2-A-1-A of the Landfill, Buyer shall quitclaim its interest in Lot 2-A-1-A to Seller. The parties acknowledge that it appears that Lot 1-A-1 is currently identified by the County of Maui Real Property Tax Division online GIS maps as Tax Map Key No. (2) 3-8-003-019. Seller is making no representation as to the accuracy of the tax map key number.

(d) Purchase Price. The purchase price (the "**Purchase Price**") for the Property shall be EIGHT HUNDRED THIRTEEN THOUSAND AND NO/100 DOLLARS ($813,000.00). At Closing, Buyer shall pay Seller, through Escrow Agent, an amount (the "**Closing Payment**") equal to EIGHT HUNDRED THIRTEEN THOUSAND AND NO/100 DOLLARS ($813,000.00), plus or minus net adjustments and prorations provided for in this Agreement. The Closing Payment shall be made in cash or other immediately available federal funds to Escrow Agent by the deadline specified by the Escrow Agent.

2.2 Threat of Condemnation. Buyer acknowledges that Seller has agreed to convey the Property to Buyer in accordance with the terms of this Agreement pursuant to the threat of the exercise or the exercise of the power of eminent domain.

3. BUYER'S REVIEW OF THE PROPERTY.

3.1 Property Survey. Buyer shall, at its own expense, obtain a survey map and metes and bounds description of the Property in a form as may be required by the Title Company to issue the Title Policy ("**Survey**").

3.2 Due Diligence. Prior to the Effective Date of this Agreement, Buyer and its agents and professional advisors have had the opportunity to conduct all investigations and tests that it desired with respect to the Property; and is satisfied with the results of its investigations and tests.

3.3 Title Report. Attached hereto as Exhibit "A" is a Preliminary Title Report for the Property from the Title Company (collectively, the "**Title Report**").

3.4 Procedure For Buyer's Title Objections. All matters referred to in the Title Report and Survey shall be hereinafter referred to as the "**Permitted Exceptions.**" If at Closing Seller is unable to convey title subject only to the Permitted Exceptions, Buyer may terminate this Agreement.

Notwithstanding the foregoing, if the Property is to be conveyed subject to any encumbrance that materially and adversely affects the Property and was first placed upon the Property after the date of the Title Report (a "**New Encumbrance**") and is not attributable to Buyer, Buyer shall have the right to terminate this Agreement by giving written notice to Seller and Escrow Agent within ten (10) days after Buyer is provided with a copy of the New Encumbrance unless Seller agrees within five (5) days after receipt of such notice to remove the New Encumbrance prior to Closing. If Buyer terminates this Agreement in accordance with the foregoing, the parties hereto shall be released from all further obligations and liabilities hereunder. If Seller and Escrow Agent do not receive such notice prior to the expiration of said ten (10) day period, Buyer shall be deemed to have waived its objection to the New Encumbrance and Buyer's right to terminate this Agreement pursuant to this paragraph, the New Encumbrance will be deemed to be a Permitted Exception and this Agreement shall continue in effect subject to the other provisions hereof.

3.5 Condition of Property; Property to be Purchased "As Is". As a material inducement to Seller to execute this Agreement, Buyer acknowledges and agrees that, except as expressly provided in this Agreement, Buyer waives any contingencies to the Closing of this Agreement. In addition Buyer agrees that as of the Closing Date: (a) Buyer will have had an opportunity to fully examine and inspect the Property, including the physical condition of the Property; (b) Buyer will have accepted the physical condition, value, financing status, use, leasing, operation, tax status, income and expenses of the Property; (c) the Property will be purchased by Buyer "AS IS" and "WITH ALL FAULTS" and, Buyer shall assume responsibility for the physical condition of the Property and its compliance with all applicable Legal Requirements, and shall assume all liability and responsibility resulting from any violation of the Hazardous Materials Laws occurring either prior to the Closing Date, to the extent arising on a portion of the Property under control of Buyer at the time of such violation or after the Closing; (d) Buyer recognizes that the Property is not new and acknowledges that: (i) consistent with the "AS IS" clause in subparagraph (c) above, the Property shall be sold in the same condition that it is in on the date of this Agreement; and (ii) Seller will not be required to take any action with respect to the Property, including, but not limited to the

repair or replacement of any part of the Property; and (e) Buyer has decided to purchase the Property solely on the basis of its own independent investigation. Seller has not made, does not make, and has not authorized anyone else to make any representation as to the present or future physical condition, value, financing status, use, leasing, operation, tax status, income and expenses or any other matter or thing pertaining to the Property, except as expressly set forth in this Agreement, and Buyer acknowledges that no such representation has been made and that in entering into this Agreement Buyer does not rely on any representation other than those expressly set forth in this Agreement.

3.6 Disclaimer. Except as expressly set forth in this Agreement, Seller makes no warranty or representation, express or implied or arising by operation of law, including, without limitation, any warranty of condition, habitability, merchantability, or fitness for a particular purpose of the Property. Seller shall not be liable for or bound by any verbal or written statements, representations, real estate broker's "setups" or information pertaining to the Property furnished by any real estate broker, agent, employee, servant or any other Person unless the same are specifically set forth in this Agreement or in any document delivered by Seller pursuant to this Agreement or at Closing.

4. CLOSING AND PRORATIONS.

4.1 Closing. Recordation of the documents necessary to complete the purchase and sale provided for in this Agreement (the "**Closing**") will occur on such date as the parties may mutually agree upon (the "**Closing Date**"); provided, however, if the Maui County Council has not given such approval on or before December 31, 2012, this Agreement shall automatically terminate.

4.2 Seller's Closing Documents and Requirements. Not later than two (2) business days prior to Closing, Seller will deposit with the Escrow Agent, the following documents, in each case duly executed by Seller or the appropriate Person, and if applicable, acknowledged and in recordable form ("**Seller's Closing Documents**"):

(a) A limited warranty deed in the form customarily used in the State of Hawaii transferring to Buyer the Property, specifically including the Agricultural Exceptions shown in Exhibit "C" attached hereto (the "**Deed**"), to be recorded and provided to Buyer and Seller. By the Deed, Seller shall also quitclaim its interest in the Remainder Parcel.

(b) A license agreement (the "**License Agreement**") allowing Seller or its affiliates, for a license fee of $1.00 per year, to continue to farm the existing sugar cane crop on the Property and harvest the same, which is anticipated to occur approximately in March 2014. At the County's sole discretion said License Agreement may be extended for an additional two-year period on the same terms and conditions.

The License Agreement shall substantially be in the form as attached hereto as Exhibit "F."

(c) A certificate of non-foreign status, upon request of Buyer, in form and content required by law certifying that Seller is not a "foreign person" as such term is used under Section 1445 of the Internal Revenue Code.

(d) A certificate of resident status in form and content required by law certifying Seller is a "resident person" as such term is used in H.R.S. Section 235-68.

(e) A certificate of good standing for Seller issued by the DCCA not more than ten (10) business days before the Closing Date, upon request of Buyer.

(f) Certified resolutions of Seller's directors (and shareholders, if required) approving the transaction contemplated by this Agreement.

4.3 Buyer's Closing Documents and Requirements. At the Closing, Buyer will deposit with the Escrow Agent, the following funds and documents, in each case duly executed by Buyer or the appropriate Person, and if applicable, acknowledged and in recordable form ("**Buyer's Closing Documents**"):

(a) The Closing Payment as required by Section 2.1(d)

(b) The Deed

(c) The License Agreement

4.4 Expenses.

(a) Seller's Expenses. Seller shall pay (a) the fees of any counsel representing Seller in connection with this transaction; (b) the fee for the issuance of the Title Policy (defined below) in the amount of the Acquisition Price; (c) one-half of any escrow fees charged by the Escrow Agent; and (d) recording fees for the Deed.

(b) Buyer's Expenses. Buyer shall pay (a) the fees of any counsel representing Buyer in connection with this transaction; (b) the incremental premiums charged by the Title Company for the ALTA extended coverage portion of the Title Policy (including any endorsements thereto required or requested by Buyer) to be issued to Buyer by the Title Company at Closing; (c) one-half of any escrow fees charged by the Escrow Agent; and (d) all other costs and expenses incident to this transaction and the closing thereof not expressly provided above.

4.5 Adjustments and Prorations. All receipts and disbursements of the Property will be prorated on the Closing Date and the Purchase Price will be adjusted on the following basis:

(a) Property Taxes and Other Expenses. All real and personal property ad valorem taxes, installments of special assessments, if any, for the year of closing and all other expenses of operating the Property for the year of Closing shall be prorated between Buyer and Seller so that Seller bears all such costs up to the Closing Date and Buyer bears all such expenses from and after the Closing Date.

(b) Post-Closing Adjustments. If at any time within thirty (30) days following the Closing either party discovers any items which should have been included in the adjustments and prorations described in this section but which were omitted therefrom, or any material error in the computation of such adjustments, such items shall be properly adjusted as of the Closing Date without interest thereon. Further, items otherwise not capable of determination prior to the Closing Date, for periods prior to the Closing Date, shall be determined and adjusted without interest thereon within thirty (30) days of the Closing Date.

5. REPRESENTATIONS AND WARRANTIES OF SELLER.

Seller represents and warrants to Buyer that:

5.1 Organization and Good Standing. Seller is a corporation duly organized, validly existing, and in good standing under the laws of the State of Hawaii and is duly authorized to conduct business in the State of Hawaii.

5.2 Authority. This Agreement constitutes the legal, valid, and binding obligation of Seller, enforceable against Seller in accordance with its terms. Upon the execution and delivery by Seller of the Seller's Closing Documents, the Seller's Closing Documents will constitute the legal, valid, and binding obligations of Seller, enforceable against Seller in accordance with their respective terms. Seller has the absolute and unrestricted right, power, and authority to execute and deliver this Agreement and the Seller's Closing Documents and to perform its obligations under this Agreement and the Seller's Closing Documents. Neither the execution nor delivery of this Agreement by Seller nor the consummation or performance of any of Seller's obligations hereunder will contravene, conflict with, or result in a violation or breach of any provision of any agreement to which Seller is a party.

5.3 Development Assistance. If it becomes desirable or necessary in the future, Seller will assist and support Buyer in Buyer's application for a Special Permit pursuant to HRS § 205-6 for proposed non-agricultural uses of the Property and/or support Buyer's petition to remove the Important Agricultural Lands (IAL) designation from that portion of the Property currently designated IAL. Seller's assistance and support identified within this subsection 5.3 shall be provided by Seller at its own expense, without additional compensation by Buyer. Seller shall not be required to reimburse Buyer for any expenses incurred by Buyer.

6. REPRESENTATIONS AND WARRANTIES OF BUYER.

Buyer represents and warrants to Seller that:

6.1 Organization and Good Standing. Buyer is a political subdivision of the State of Hawaii.

6.2 Authority. This Agreement constitutes the legal, valid, and binding obligation of Buyer, enforceable against Buyer in accordance with its terms. Upon the execution and delivery by Buyer of the Buyer's Closing Documents, the Buyer's Closing Documents will constitute the legal, valid, and binding obligations of Buyer, enforceable against Buyer in accordance with their respective terms. Buyer has the absolute and unrestricted right, power, and authority to execute and deliver this Agreement and the Buyer's Closing Documents and to perform its obligations under this Agreement and the Buyer's Closing Documents. Neither the execution nor delivery of this Agreement by Buyer nor the consummation or performance of any of Buyer's obligations hereunder will contravene, conflict with, or result in a violation or breach of any provision of any agreement to which Buyer is a party.

7. CONDITIONS PRECEDENT TO BUYER'S OBLIGATION TO CLOSE.

Buyer's obligation and authority to purchase and close this transaction is subject to the approval of the Maui County Council in accordance with the provisions and requirements of Chapter 3.44 of the Maui County Code, and further, subject to said Maui County Council's approval to fund the purchase.

Buyer's obligation to purchase the Property and to take the other actions required to be taken by Buyer at the Closing is subject to the satisfaction, at or prior to the Closing, of each of the following conditions (any of which may be waived by Buyer, in whole or in part):

7.1 Accuracy of Representations. All of Seller's representations and warranties in this Agreement must have been accurate in all material respects as of the date of this Agreement, and must be accurate in all material respects as of the Closing Date as if made on the Closing Date.

7.2 Seller's Performance. All of the covenants and obligations that Seller is required to perform or to comply with pursuant to this Agreement at or prior to the Closing must have been duly performed and complied with in all material respects. Each document required to be delivered pursuant to Section 4.2 must have been delivered.

7.3 Title Policy. Buyer shall have received a commitment from the Title Company to issue an ALTA fee simple owner's policy (the "**Title Policy**") effective as of the Closing, in the amount of the purchase price, insuring that Buyer is the owner of the fee simple interest in the Real Property, subject to no Encumbrances other than the Permitted Exceptions.

8. CONDITIONS PRECEDENT TO SELLER'S OBLIGATION TO CLOSE.

Seller's obligation to sell the Property and to take the other actions required to be taken by Seller at the Closing is subject to the satisfaction, at or prior to the Closing, of each of the following conditions (any of which may be waived by Seller, in whole or in part):

8.1 Accuracy of Representations. All of Buyer's representations and warranties in this Agreement must have been accurate in all material respects as of the date of this Agreement and must be accurate in all material respects as of the Closing Date as if made on the Closing Date.

8.2 Buyer's Performance. All of the covenants and obligations that Buyer is required to perform or to comply with pursuant to this Agreement at or prior to the Closing must have been performed and complied with in all material respects. Buyer must have delivered each of the documents required to be delivered by Buyer pursuant to Section 4.3 and must have made the cash payments required to be made by Buyer pursuant to Section 2.1.

9. RISK OF LOSS; EMINENT DOMAIN.

9.1 Casualty or Taking. Seller and Buyer hereby waive the Uniform Vendor and Purchaser Risk Act, H.R.S. Chapter 508. If, prior to the Closing, the Property is damaged by fire, vandalism, acts of God or other casualty or cause ("**Casualty**"), or the Property is taken or made subject to condemnation, eminent domain or other governmental acquisition proceedings (a "**Taking**") then the procedures of this Section 9 shall apply.

9.2 Obligated to Close. If the cost of required repair or replacement related to or arising out of the Casualty or if the value of the Taking is $100,000.00 or less, or the Taking is by the County of Maui or any agency or instrumentality thereof, Buyer shall proceed to close and take the Property as diminished by such events. In the case of a Casualty there shall be no adjustment of the Purchase Price and all insurance proceeds otherwise payable to Seller on account of such casualty shall be paid to Buyer. In the case of a Taking, there will be no adjustment of the Purchase Price and all awards otherwise payable to Seller shall be paid to Buyer.

9.3 Buyer's Option to Close. If the cost of repair or replacement related to or arising out of the Casualty or if the value of the Taking is greater than $100,000.00 and the Taking is not by the County of Maui or any agency or instrumentality thereof, Buyer, at its sole option, may elect either to (a) terminate this Agreement by written notice to Seller given at or prior to the Closing; or (b) proceed to close in the manner set forth in Section 9.2.

9.4 Determination of Cost of Casualty or Taking. The cost of repair or replacement related to or arising out of the Casualty or the value of the Taking shall be

determined by Seller and Buyer, or, if they are unable to agree, by an independent appraiser selected by two other appraisers, each of which shall be selected by Seller and Buyer.

9.5 Insurance and Awards. If, pursuant to the preceding Sections, Buyer is either obligated or elects to take the Property as it is together with the insurance or condemnation proceeds or the right to receive the same, Seller agrees to cooperate with Buyer in any loss adjustment or condemnation negotiations, legal actions and agreements with the insurance company or the condemning authority, and to assign to Buyer at the Closing its rights to such insurance or condemnation proceeds and will not settle any insurance claims, condemnation awards or legal actions relating thereto without Buyer's prior written consent.

9.6 Termination. If this Agreement is terminated pursuant to this Section 9, the parties hereto shall be released from all further obligations and liabilities hereunder, and the parties shall enter into a co-tenancy agreement to set forth each party's rights and obligations in the Property, until such time that the Property is consolidated with Lot 2-A-1-A of the Landfill or such other parcel as Seller may reasonably require.

10. GENERAL PROVISIONS.

10.1 Expenses. Except as otherwise expressly provided in this Agreement, each party to this Agreement will bear its respective expenses, fees, and costs incurred in connection with the preparation, execution, and performance of this Agreement and the contemplated transactions, including all fees and expenses of agents, representatives, counsel, and accountants. In the event of termination of this Agreement, the obligation of each party to pay its own expenses will be subject to any rights of such party arising from a breach of this Agreement by another party. In any case where this Agreement is terminated without the fault of either party, the Buyer and Seller shall share equally any cancellation fees charged by Escrow Agent. In the event of a dispute arising out of this Agreement, the prevailing party in any Proceeding may be entitled to recover its costs and expenses and reasonable attorneys' fees, including such costs and expenses on appeal, unless otherwise agreed upon and/or ordered by court and subject to Maui County Code Chapter 3.16.

10.2 Notices. Any notice or demand to Seller or Buyer provided for or permitted by this Agreement shall be given in writing (unless otherwise expressly provided), and may be: (a) mailed as registered or certified mail, addressed to such party at its post office address herein specified or the last such address designated by such party in writing to the other; or, (b) delivered personally within the State of Hawaii to any one of Seller or Buyer or any officer of a party if such party is a corporation or any general partner of a party if such party is a partnership, or any manager or member of a party if such party is a limited liability company, as the case may be; (c) sent by facsimile transmission (herein "**Fax**") to the Fax number, if any, of such party as

specified herein or such other Fax number designated by such party in writing to the other or (d) delivered by Federal Express or other reliable overnight courier. Any such written notice shall be deemed received at the time of such personal delivery or receipt of the Fax (as evidenced by a confirmation slip indicating the fax was sent to the appropriate number set forth below), or at 5:00 P.M. (Hawaii Standard Time) on the third business day after being deposited with the United States mail as aforesaid, or on the next business day after being sent by overnight courier, as the case may be.

The initial address for each party is as follows:

To Seller:

ALEXANDER & BALDWIN, LLC
c/o A & B PROPERTIES, INC.
822 Bishop Street
Honolulu, Hawaii 96813
Attn: Richard B. Stack
Tel: (808) 525-5424
Fax No.: (808) 525-8447

And to:

ALEXANDER & BALDWIN, LLC
822 Bishop Street
Honolulu, Hawaii 96813
Attn: Charles W. Loomis
Tel: (808) 525-8451
Fax No.: (808) 525-6678

To Buyer:

COUNTY OF MAUI
Kalana O Maui Building
200 South High Street
Wailuku, Maui 96793
Attn: Mayor and Director of Finance
Tel: (808) 270-7855
FAX: (808) 270-7874

And to:

COUNTY OF MAUI
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
2200 Main Street
One Main Plaza Building, Suite 100
Wailuku Hawaii 96793
Tel: (808) 270-8230
Fax No.: (808) 270-8234

Rejection or other refusal to accept, or inability to deliver because of changed address of which no written notice was received, will constitute receipt of the notice or other communication.

10.3 Jurisdiction of Service of Process. Any action or proceeding seeking to enforce any provision of, or based on any right arising out of, this Agreement may be brought against any of the parties in the courts of the State of Hawaii, County of Maui, or, if it has or can acquire jurisdiction, in the United States District Court for the District of Hawaii, and each of the parties consents to the jurisdiction of such courts (and of the appropriate appellate courts) in any such action or proceeding and waives any objection to venue laid therein. Process in any action or Proceeding referred to in the preceding sentence may be served on any party anywhere in the world.

10.4 Further Assurances. The parties agree: (a) to furnish upon request to each other such further information; (b) to execute and deliver to each other such other documents; and (c) to do such other acts and things, all as the other party may reasonably request for the purpose of carrying out the intent of this Agreement and the documents referred to in this Agreement.

10.5 Waiver. Neither the failure nor any delay by any party in exercising any right, power, or privilege under this Agreement or the documents referred to in this Agreement will operate as a waiver of such right, power, or privilege, and no single or partial exercise of any such right, power, or privilege will preclude any other or further exercise of such right, power, or privilege or the exercise of any other right, power, or privilege.

10.6 Entire Agreement and Modification. This Agreement supersedes all prior agreements between the parties with respect to its subject matter and constitutes (along with the documents referred to in this Agreement) a complete and exclusive statement of the terms of the agreement between the parties with respect to its subject matter. This Agreement may not be amended except by a written agreement executed by the party to be charged with the amendment.

10.7 Construction. This Agreement and any certificates or documents delivered pursuant to this Agreement will be construed without regard to which party drafted the document or any particular provision therein.

10.8 Assignments, Successors, and No Third-Party Rights. Buyer may not assign its rights and obligations hereunder to any other person without the prior written consent of Seller which may be withheld in Seller's sole discretion. In the event of any permitted assignment, the assignee shall assume in writing all of the assignor's obligations hereunder. The assignor shall in no event be released from its obligations hereunder by reason of any assignment. This Agreement will apply to, be binding in all respects upon, and inure to the benefit of the successors and permitted assigns of the parties. This Agreement and all of its provisions and conditions are for the sole and

exclusive benefit of the parties to this Agreement and their successors and permitted assigns.

10.9 Severability. If any provision of this Agreement is held invalid or unenforceable by any court of competent jurisdiction, the other provisions of this Agreement will remain in full force and effect. Any provision of this Agreement held invalid or unenforceable only in part or degree will remain in full force and effect to the extent not held invalid or unenforceable.

10.10 Section Headings, Construction. The headings of Sections in this Agreement are provided for convenience only and will not affect its construction or interpretation. All references to "Section" or "Sections" refer to the corresponding Section or Sections of this Agreement. All words used in this Agreement will be construed to be of such gender or number as the circumstances require. Unless otherwise expressly provided, the word "including" does not limit the preceding words or terms.

10.11 Time of Essence. With regard to all dates and time periods set forth or referred to in this Agreement, time is of the essence.

10.12 Governing Law. This Agreement will be governed by the laws of the State of Hawaii without regard to conflicts of laws principles.

10.13 Brokers. Seller and Buyer each represent it has not engaged or contracted with any person entitled to any brokerage commission or finder's fee in connection with this transaction. Each party agrees to indemnify the other party against any claim asserted against or adjudged against the other party, for any brokerage commission or finder's fee or any like compensation occasioned by or as a result of any act or omission of the indemnifying party, including all attorney's fees, costs, expenses and any other fees incurred by, charged against or adjudicated against, the other party, whether or not suit is filed, which are related to this indemnity agreement or enforcement thereof.

10.14 Counterparts. This Agreement may be executed in one or more counterparts, each of which will be deemed to be an original copy of this Agreement and all of which, when taken together, will be deemed to constitute one and the same agreement.

10.15 Dispute Prevention Resolution. In the event of a dispute arising out of or relating to this Agreement or the services to be rendered hereunder, the parties to this Agreement agree to attempt to resolve such dispute in the following manner. First, the parties agree to attempt to resolve such dispute(s) through direct negotiations between representatives of each party. Second, if the dispute or any issues remain unresolved after attempts to negotiate, the parties agree to submit the dispute to a mutually agreed upon mediator, provided, however, if the dispute is not resolved within

thirty (30) days after demand by either Seller or Buyer, Buyer and Seller shall have the right to exercise all remedies available at law or in equity.

10.16 No Party Deemed Drafter. The parties hereby represent that they have reviewed this Agreement and all of the documents memorializing the transaction contemplated herein and agree that no party shall be deemed to be the drafter of this Agreement and further that in the event that this Agreement is ever construed by a court of law, such court shall not construe this Agreement or any provision hereof against either party as drafter of this Agreement and shall in no way define, limit or describe the scope or intent of any provision of this Agreement.

10.17 Exhibits. The following exhibits are attached hereto, incorporated herein, and made a part hereof:

Exhibit "AA"	Legal Description
Exhibit "A"	Title Report of TMK (2) 3-8-003: 019 (por) Pulehu Road, Puunene, Maui, Hawaii
Exhibit "B"	Appraisal
Exhibit "C"	Agricultural Exceptions
Exhibit "D"	Subdivision Approval Letter
Exhibit "E"	General Location of Waterline Easement
Exhibit "F"	License Agreement

Signatures begin on the following page.

IN WITNESS WHEREOF, Seller and Buyer have executed this REAL PROPERTY PURCHASE AND SALE AGREEMENT on the _____ day of _____, 2012.

SELLER & OWNER:

ALEXANDER & BALDWIN, LLC,
a Hawaii limited liability company

By: _____
NELSON N.S. CHUN
Its SENIOR VICE PRESIDENT

By: _____
CHARLES W. LOOMIS
Its ASST. SECRETARY

BUYER:

COUNTY OF MAUI

By: _____
ALAN M. ARAKAWA
Its: Mayor

By: _____
DANILO F. AGSALOG
Its: Director of Finance

APPROVAL RECOMMENDED:

_____
KYLE K. GINOZA
Director of Environmental Management

APPROVED AS TO FORM AND LEGALITY:

_____
RICHELLE M. THOMSON
Deputy Corporation Counsel
County of Maui

STATE OF HAWAII)
) SS:
CITY AND COUNTY OF HONOLULU)

On this 16th day of November, 2012, before me personally appeared NELSON N.S. CHUN, to me personally known, who, being by me duly sworn or affirmed, did say that such person executed the foregoing instrument as the free act and deed of such person, and if applicable in the capacity shown, having been duly authorized to execute such instrument in such capacity.

SUZANNE K. McGUIGAN NOTARY 93-70 PUBLIC STATE OF HAWAII

(Official Stamp or Seal)

Notary Public, State of Hawaii

Printed Name: SUZANNE K. McGUIGAN

My commission expires: 8/18/2013

NOTARY CERTIFICATION STATEMENT

Document Identification or Description: Real Property Purchase and Sale Agreement

Doc. Date: _____ or ☒ Undated at time of notarization.

No. of Pages: 86 Jurisdiction: First Circuit (in which notarial act is performed)

Signature of Notary

11/16/12
Date of Notarization and Certification Statement

SUZANNE K. McGUIGAN
Printed Name of Notary

SUZANNE K. McGUIGAN NOTARY 93-70 PUBLIC STATE OF HAWAII

(Official Stamp or Seal)

STATE OF HAWAII)
) SS:
CITY AND COUNTY OF HONOLULU)

On this 16th day of November, 2012, before me personally appeared CHARLES W. LOOMIS, to me personally known, who, being by me duly sworn or affirmed, did say that such person executed the foregoing instrument as the free act and deed of such person, and if applicable in the capacity shown, having been duly authorized to execute such instrument in such capacity.

SUZANNE K. McGUIGAN NOTARY 93-70 PUBLIC STATE OF HAWAII

(Official Stamp or Seal)

Notary Public, State of Hawaii

Printed Name: SUZANNE K. McGUIGAN

My commission expires: 7/18/2013

NOTARY CERTIFICATION STATEMENT

Document Identification or Description: Real Property Purchase and Sale Agreement

Doc. Date: _____ or ☒ Undated at time of notarization.

No. of Pages: 86 Jurisdiction: First Circuit (in which notarial act is performed)

11/16/12

Signature of Notary Date of Notarization and Certification Statement

SUZANNE K. McGUIGAN NOTARY 93-70 PUBLIC STATE OF HAWAII

(Official Stamp or Seal)

SUZANNE K. McGUIGAN

Printed Name of Notary

STATE OF HAWAII)
) SS:
COUNTY OF MAUI)

On this __ day of _____, 20__, before me personally appeared ALAN M. ARAKAWA, to me personally known, who, being by me duly sworn, did say that he is the Mayor of the County of Maui, a political subdivision of the State of Hawaii, and that the seal affixed to the foregoing instrument is the lawful seal of the said County of Maui, and that the said instrument was signed and sealed on behalf of said County of Maui pursuant to Section 7-5.11 and Section 9-18 of the Charter of the County of Maui; and the said ALAN M. ARAKAWA acknowledged the said instrument to be the free act and deed of said County of Maui.

_____
Notary Public, State of Hawaii

Printed Name: _____

My commission expires: _____

(Official Stamp or Seal)

NOTARY CERTIFICATION STATEMENT

Document Identification or Description: Real Property Purchase and Sale Agreement

Doc. Date: _____ or ☐ Undated at time of notarization.

No. of Pages: _____ Jurisdiction: _____ Circuit
(in which notarial act is performed)

_____
Signature of Notary

Date of Notarization and Certification Statement

_____
Printed Name of Notary

(Official Stamp or Seal)

STATE OF HAWAII)
) SS:
COUNTY OF MAUI)

On this __ day of _____, 20__, before me personally appeared DANILO F. AGSALOG, to me personally known, who, being by me duly sworn, did say that he is the Director of Finance of the County of Maui, a political subdivision of the State of Hawaii, and executed the foregoing as his free act and deed, and in the capacity shown, having been duly authorized to execute such instrument in such capacity.

_____
Notary Public, State of Hawaii

Printed Name: _____

My commission expires: _____

(Official Stamp or Seal)

NOTARY CERTIFICATION STATEMENT

Document Identification or Description: Real Property Purchase and Sale Agreement

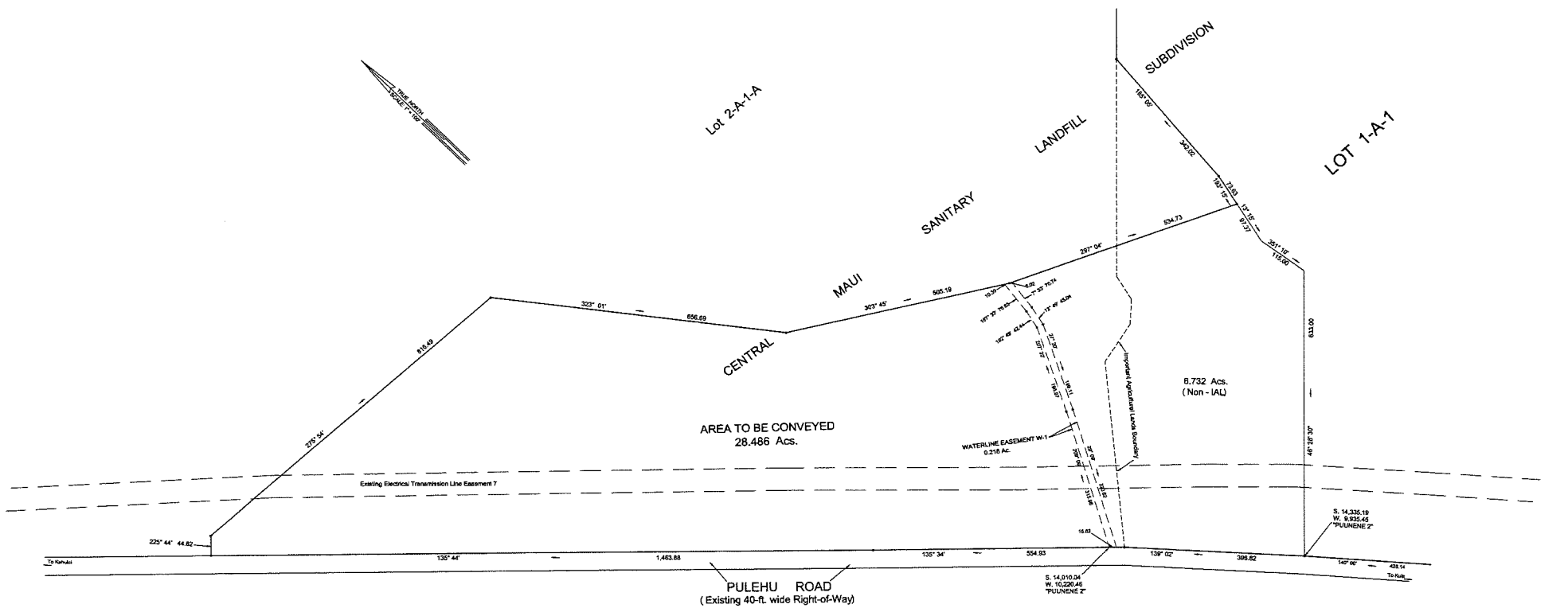
Doc. Date: _____ or ☐ Undated at time of notarization.

No. of Pages: _____ Jurisdiction: _____ Circuit
(in which notarial act is performed)

_____
Signature of Notary

Date of Notarization and Certification Statement

_____(Official Stamp or Seal)
Printed Name of Notary



CENTRAL MAUI SANITARY LANDFILL SUBDIVISION

DESIGNATION OF EASEMENT W-1 OVER AND ACROSS LOT 1-A-1

Being a portion of Grant 3343 to Claus Spreckels

PUUNENE, WAILUKU, MAUI, HAWAII

SCALE: 1 inch = 100 feet DATE: September 12, 2012

Prepared by: A&B Properties, Inc.
Kahului, Maui, Hawaii

NOTES:

1. Azimuths and coordinates referred to Government Survey Triangulation Station "PUUNENE 2"
2. Easement W-1 is for waterline purposes in favor of Alexander & Baldwin, LLC.
3. Existing Electrical Transmission Line Easement 7 is in favor of Maui Electric Company, Limited per Civil No. 98-0929 (3) and recorded in Document No. 95-170196.

This work was prepared by me or under my supervision.

Ken T. Nomura
Licensed Professional Land Surveyor
Certificate No. LS-7633
Expiration Date: 4/30/2014

T. M. K: (2) 3-8-003:019

OFFICE OF PLANNING CORRESPONDENCE REGARDING IMPORTANT AGRICULTURAL LANDS

APPENDIX D-2

MUNEKIYO HIRAGA
Planning. Project Management. Sustainable Solutions.

Michael T. Munekiyo
PRESIDENT
Karlynn K. Fukuda
EXECUTIVE VICE PRESIDENT
Mark Alexander Roy
VICE PRESIDENT
Tessa Munekiyo Ng
VICE PRESIDENT

April 28, 2016

Leo R. Asuncion, Acting Director
Office of Planning
P.O. Box 2359
Honolulu, Hawai'i 96804

SUBJECT: Proposed Central Maui Landfill Facilities Project at TMK (2)3-8-003:019 (por.), Puunēnē, Maui, Hawai'i

Dear Mr. Asuncion:

On behalf of the County of Maui, Department of Environmental Management (DEM), please be advised that State Land Use Commission (LUC) Special Use Permit (SUP) requirements will be addressed for the subject project, a portion of which involves lands designated Important Agricultural Lands (IAL). See **Exhibit "A"** and **Exhibit "B"**. The proposed project will expand maintenance and landfill related activities adjacent to the existing Central Maui Landfill and will include offices, a refuse collection baseyard, a maintenance facility, a household hazardous and electronic waste collection facility, a construction and demolition material recovery facility, metals processing facility, warehousing and storage facility, and an abandoned vehicle yard. An updated conceptual site plan for the project is provided in **Exhibit "C"**.

Given the use of County lands and funds, a Chapter 343, Hawai'i Revised Statutes Environmental Assessment (EA) is being prepared to evaluate the proposed project. The DEM received early consultation comments dated August 12, 2015 from your office. See **Exhibit "D"**. However, as noted above, this project also involves IAL lands designated for agricultural use. Pursuant to §15.15.127(b), LUC Rules, Hawai'i Administrative Rules (HAR), we respectfully request any additional comments and/or recommendations your office may have regarding the proposed use of IAL lands for the project.

§15-15-127 Standards and criteria for the reclassification or rezoning of important agricultural lands.

(b) An application for a special permit involving important agricultural lands shall include evidence that the request has been referred to the state department of agriculture and the state office of planning for review and comment and contain as part

of the petition any comments or recommendations made by both the state department of agriculture and the state office of planning.

I would appreciate if you could provide any additional early consultation comments your office may have on the proposed project by May 20, 2016. Please address your comments to the following:

Colleen Suyama
Munekiyo Hiraga
305 High Street, Suite 104
Wailuku, Hawai'i 96793

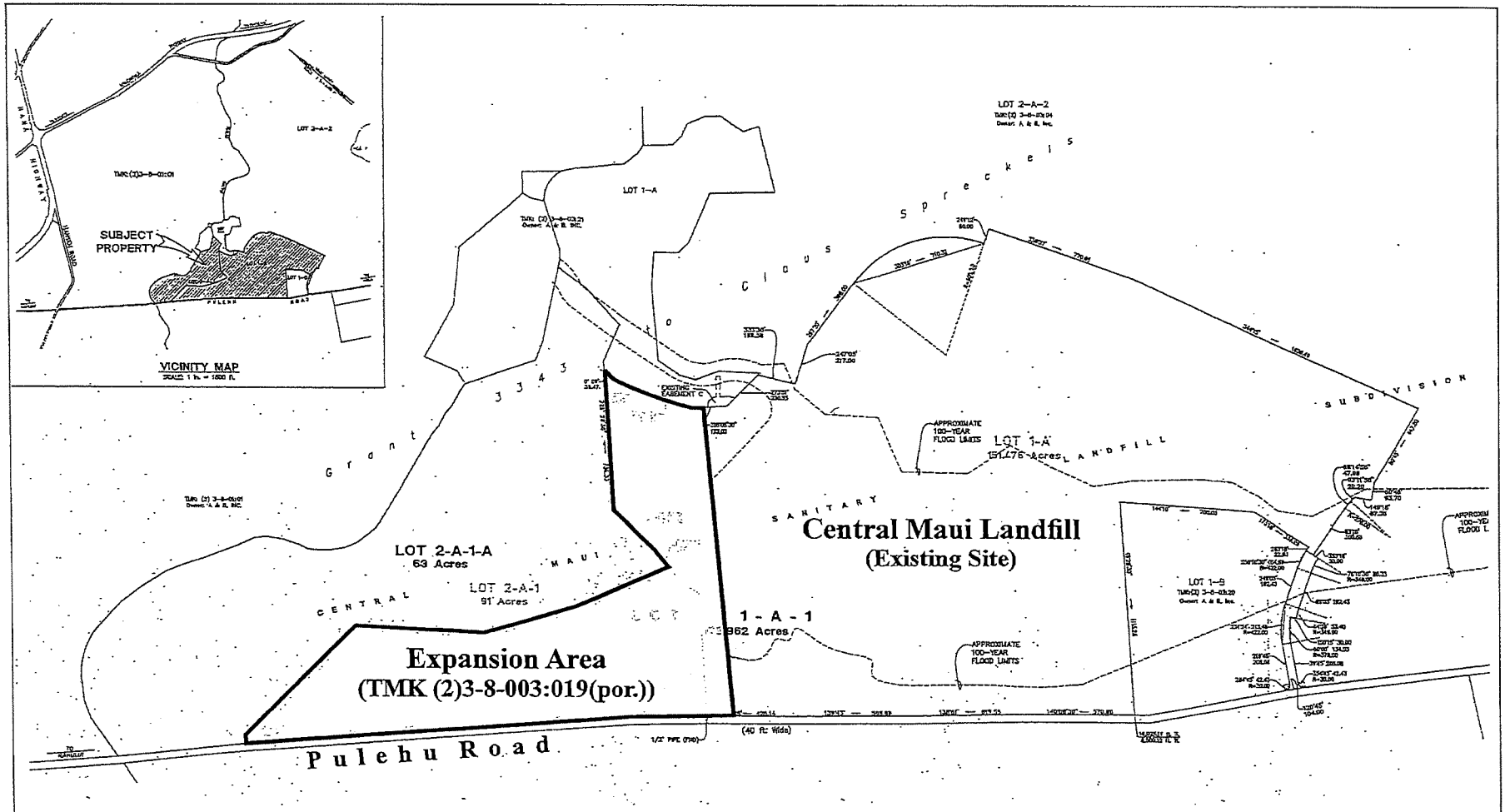
Elaine Baker
Department of Environmental Management
2200 Main Street, Suite 225
Wailuku, Hawai'i 96793

Thank you for your assistance with this request. Should you have any questions, please feel free to call me at (808) 244-2015.

Very truly yours,

Colleen Suyama
Senior Associate

CS:tn
Attachments
Cc: Elaine Baker, Department of Environmental Management (w/attachments)
K:\DATA\COM\DEM CMaui LP\ECL Responses\Office of Planning ECL.doc



Source: R.T. Tanaka Engineers, Inc.

Exhibit "A" Proposed Central Maui Landfill Facilities Project

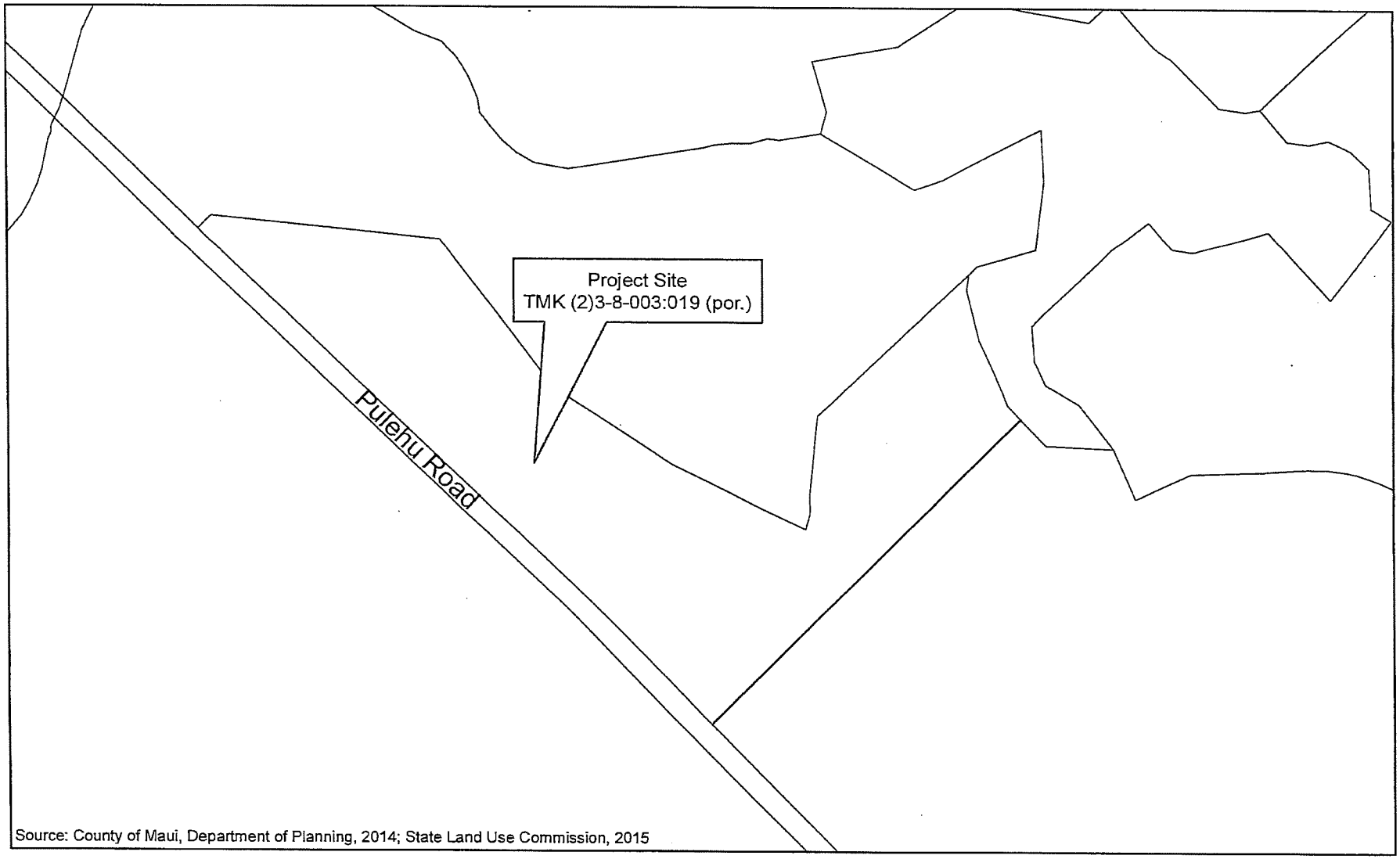
Project Location Map

NOT TO SCALE

MUNEKIYO HIRAGA

Prepared for: County of Maui, Department of Environmental Management

K:\DATA\COM\DEM CMaui LF\ECL Responses\Agriculture ECL.Exhibit A-ProjectLocation



N

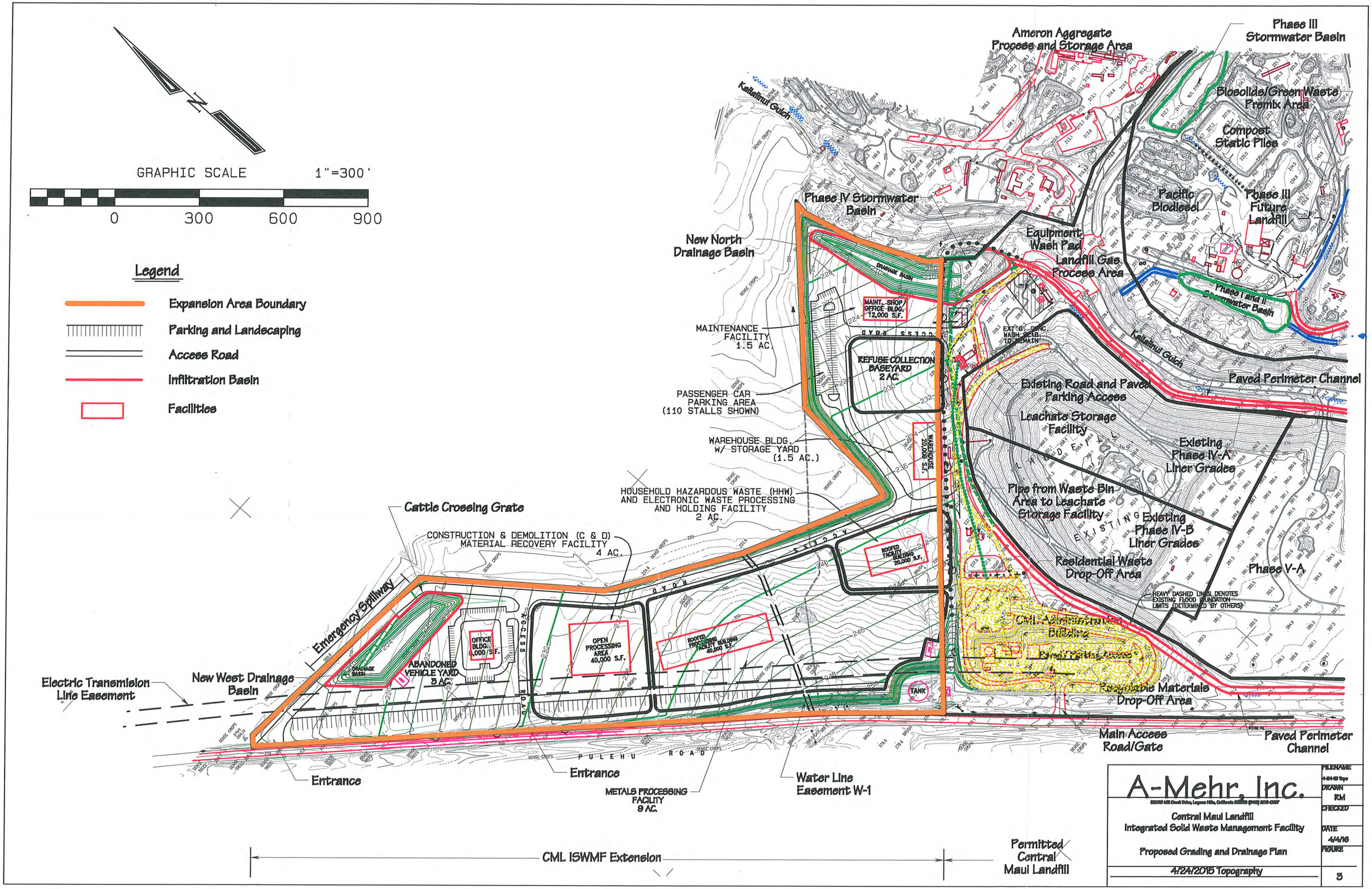
1 inch = 500 feet

Central Maui Landfill Facilities Project
Important Agricultural Lands Map

Legend

Important Agricultural Lands

EXHIBIT "B"



GRAPHIC SCALE 1"=300'
0 300 600 900
Legend
Expansion Area Boundary
Parking and Landscaping
Access Road
Infiltration Basin
Facilities
Ameron Aggregate Process and Storage Area
Phase III Stormwater Basin
Biosolids/Green Waste Premix Area
Compost Static Piles
Pacific Biodiesel
Phase III Future Landfill
Phase IV Stormwater Basin
New North Drainage Basin
Equipment Wash Pad
Landfill Gas Process Area
Phase I and II Stormwater Basin
Kailalinui Gulch
MAINTENANCE FACILITY 1.5 AC.
MAINT. SHOP/ OFFICE BLDG. 12,000 S.F.
REFUSE COLLECTION BASEYARD 2 AC.
PASSENGER CAR PARKING AREA (110 STALLS SHOWN)
WAREHOUSE BLDG. W/ STORAGE YARD (1.5 AC.)
WAREHOUSE 20,000 S.F.
Paved Perimeter Channel
Existing Road and Paved Parking Access
Leachate Storage Facility
Existing Phase IV-A Liner Grades
Pipe from Waste Bin Area to Leachate Storage Facility
Existing Phase IV-B Liner Grades
Residential Waste Drop-Off Area
Phase V-A
HEAVY DASHED LINES DENOTES EXISTING FLOOD INUNDATION LIMITS (DETERMINED BY OTHERS)
HOUSEHOLD HAZARDOUS WASTE (HHW) AND ELECTRONIC WASTE PROCESSING AND HOLDING FACILITY 2 AC.
Cattle Crossing Grate
CONSTRUCTION & DEMOLITION (C & D) MATERIAL RECOVERY FACILITY 4 AC.
ROOFED FACILITY BUILDING 20,000 S.F.
Emergency Spillway
OFFICE BLDG. 1,000 S.F.
OPEN PROCESSING AREA 40,000 S.F.
ROOFED PROCESSING FACILITY BUILDING 40,000 S.F.
ABANDONED VEHICLE YARD 3 AC.
DRAINAGE BASIN
Electric Transmision Line Easement
New West Drainage Basin
TANK
Recyclable Materials Drop-Off Area
Main Access Road/Gate
Paved Perimeter Channel
PULEHU ROAD
Entrance
Entrance
METALS PROCESSING FACILITY 9 AC.
Water Line Easement W-1
CML ISWMF Extension
Permitted Central Maui Landfill
A-Mehr, Inc.
Central Maui Landfill
Integrated Solid Waste Management Facility
Proposed Grading and Drainage Plan
4/24/2015 Topography
FILENAME
DRAWN RM
CHECKED
DATE 4/4/16
FIGURE 3

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/

RECEIVED
2015 AUG 17 AM 7:46
COUNTY OF MAUI
DEPT. OF ENVIRONMENTAL MGMT.

Ref. No. P-14849

August 12, 2015

Ms. Michelle Makii
Department of Environmental Management
2050 Main Street, Suite 1C
Wailuku, Hawaii 96793

Dear Ms. Makii:

Subject: Early Consultation Request for the Central Maui Landfill Expansion, Puunene, Maui, Hawaii; TMK: (2) 3-8-003:019 (por)

Thank you for the opportunity to provide comments on the early consultation request for a Draft Environmental Assessment (Draft EA) for the Central Maui Landfill Expansion, which was submitted by the County of Maui, Department of Environmental Management (DEM). The pre-consultation review material was transmitted to our office by letter, dated July 13, 2015.

It is our understanding that DEM seeks to expand maintenance and landfill activities adjacent to the Central Maui Landfill on an approximately 40-acre site. The current activities at the landfill include refuse collection, a vehicle baseyard, a maintenance facility, a household hazardous waste facility, a material recovery facility, warehousing and storage, and an abandoned vehicle yard. These activities occur at the Central Maui landfill, as well as in other locations on Maui. DEM proposes to gather these activities in a centralized area. Furthermore, the proposed subject location is zoned for agricultural use and is currently used to cultivate sugar cane.

The Office of Planning (OP) has reviewed the transmitted material and has the following comments to offer:

1. Pursuant to the HAR § 11-200-17(h) – land use plans, policies, and controls – this project must demonstrate that it is consistent with a number of state environmental, social, and economic goals and policies for land-use and housing development. 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, policies, and priority guidelines for growth, development, and the allocation of resources throughout the State. The Hawaii State Plan includes diverse objectives and policies 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.

   The Draft EA should include an analysis that addresses whether the proposed project conforms or is in conflict with the goals, objectives, policies, and priority guidelines listed in the Hawaii State Plan.

EXHIBIT D

2. 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").

   HRS Chapter 205A requires all State and county agencies to enforce the coastal zone management (CZM) objectives and policies. The Draft EA 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.

3. The Draft EA, should provide a list of any federal, state, or county permits required for this project. A listing of required permits will allow OP to examine the impact on plans, programs, and policy objectives that fall under the jurisdiction of our office.

4. Based on the information provided, the Central Maui Landfill project site is considerable distance from the coastline, however the project is within the State Land Use District zoned for agricultural use, within the Kalialinui watershed, and near water resources that ultimately connect to the coastline and nearshore waters of Kahului Bay. In order to ensure that valuable natural resources in the area remain protected, the negative effects of stormwater runoff and a wide range of human activities should be considered and mitigated. The Draft EA should summarize the area's classification in the State Land Use Districts, its relation to wetlands and perennial streams, the tsunami evacuation zone, and the 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

5. The 40-acre expansion site is within the State Agricultural District. The existing landfill previously obtained a State Special Use Permit via the County permit SP97-390. The expansion may require another State Special Permit or an amendment to the existing State Special Permit. Since the expansion is over 15-acres, the Land Use Commission must also approve the permit.

6. The expansion area is designated as Prime lands under the ALISH system and as A, C, and E lands according to the Land Study Bureau ratings of soil productivity. The proposal will permanently remove Prime agricultural lands from cultivation. Information on the impacts to agriculture should be addressed in the Environmental Assessment.

7. The Environmental Assessment should also include information on archaeological resources, flora and fauna resources, including invertebrates.

If you have any questions regarding this comment letter, please contact Josh Hekekia at 587-2845 or Lorene Maki at 587-2888.

Sincerely,

Leo R. Asuncion
Acting Director

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-15135

May 11, 2016

Ms. Colleen Suyama
Munekiyo Hiraga
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Ms. Suyama:

Subject: Proposed Central Maui Landfill Facilities Project
Environmental Assessment Pre-Consultation
State Special Permit
TMK: (2) 3-8-003: 019 (por.)
Puunene, Maui

The Office of Planning (OP) has reviewed the subject preparation notice for an Environmental Assessment (EA) by letter dated August 12, 2015. The comments from this letter remain applicable to the forthcoming draft EA. We note that the site is also within Important Agricultural Lands (IAL), and OP offers the following comments.

1. The County of Maui Department of Environmental Management (DEM) proposes to expand and consolidate maintenance and landfill activities adjacent to the Central Maui Landfill on an approximately 40-acre site.

2. The Draft EA should include detailed information regarding the previous IAL designation approval (DR09-38 Alexander & Baldwin, Inc.), and supporting information on the request for a State Special Permit to allow landfill activities on IAL designated lands.

Thank you for the opportunity to comment. If you have any questions, please contact Ms. Lorene Maki of our Land Use Division, at (808) 587-2888.

Sincerely,

Leo R. Asuncion
Director

c: Elaine Baker, Department of Environmental Management
Land Use Commission

MUNEKIYO HIRAGA
Planning. Project Management. Sustainable Solutions.

Michael T. Munekiyo
PRESIDENT
Karlynn K. Fukuda
EXECUTIVE VICE PRESIDENT
Mark Alexander Roy
VICE PRESIDENT
Tessa Munekiyo Ng
VICE PRESIDENT

January 3, 2018

Leo R. Asuncion, Director
Office of Planning
P.O. Box 2359
Honolulu, Hawai'i 96804

SUBJECT: Early Consultation Letter for the Central Maui Landfill Facilities Project at TMK (2)3-8-003:019 (por.), Pu'unēnē, Maui, Hawai'i (Ref. No. P-14849 and P-15135)

Dear Mr. Asuncion:

Thank you for your department's letters, dated August 12, 2015 and May 11, 2016, providing early consultation comments for use in preparing the Draft Environmental Assessment (EA) for the proposed Central Maui Landfill Facilities project. On behalf of the County of Maui, Department of Environmental Management (DEM), we offer the following responses in the order of your department's comments:

August 12, 2015 Letter

1. The Draft EA will include an analysis that addresses the goals, objectives, policies, and priority guidelines in the Hawai'i State Plan.

2. The Draft EA will include an analysis of Chapter 205A, Hawai'i Revised Statutes (HRS), relating to the Hawai'i Coastal Zone Management objectives and policies.

3. The Draft EA will include a list of all federal, state and county permits anticipated to be required for the project.

4. The Draft EA will include a summary of the area's classification in the State Land Use Districts, its relation to wetlands and perennial streams, the tsunami evacuation zone and the flood zone. The nearby Kalialinui Gulch empties into the ocean several miles downstream near the Kahului Airport. The near shore water quality classification near the airport is Class A. As appropriate, mitigation measures will be included in the Draft EA.

5. The DEM will seek an amendment to State Special Permit No. 97-390 in order to include the additional approximate 40.8 acres in the Central Maui Landfill. We acknowledge the amendment will require State Land Use Commission approval.

6. The Draft EA will include a discussion on the impact of removing approximately 40.8 acres of land from the agricultural lands available on Maui.

7. The Draft EA will include information on archaeological resources, flora and fauna resources, including vertebrates. An archaeological assessment and flora and fauna study will be included and discussed in the Draft EA.

May 11, 2016 Letter

1. The Draft EA will include information regarding the previous Important Agricultural Land (IAL) designation approval (DR09-38 Alexander & Baldwin, Inc.) and supporting information on the request for an amendment to a State Special Permit to allow the proposed project on IAL designated lands.

Again, thank you for your participation in the Chapter 343, HRS review process. A copy of your letter will be included in the Draft EA. A copy of the Draft EA will be sent to your office for review and comment. In the meantime, if there are any questions or if additional information is needed, please feel free to contact me at (808) 244-2015.

Sincerely,

Colleen Suyama
Senior Associate

CS:tn
cc: Elaine Baker, Department of Environmental Management
Ali Mehrazarin, A-MEHR, Inc.
K:\DATA\COM\DEM CMaui LF\ECL Responses\Office of Planning Response.doc

APR 0 9 2018

DAVID Y. IGE
GOVERNOR

LEO R. ASUNCION
DIRECTOR
OFFICE OF PLANNING

OFFICE OF PLANNING
STATE OF HAWAII

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
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Telephone: (808) 587-2846
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Web: http://planning.hawaii.gov/

DTS No. 201804031259BE

April 6, 2018

Ms. Elaine Baker
County of Maui
Solid Waste Division
2200 Main Street, Suite 225
Wailuku, Hawaii 96793

Dear Ms. Baker:

Subject: Chapter 343, Hawaii Revised Statutes, Draft Environmental Assessment (DEA) for the Proposed Central Maui Landfill Facilities Project
TMK: 3-8-003: 019 (Por)
Puunene, Maui, Hawaii

Thank you for the opportunity to review the DEA for the proposed 40.8-acre expansion of the Central Maui Landfill facility. The existing landfill was established in 1986 by a State Special Permit on a 55-acre site by SP86-359. The activities listed for this Special Permit include landfill activities, weigh station, special waste, and green waste composting. There is no time limit for the use on this Special Permit.

In 1997, the County of Maui expanded the landfill via a second State Special Permit (SP97-390) with an additional 29.340 acres. The County requested three amendments to this Special Permit for various improvements, and an extension of time for the permit, and an expansion of 41.2 acres. The current permit is valid until October 31, 2018. The combined land area for the entire existing landfill and appurtenant uses is approximately 125.54 acres.

The DEA indicates that the County will be requesting an amendment to SP97-390 and CUP 2008/003 to extend the time limit on the permit and allow an expansion of the facility of 40.8 acres. The uses proposed for the expansion area include offices, an abandoned vehicle area, metals processing area, open construction and demolition material recovery area, household hazardous waste and electronic waste processing and storage area, warehouse building and

storage area, refuse collection office, truck parking, maintenance area, drainage basins, and associated infrastructure.

The Office of Planning (OP) has the following comments:

1. Page 33. DR09-38 was approved by the Land Use Commission (LUC) to designate approximately 27,102 acres of land as Important Agricultural Lands (IAL). As noted in the DEA, about 22 acres of this IAL designated area is proposed to be included within the proposed expansion of the County's Central Maui Landfill.

   The Legislature's intent for IAL lands was to preserve and protect good agricultural lands. The LUC has approved DR09-38 and designated as Important Agricultural Lands 22 acres of this proposed expansion. Thus, OP is concerned that using IAL designated lands for non-agricultural uses could set a precedent in the future. This is a significant impact of the proposed expansion. We also note that since the DEA does not recognize this as a significant impact, no mitigation measures are proposed.

2. Page 85. Hawaii State Plan, Chapter 226, HRS-Part III. Priority Guidelines (d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture. The DEA indicates that this section is Not Applicable to this proposal. However, since this proposal would include the use of 22 acres of IAL lands, it may be appropriate to indicate that it is "N/S = Not Supportive rather than N/A or Not Applicable.

3. The DEA indicates that the project will be on a 40.8-acre portion of the parcel. According to Hawaii Revised Statutes 205-6(d) Special Permits for land areas over 15 acres are approved by the LUC. Thus, the Special Permit will require approval by the LUC and the County of Maui.

4. The DEA indicates that the majority of the proposed expansion area is within the Maui Island Plan Urban Growth Boundary. The approximate acreage within the Urban Growth Boundary should be indicated, and not merely referenced as being shown on Exhibit 13.

5. We note that our pre-consultation comments have been satisfactorily addressed in the DEA.

6. The DEA includes the Special Permit 97-390 FY 2017 Annual Report. All conditions are currently being met. OP comments that if the proposed expansion is approved, that these conditions should also apply to the expansion area.

Thank you for the opportunity to review this project. If you have any questions, please call Lorene Maki of our Land Use Division at (808) 587-2888.

Sincerely,

Leo R. Asuncion
Director

cc: Land Use Commission
Colleen Suyama, Munekiyo Hiraga
Kimberley Willenbrink, County of Maui Department of Planning
Department of Agriculture

MICHAEL P. VICTORINO
Mayor

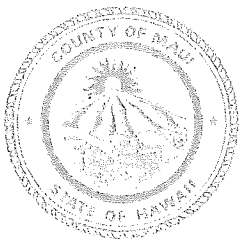
ERIC A. NAKAGAWA, P.E.
Director

SHAYNE R. AGAWA, P.E.
Deputy Director

MICHAEL P. RATTE
Solid Waste Division

SCOTT R. ROLLINS, P.E.
Wastewater Reclamation Division

TAMARA L. FARNSWORTH
Environmental Protection &
Sustainability Division





COUNTY OF MAUI
DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
2050 MAIN STREET, SUITE 2B
WAILUKU, MAUI, HAWAII 96793

July 19, 2019

Mary Alice Evans, Director
State of Hawai'i
Office of Planning
P.O. Box 2359
Honolulu, Hawai'i 96804

SUBJECT: Draft Environmental Assessment (EA) for the Proposed Central Maui Landfill Facilities Project at Tax Map Key (2)3-8-003:019 (por.), Pu'unēnē, Maui, Hawai'i (DTS No. 201804031259BE)

Dear Ms. Evans:

Thank you for your letter of April 6, 2018 providing comments on the Draft Environmental Assessment (EA) for the Central Maui Landfill Facilities Project. The County of Maui (COM), Department of Environmental Management (DEM) offers the following information in the order of the comments presented in your letter:

1. We note your comment regarding Important Agricultural Lands (IAL). As discussed in the Draft EA, the State Agriculture Functional Plan also recognizes that redesignation of IAL should be allowed *"... upon a demonstrated change in economic or social conditions, and where the requested redesignation will provide greater benefits to the general public than its retention in the IAL district;* when an "*overriding public interest exists*". The contraction of plantation agriculture, which resulted in a supply of agricultural land which has far exceeded demand, constitutes a major change in economic conditions.

   A 2017 Impacts on Agriculture Report prepared in support of an Environmental Impact Statement (EIS) for the Department of Land and Natural Resources' Industrial and Business Park at Pulehunui, Maui assessed potential impacts of this State project on agricultural resources. According to the report, many of the State's agricultural policies were written before the major contraction of plantation agriculture and assumed that profitable agricultural activities would be available to utilize all available agricultural lands. The report noted that this has proven to be a questionable assumption in view of the size of the contraction of plantation agriculture, the abundant supply of farmland that is now available for diversified agriculture, and the slow growth in the amount of land being utilized for diversified agriculture.

   The contraction of plantation agriculture has changed the economic conditions of the State and Maui island in particular with the closure of HC&S plantation in 2016. Furthermore, the 2012 purchase of the subject property by the County of Maui effectively took the 22 acres out of plantation agriculture prior to the 2016 closure of HC&S.

Moreover, since 2009 when the project site was designated as IAL, the State of Hawai'i in 2011 revised Chapter 226, Hawai'i Revised Statutes, to include sustainability priority guidelines. The proposed project will enable the County of Maui to implement sustainable measures to reduce the waste stream entering the Central Maui Landfill in keeping with the priority guidelines identified in the State Plan. Use of the property to expand facilities associated with the Central Maui Landfill to meet the sustainability goals of the State is anticipated to qualify as an overriding public interest.

As discussed above, the use of 22 acres, or 0.08 percent, of Maui Island's IAL that is no longer in plantation agriculture, for the subject project, is not expected to present a significant adverse impact on IAL.

The use by a public agency to provide needed public services for the Maui community sets it apart from other requests to utilize IAL for non-agricultural use. As such, we do not feel this request will set a precedent.

2. Although the proposed project does not oppose promotion of the growth and development of diversified agriculture and aquaculture in general, item (d)(1) will be revised to indicate "N/S", since it is proposing a non-agricultural use for the 22 acres of IAL within the project area.

3. We acknowledge the project site is over 15 acres and an amendment to the State Special Permit (SP 97-390) will require approval of both the Land Use Commission and the County of Maui.

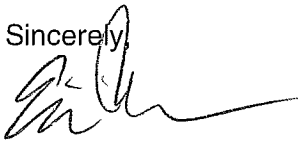
4. Approximately 38.6 acres of the approximately 40-acre project site is within the Maui Island Plan Urban Growth Boundary. This information will be included in the Final EA.

5. Thank you for acknowledging that your pre-consultation comments were satisfactorily addressed in the Draft EA.

6. Thank you for acknowledging that all of the conditions of Special Permit 97-390 are currently being met. It is noted that OP recommends that these conditions should also apply to the proposed expansion, if approved.

We appreciate the input provided by your office and will include a copy of your letter and this response in the Final EA. Should you have any questions or require further information regarding the proposed action, please feel free to contact our planning consultant, Colleen Suyama of Munekiyo Hiraga at (808) 244-2015.

Sincerely,



ERIC A. NAKAGAWA, P.E.
Director of Environmental Management

EN
cc: Elaine Baker, Department of Environmental Management
Clayton Yoshida, Department of Planning
Colleen Suyama, Munekiyo Hiraga

DEPARTMENT OF AGRICULTURE CORRESPONDENCE REGARDING IMPORTANT AGRICULTURAL LANDS

APPENDIX D-3

MUNEKIYO HIRAGA
Planning. Project Management. Sustainable Solutions.

Michael T. Munekiyo
PRESIDENT
Karlynn K. Fukuda
EXECUTIVE VICE PRESIDENT
Mark Alexander Roy
VICE PRESIDENT
Tessa Munekiyo Ng
VICE PRESIDENT

April 29, 2016

Scott Enright, Chairperson
Department of Agriculture
1428 South King Street
Honolulu, Hawai'i 96813-2512

SUBJECT: Proposed Central Maui Landfill Facilities Project at TMK (2)3-8-003:019 (por.), Puunēnē, Maui, Hawai'i

Dear Mr. Enright:

On behalf of the County of Maui, Department of Environmental Management (DEM), please be advised that State Land Use Commission (LUC) Special Use Permit requirements will be addressed for the subject project, a portion of which involves lands designated as Important Agricultural Lands (IAL). See **Exhibit "A"** and **Exhibit "B"**. The proposed project will expand maintenance and landfill related activities adjacent to the existing Central Maui Landfill and will include offices, a refuse collection baseyard, a maintenance facility, a household hazardous and electronic waste collection facility, a construction and demolition material recovery facility, metals processing facility, warehousing and storage facility, and an abandoned vehicle yard. An updated conceptual site plan for the project is provided in **Exhibit "C"**.

Given the use of County lands and funds, a Chapter 343, Hawai'i Revised Statutes Environmental Assessment (EA) is being prepared to evaluate the proposed project. On July 10, 2015 the DEM requested early consultation comments from your department but did not receive a response. As mentioned above, this project involves IAL lands designated for agricultural use. Pursuant to §15.15.127(b), LUC Rules, Hawai'i Administrative Rules (HAR) as noted below, we are writing to you today to respectfully request your comments and/or recommendations on the proposed project.

§15-15-127 Standards and criteria for the reclassification or rezoning of important agricultural lands.

(b) An application for a special permit involving important agricultural lands shall include evidence that the request has been referred to the state department of agriculture and the state office of planning for review and comment and contain as part of the petition any comments or recommendations made by both the state department of agriculture and the state office of planning.

I would appreciate if you could please provide any early consultation comments or recommendations you may have on the proposed project by May 20, 2016. Please address your written comments to the following:

Colleen Suyama
Munekiyo Hiraga
305 High Street, Suite 104
Wailuku, Hawai'i 96793

Elaine Baker
Department of Environmental Management
2200 Main Street, Suite 225
Wailuku, Hawai'i 96793

Thank you for your assistance with this request. Should you have any questions, please feel free to call me at (808) 244-2015.

Very truly yours,

Colleen Suyama
Senior Associate

CS:tn
Attachments
Cc: Elaine Baker, Department of Environmental Management (w/attachment)
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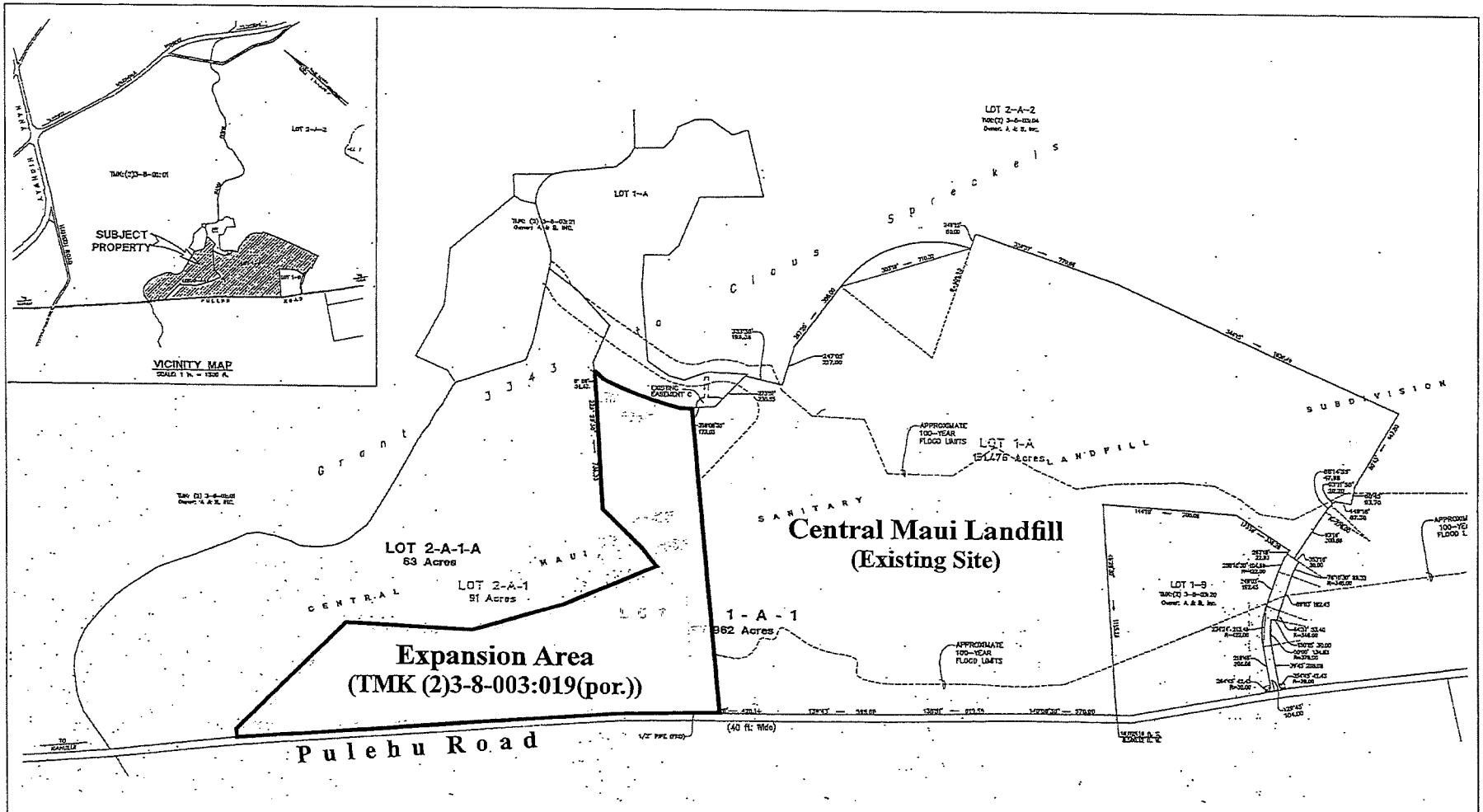


Source: R.T. Tanaka Engineers, Inc.

Exhibit "A" Proposed Central Maui Landfill Facilities Project

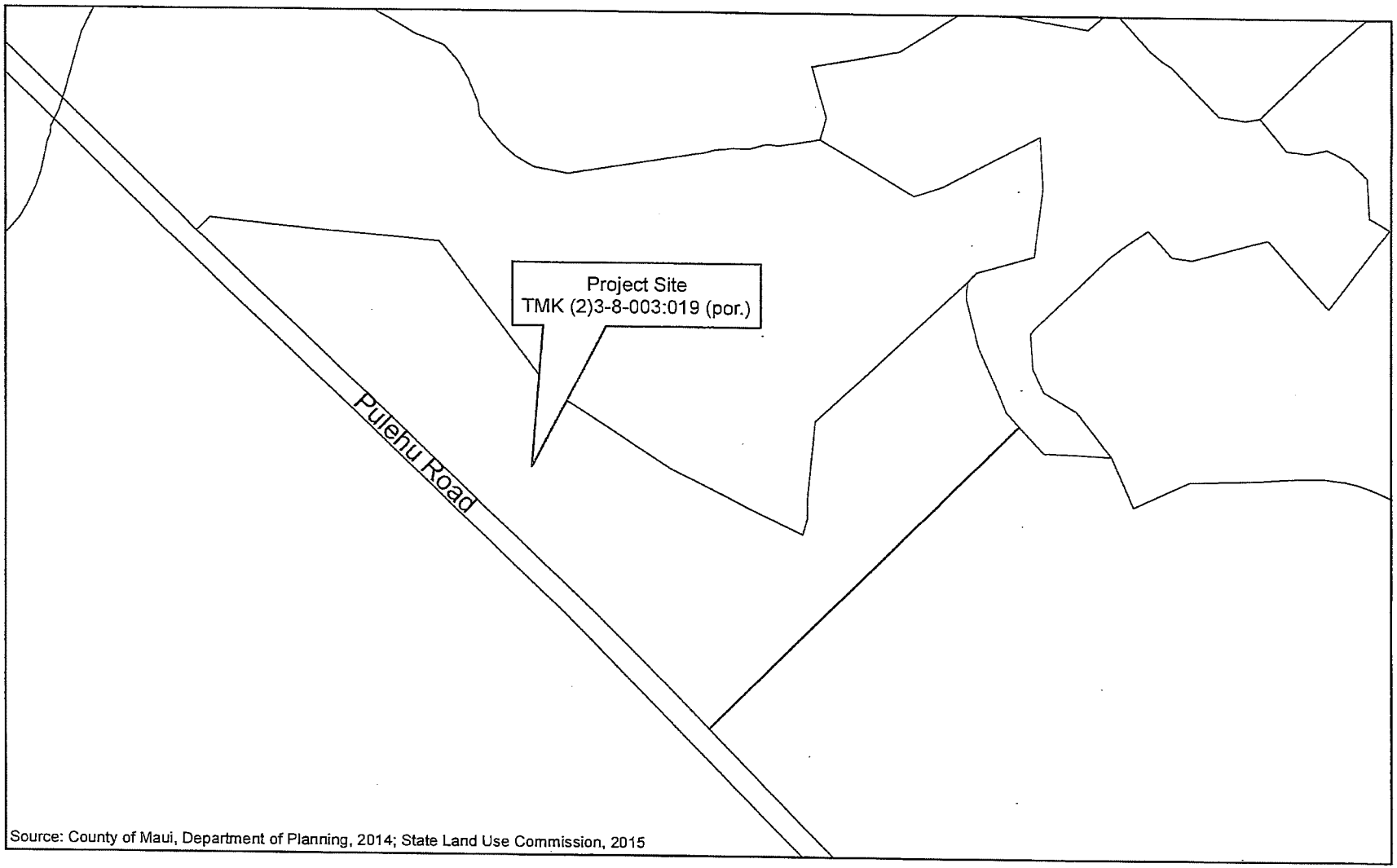
Project Location Map

NOT TO SCALE

MUNEKIYO HIRAGA

Prepared for: County of Maui, Department of Environmental Management

K:\DATA\COM\DEM CMaui LF\ECL Responses\Agriculture ECL Exhibit A-ProjectLocation



N

1 inch = 500 feet

Central Maui Landfill Facilities Project
Important Agricultural Lands Map

Legend

Important Agricultural Lands

EXHIBIT "B"

N

GRAPHIC SCALE 1"=300'

0 300 600 900

Legend

- Expansion Area Boundary
- Parking and Landscaping
- Access Road
- Infiltration Basin
- Facilities

Ameron Aggregate Process and Storage Area

Phase III Stormwater Basin

Kahalinui Gulch

Biosolids/Green Waste Premix Area

Compost Static Piles

Phase IV Stormwater Basin

Pacific Biodiesel

Phase III Future Landfill

New North Drainage Basin

Equipment Wash Pad

Landfill Gas Process Area

Phase I and II Stormwater Basin

MAINT. SHOP/ OFFICE BLDG. 12,000 S.F.

EXT'G. CMC WASH RACK TO REMAIN

MAINTENANCE FACILITY 1.5 AC.

REFUSE COLLECTION BASEYARD 2 AC.

Kahalinui Gulch

Paved Perimeter Channel

PASSENGER CAR PARKING AREA (110 STALLS SHOWN)

Existing Road and Paved Parking Access

Leachate Storage Facility

WAREHOUSE BLDG. W/ STORAGE YARD (1.5 AC.)

WAREHOUSE 20,000 S.F.

Existing Phase IV-A Liner Grades

HOUSEHOLD HAZARDOUS WASTE (HHW) AND ELECTRONIC WASTE PROCESSING AND HOLDING FACILITY 2 AC.

Pipe from Waste Bin Area to Leachate Storage Facility

EXISTING Existing Phase IV-B Liner Grades

Cattle Crossing Grate

CONSTRUCTION & DEMOLITION (C & D) MATERIAL RECOVERY FACILITY 4 AC.

ROOFED FACILITY BUILDING 20,000 S.F.

Residential Waste Drop-Off Area

Phase V-A

Emergency Spillway

HEAVY DASHED LINES DENOTES EXISTING FLOOD INUNDATION LIMITS (DETERMINED BY OTHERS)

OFFICE BLDG. 4,000 S.F.

OPEN PROCESSING AREA 40,000 S.F.

ROOFED PROCESSING FACILITY BUILDING 40,000 S.F.

CML Administration Building

Parking Area

Electric Transmission Line Easement

New West Drainage Basin

ABANDONED VEHICLE YARD 5 AC.

TANK

Recyclable Materials Drop-Off Area

Main Access Road/Gate

Paved Perimeter Channel

Entrance

Entrance

METALS PROCESSING FACILITY 9 AC.

Water Line Easement W-1

CML ISWMF Extension

Permitted Central Maul Landfill

A-Mehr, Inc.

Central Maui Landfill
Integrated Solid Waste Management Facility

Proposed Grading and Drainage Plan

4/24/2015 Topography

FILENAME	4-24-15 Topo
DRAWN	RM
CHECKED	
DATE	4/4/16
FIGURE	5

DAVID Y. IGE
Governor

DOUGLAS S. CHIN
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

May 1, 2018

COPY

Ms. Elaine Baker
County of Maui
Solid Waste Division
2200 Main Street, Suite 225
Wailuku, Hawaii 96793

Dear Ms. Baker:

Subj: Chapter 343, Hawaii Revised Statutes (HRS), Draft Environmental Assessment (DEA) for the proposed Central Maui Landfill Facilities Project
TMK: 3-8-003:019 (por.)
Puunene, Maui, Hawaii

The Department of Agriculture (DOA) has reviewed the County of Maui, Department of Environmental Management's DEA for the proposed 40.8-acre expansion for the Central Maui Landfill (CML) facility and offers the following comments and recommendations.

Background

The CML currently operates on a portion of TMK: 3-8-003:019 (Parcel 19) encompassing approximately 126 acres, and is located immediately adjacent to the southeast of the proposed 40.8-acre expansion area (DEA, page 14). The landfill has been in operation since 1986 (DEA, page 14). The expansion area will contain the following facilities: offices, abandoned vehicles area, metals processing area, open construction and demolition material recovery area, household hazardous waste area, warehouse building and storage area, and a refuse collection office area (DEA, page 1). The project completion date is estimated to be the end of 2020.

The expansion area is in the State Agricultural District. Previously, a portion of the expansion area was owned by Alexander and Baldwin Inc. and managed by Hawaiian Commercial & Sugar Co. In 2009, the Land Use Commission (LUC) approved a petition to designate approximately 27,102 acres of land as Important Agricultural Lands (IAL). Approximately 22 acres within the northwestern half of the expansion area is designated as IAL (LUC DR09-38). The majority of the expansion area is within the Maui Island Plan's Urban Growth Boundary; however, a portion of the northwest corner is not within the Urban Growth Boundary (DEA, Figure 13). The Wailuku-Kahului Community Plan designates the entire expansion area as "Agriculture" (DEA, Figure 15).

The Applicant is also seeking to amend SP No. 97-390 and CUP No. 2008/0003 to expand the Central Maui Landfill Facilities (DEA, page 57).

Comments/Recommendations:

The Department recommends that the Environmental Assessment include additional discussion in the following sections:

- In Part III "Relationship to Government Plans, Policies, and Controls", whether the proposed expansion conflicts with the IAL sections of 205-41 to 52, HRS. Pursuant to Section 205-6(c), HRS, certain unusual and reasonable non-agricultural uses may be permitted within agricultural and rural districts; however, such uses proposed on IAL designated lands shall not conflict with any part of Chapter 205, HRS. We note that the intent of IAL designation under section 205-41, HRS, is to: "(1) conserv[e] and protect agricultural lands; (2) promot[e] diversified agriculture; (3) increas[e] agricultural self-sufficiency; and (4) assur[e] the availability of agriculturally suitable lands...."
- In Part IV, "Alternatives", or Part II, "Description of Existing Environment, Potential Impacts, and Proposed Mitigation Measures", the possibility of removing IAL designation within the expansion area under the process described in Section 205-50(g), HRS, before starting construction of the CML expansion.
- In Part II, "Description of Existing Environment, Potential Impacts, and Proposed Mitigation Measures", the possibility of implementing a remediation plan for IAL designated lands to be returned to agricultural use after the life of the CML.
- The Department of Agriculture believes that the discussion on the alternatives to the proposed action in section IV in the DEA should reflect the protections that apply to designated IAL, such as that articulated in Section 205-43, HRS (IAL, policies).

Thank you for the opportunity to provide our input. Should you have any questions, please contact Earl Yamamoto at 973-9466 or email at earl.j.yamamoto@hawaii.gov.

Sincerely,

Scott E. Enright
Chairperson, Board of Agriculture

c: Office of Planning
William Spence, Department of Permitting and Planning, County of Maui
Colleen Suyama, Munekiyo Hiraga

DAVID Y. IGE
Governor

DOUGLAS S. CHIN
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

May 1, 2018

Mr. William Spence, Director
Planning Department
County of Maui
2200 Main Street, Suite 619
Wailuku, Hawaii 96793

Attn. Ms. Kimberley Willenbrink, Planner

Dear Mr. Spence:

Subj: Applications to amend State Special Permit (SP) 97-390 and County Special Use Permit (CUP) 2008/0003 for the proposed Central Maui Landfill Facilities Project, Tax Map Key (2) 3-8-003: 019 (por.) and 020, Pu'unene, Maui, Hawaii.

The Department of Agriculture (DOA) has reviewed the subject applications and offers the following comments and recommendations.

The County of Maui, Department of Environmental Management is seeking to amend SP No. 97-390 and CUP No. 2008/0003 to expand the Central Maui Landfill Facilities. The proposed amendments to SP 97-390 and CUP 2008/0003 are to remove Parcel 20 (19.7 acres), extend the time period of the SP to be coterminous with that of the corresponding CUP (October 31, 2028), and include an additional 40.8 acres within the SP and CUP boundary for the development of the project.

Background
The existing Central Maui Landfill (CML) currently operates on a portion of TMK: 3-8-003:019 (Parcel 19) encompassing approximately 126 acres, and is located immediately adjacent to the southeast of the proposed 40.8-acre expansion area (Index 15, page 14). The landfill has been in operation since 1986 (Page 1). The expansion area will contain the following facilities: offices, abandoned vehicles area, metals processing area, open construction and demolition material recovery area, household hazardous waste area, warehouse building and storage area, and a refuse collection office area (Page 1). The project completion date is estimated to be the end of 2020. The expansion area is in the State Agricultural District. Previously, a portion of the expansion area was owned by Alexander and Baldwin Inc. and managed by Hawaiian

Commercial & Sugar Co. In 2009, the Land Use Commission (LUC) approved a petition to designate approximately 27,102 acres of land as Important Agricultural Lands (IAL). Approximately 22 acres within the northwestern half of the expansion area is designated as IAL (LUC DR09-38). The majority of the expansion area is within the Maui Island Plan's Urban Growth Boundary; however, a portion of the northwest corner is not within the Urban Growth Boundary (Index 15, Figure 13). The Wailuku-Kahului Community Plan designates the entire expansion area as "Agriculture" (Index 15, Figure 15).

Comments/Recommendations:
The Department reviews SPs and CUPs with guidance from Section 205-6, Hawaii Revised Statutes (HRS), Land Use Commission Administrative Rules Section 15-15-95, Maui County Code Section 19.510.070, and prior SPs and CUPs we have reviewed and submitted comments on. Under Section 205-6(c), HRS, certain unusual and reasonable non-agricultural uses may be permitted within agricultural and rural districts; however, such uses proposed on IAL designated lands shall not conflict with any part of Chapter 205, HRS. The Department recommends the applicant address this requirement, particularly regarding the IAL Sections of 205-41 to 52, HRS.

The Department agrees with the Applicant that the proposed use is unusual and reasonable in that the project will support and expand the CML, which is a unique and essential facility for the County of Maui. We also urge the County to hold any special permit considered for agricultural lands that are designated as IAL to a higher level of scrutiny.

Finally, the Department also recommends that the Applicant consider significant mitigation measures, including removing IAL designation within the expansion area pursuant to the process described in Section 205-50(g), HRS, and/or implementing a remediation plan for IAL designated lands to be returned to agricultural use after the life of the CML.

Thank you for the opportunity to provide our input. Should you have any questions, please contact Earl Yamamoto at 973-9466 or email at earl.j.yamamoto@hawaii.gov.

Sincerely,

Scott E. Enright
Chairperson, Board of Agriculture

c: Office of Planning
Elaine Baker, Department of Environmental Management, County of Maui
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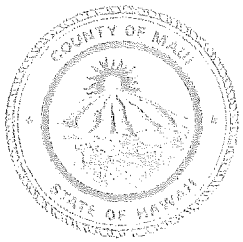



COUNTY OF MAUI
DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
2050 MAIN STREET, SUITE 2B
WAILUKU, MAUI, HAWAII 96793

July 19, 2019

Phyllis Shimabukuro-Gieser, Chairperson
State of Hawai'i
Department of Agriculture
1428 S. King Street
Honolulu, Hawai'i 96814-2512

SUBJECT: Draft Environmental Assessment (EA) and Applications to Amend State Special Permit No. 97-390 and County Special Use Permit No. CUP 2008/003 for the Proposed Central Maui Landfill Facilities Project at Tax Map Key (2) 3-8-003:019 (por.) and 020, Pu'unēnē, Maui, Hawai'i

Dear Ms. Shimabukuro-Gieser:

Thank you for your department's two letters of May 1, 2018 providing comments on the Draft Environmental Assessment (EA) and Applications to Amend State Special Permit No. 97-390 and County Special Use Permit No. CUP 2008/003 for the Central Maui Landfill Facilities Project. The County of Maui (COM), Department of Environmental Management (DEM), offers the following information in response to the comments presented in your letters.

As recommended, we have reviewed Chapter 205, Hawai'i Revised Statutes (HRS), Sections 205-6(c), 205-41 through 52 regarding special permits and Important Agricultural Lands (IAL). The Environmental Assessment (EA) will be revised to include an analysis of Chapter 205 as it relates to IAL and the special permit amendment process.

An amendment to the existing SP No. 97-390 is being pursued based on coordination undertaken with both the State Land Use Commission and the County of Maui's Department of Planning during the early consultation phase of the EA process.

The proposed project will improve a critical County of Maui Solid Waste Management facility to extend the useful life of the existing landfill beyond 2030. The project will involve use of approximately 22 acres of IAL, the majority of which are located within the Urban Growth Boundary (UGB) of the Maui Island Plan, which was adopted in 2012. The IAL portion of the project site represents approximately 22 acres of the 27,102 acres of IAL designated lands on Maui or approximately 0.08 percent of the total IAL designated lands and is not anticipated to present a significant impact on the availability of agricultural lands given the recent demise of sugar cane cultivation activities on Maui. As such, DEM does not believe that a remediation plan would be appropriate in this instance. DEM will, however, coordinate with your Department and the State Land Use Commission to determine the feasibility of the County possibly petitioning the State to remove the IAL designation from the property in the future.

Also, as recommended, Chapter IV Alternatives of the EA will be revised to include a discussion of §205-43 and the protections afforded to IAL. We understand that there are priorities in the State and County planning framework that may not support the intent of the IAL. The public need to provide reliable public infrastructure, including solid waste management facilities, is also addressed in this framework and may be contrary to the intent of IAL. The proposed project at the Central Maui Landfill will ensure the provision of continued solid waste services to residents and visitors on Maui and will implement the solid waste objectives of the State and COM. The proposed project will implement sustainability measures intended to reduce the solid waste stream entering the Central Maui Landfill.

We appreciate the input provided by your Department and will include a copy of your letter and this response in the Final EA. Should you have any questions or require further information regarding the proposed action, please feel free to contact Colleen Suyama of Munekiyo Hiraga at (808) 244-2015.

Sincerely,

ERIC A. NAKAGAWA, P.E.
Director of Environmental Management

EN

cc: Elaine Baker, Department of Environmental Management
Clayton Yoshida, Department of Planning
Colleen Suyama, Munekiyo Hiraga

APPENDIX E

BIOLOGICAL RESOURCES SURVEY

BIOLOGICAL RESOURCES SURVEY

for the

CENTRAL MAUI SANITARY LANDFILL FACILITY EXPANSION PROJECT

PU'UNĒNĒ, MAUI, HAWAII

by

ROBERT W. HOBDY
ENVIRONMENTAL CONSULTANT
Kokomo, Maui
April 2016

Prepared for:
County of Maui
Department of Environmental Management

FLORA AND FAUNA SURVEY
CENTRAL MAUI SANITARY LANDFILL FACILITY EXPANSION PROJECT
PU'UNĒNĒ, MAUI, HAWAII

INTRODUCTION

The Central Maui Sanitary Landfill Facility Expansion Project lies on approximately 40 acres of land adjacent to the current Landfill Facility along Pūlehu Road (TMK (2) 3-8-013:019 por.). It is situated on recently fallow land surrounded by sugar cane fields. This biological resources study was initiated by the County of Maui, Department of Environmental Management in compliance with environmental requirements of the planning process.

SITE DESCRIPTION

The project area lies on gently to moderately sloping land below the existing landfill facility at elevations ranging from 280 feet down to 210 feet. Vegetation consists of low and scattered herbaceous species with some bare ground. Soils are characterized as Waiakoa Silty Clay Loam, 3 – 15% slopes (WeB and WeC) and Molokai Silty Clay Loam, 3 – 7% slopes (MuB) (Foote et al, 1972) which are deep, well-drained soils. Rainfall averages 17 inches per year with most occurring during the winter months.

SITE HISTORY

During the late 1800's this area was cleared for sugar cane production. The area has been plowed, planted, cultivated, burned, and harvested in continuous cycles for over 100 years. The original native vegetation was replaced by sugar cane and increasing numbers of agricultural weeds.

Presently this site is nearly devoid of native vegetation and wildlife species.

SURVEY OBJECTIVES

This report summarizes the findings of a flora and fauna survey of the proposed Central Maui Sanitary Landfill Facility Expansion Project which was conducted in April 2016. 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 for covering the entire project area. Notes were made on plant species, distribution and abundance as well as on terrain and substrate.

DESCRIPTION OF THE VEGETATION

The final crop of sugar cane had been recently harvested and the land was lying fallow. The vegetation was low in stature with much bare ground. Seven non-native species were common throughout the project area. These included resprouting sugar cane (*Saccharum officinarum*), nut sedge (*Cyperus rotundus*), buffelgrass (*Cenchrus ciliaris*), Guinea grass (*Megathyrsus maximus*), little bell (*Ipomoea triloba*), Castor bean (*Ricinus communis*) and Mexican poppy (*Argemone mexicana*). A total of 54 plant species were recorded during the survey. Just two hardy native plant species were sparingly present, 'ilima (*Sida fallax*) and 'uhaloa *(Waltheria indica*). The remaining 52 species were non-native agricultural grasses and weeds.

DISCUSSION AND RECOMMENDATIONS

The vegetation throughout the project area is dominated by non-native species that are of no particular environmental interest or concern. Just two common indigenous plants, 'ilima and 'uhaloa were found growing in small numbers. No federally listed Endangered or Threatened plant species (USFWS, 2016) were found, nor do any plants that are candidates for such status occur on the project area. No special plant habitats occur on or near the project and no potential wetlands occur in this dry upland site.

This project is not expected to have any significant negative impacts on the botanical resources in this part of Maui. No recommendations regarding botanical resources are deemed necessary or appropriate.

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 two groups: Monocots and Dicots. Taxonomy and nomenclature of the plants 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 geographic 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
MONOCOTS			
CYPERACEAE (Sedge Family)			
Cyperus rotundus L.	nut sedge	non-native	common
POACEAE (Grass Family)			
Cenchrus ciliaris L.	buffelgrass	non-native	common
Cenchrus purpureus (Schumach.) Morrone	Napier grass	non-native	rare
Chloris barbata (L.) Sw.	swollen fingergrass	non-native	uncommon
Chloris gayana Kunth	Rhodes grass	non-native	uncommon
Digitaria insularis (L.) Mez ex Ekman	sourgrass	non-native	rare
Echinochloa crus-galli (L.) P. Beauv.	barnyard grass	non-native	rare
Eleusine indica L.	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	rare
Saccharum officiniarum L.	sugar cane	non-native	common
DICOTS			
AMARANTHACEAE (Amaranth Family)			
Amaranthus spinosus L.	spiny amaranth	non-native	rare
Amaranthus viridis L.	smooth amaranth	non-native	rare
Atriplex subereta Verd.	saltbush	non-native	uncommon
Kali tragus (L.) Scop.	Russian thistle	non-native	uncommon
APIACEAE (Parsley Family)			
Ciclospermum leptophyllum (Pers.) Sprague	fir-leaved celery	non-native	rare
APOCYNACEAE (Dogbane Family)			
Asclepias physocarpa (E.Mey.) Schlect.	baloon plant	non-native	rare
ASTERACEAE (Sunflower Family)			
Bidens pilosa L.	Spanish needle	non-native	rare
Eclipta prostrata (L.) L.	false daisy	non-native	rare
Emilia fosbergii Nicolson	red pualele	non-native	rare
Sonchus oleraceus L.	pualele	non-native	rare
Tridax procumbens L.	coat buttons	non-native	rare
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	non-native	uncommon
Xanthium strumarium L.	kīkania	non-native	rare
CLEOMACEAE (Cleome Family)			
Cleome gynandra L.	wild spider flower	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
Ipomoea triloba L.	little bell	non-native	common
CUCURBITACEAE (Gourd Family)			
Lagunaria siceraria (Molina) Standl.	long gourd	non-native	rare
Momordica charantia L.	bitter melon	non-native	uncommon
EUPHORBIACEAE (Spurge Family)			
Euphorbia heterophylla L.	kaliko	non-native	rare
Euphorbia hypericifolia L.	graceful spurge	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Ricinus communis L.	Castor bean	non-native	common
FABACEAE (Pea Family)			
Chamaecrista nictitans (L.) Moench	partridge pea	non-native	rare
Crotalaria incana L.	fuzzy rattlepod	non-native	uncommon
Crotalaria retusa L.	rattlepod	non-native	rare
Leucaena leucocephala (Lamarck) de Wit	*koa haole*	non-native	uncommon
Macroptilium atropurpureum (DC.) Urb.	siratro	non-native	uncommon
Neonotonia wightii (Wight & Arnott) Lackey	glycine	non-native	rare
Prosopis pallida (Humb. & Bonpl. ex Willd.)	*kiawe*	non-native	rare
Samanea saman (Jacq.) Merr.	monkey pod	non-native	rare
Senna occidentalis (L.) Link	coffee senna	non-native	rare
MALVACEAE (Mallow Family)			
Malva parviflora L.	cheese weed	non-native	uncommon
Sida fallax Walp.	*'ilima*	indigenous	rare
Sida rhombifolia L.	arrow-leaved sida	non-native	rare
Waltheria indica L.	*'uhaloa*	indigenous	rare
NYCTAGINACEAE (Four-o'clock Family)			
Boerhavia coccinea Mill.	scarlet spiderling	non-native	uncommon
ONAGRACEAE (Evening Primrose Family)			
Ludwigia octovalvis (Jacq.) Raven	primrose willow	non-native	rare
PAPAVERACEAE (Poppy Family)			
Argemone mexicana L.	Mexican poppy	non-native	common
PORTULACACEAE (Purslane Family)			
Portulaca oleracea L.	pig weed	non-native	rare
SOLANACEAE (Nighshade Family)			
Datura stramonium L.	Jimson weed	non-native	rare
Nicandra physalodes (L.) Gaertn.	apple of Peru	non-native	rare
Solanum americanum Mill.	pōpolo	inidgenous	rare
Solanum lycospersicum L.	cherry tomato	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

No mammals were seen during two site visits. Several common non-native mammal species, however, could be occasionally expected to utilize this habitat. These include the mongoose (*Herepestes auropunctatus*), cats (*Felis catus*), domestic dogs (*Canis familiaris*), rats (*Rattus* spp.) and mice (*Mus domesticus*). The rodent species can be difficult to detect because of the dense vegetation. Taxonomy and nomenclature follow Tomich (1986).

A special effort was made to look for the native Hawaiian hoary bat by making an evening survey of the area. 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 was used at two locations, set to the frequency of 27,000 to 28,000 Hertz which is the typical range within which these bats are known to echolocate for flying insect prey. No activity was detected using this device.

BIRDS

Birdlife was rather sparse due to the lack of habitat diversity. Just six speices of non-native birds were observed during two site visits. Taxonomy and nomenclature follow American Ornitholigists' Union (2014). Three species were uncommon, zebra dove (*Geopelia striata*), common myna (*Acridotheres tristis*) and spotted dove (*Streptopelia chinensis*). The remaining three species were of rare occurrence. A few other non-native birds might occasionally be seen here but the habitat is not suitable for Hawaii's native forest birds, water birds or sea birds.

INSECTS

Insect life was rather modest in species diversity and in total numbers. A total of 15 species were observed in seven insect Orders during two site visits. Taxonomy and nomenclature follow Nishida et al (1992). One species, the house fly (*Musca domestica*), was abundant throughout the project area. Two other non-native insects were common, the Cuban koa haole psyllid (*Heteropsylla cubana*) and the long tail blue butterfly (*Lampides boeticus*). Four other species were uncommon and eight species were rare in this habitat. One native dragonfly, the indigenous globe skimmer (*Pantala flavescens*) was observed.

DISCUSSION AND RECOMMENDATIONS

The wildlife within and around this project area is composed nearly entirely of non-native species. Of a total of 6 birds and 15 insects, just one indigenous dragonfly was recorded. This dragonfly is found throughout the tropics worldwide and is one of the commonest native insects in Hawaii.

No Endangered or Threatened native animals were found during the survey, nor were any found that are candidates for such status. No special wildlife habitats were found either.

As a result of these findings, it is determined that there is little of environmental concern with regard to animal life within the proposed project. The development of this project is not expected to have a significant negative impact on the native wildlife resources in this part of Maui.

While no protected seabirds were found on the property, the Endangered ua'u (*Pterodrama sanwichensis*) and Threatened 'a'o (*Puffinus newelli*) 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.

ANIMAL SPECIES LIST

Following is a checklist of the animal species inventoried during the field work. Animal species are arranged in descending abundance within two groups: Birds and Insects.
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 overwintering/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.

COMMON NAME	SCIENTIFIC NAME	STATUS	ABUNDANCE
MAMMALS			
NONE			
BIRDS			
Acridotheres tristis L.	common myna	non-native	uncommon
Geopelia striata L.	zebra dove	non-native	uncommon
Streptopelia chinensis Scopoli	spotted dove	non-native	uncommon
Carpodacus mexicanus Muller	house finch	non-native	rare
Cardinalis cardinalis L.	northern cardinal	non-native	rare
Francolinus francolinus L.	black francolin	non-native	rare

COMMON NAME	SCIENTIFIC NAME	STATUS	ABUNDANCE
INSECTS			
Order ARANAE - true spiders			
ARANEIDAE (Orb Weaver Family)			
Araneus diadematus Clerck	European garden spider	non-native	rare
Order COLEOPTERA - beetles			
COCCINELLIDAE (Lady Beetle Family)			
Coccinella septempunctata brucki Multsant	seven-spot lady beetle	non-native	rare
Order DIPTERA - flies			
CULICIDAE (Mosquito Family)			
Culex quinquefasciatus Say	southern house mosquito	non-native	uncommon
MUSCIDAE (Housefly Family)			
Musca domestica L.	housefly	non-native	abundant
Musca sorbens Wiedemann	dung fly	non-native	rare
Order HEMIPTERA - true bugs			
PSYLLIDAE (Psyllid Family)			
Heteropsylla cubana Crawford	Cuban koa haole psyllid	non-native	common
Order HYMENOPTERA - bees, wasps			
APIDAE (Honey Bee Family)			
Apis mellifera L.	honey bee	non-native	rare
Xylocopa sonorina Smith	Sonoran carpenter bee	non-native	rare
FORMICIDAE (Ant Family)			
Pheidole megacephala Fabricius	big-headed ant	non-native	uncommon
VESPIDAE (Vespid Wasp Family)			
Polistes aurifer Saussure	golden paper wasp	non-native	rare
Order LEPIDOPTERA - butterflies, moths			
LYCAENIDAE (Gossamer-winged Butterfly Family)			
Brephidium exilis Boisduval	western pygmy blue butterfly	non-native	rare
Lampides boeticus L.	long tail blue butterfly	non-native	common
NYMPHALIDAE (Brush-footed Butterfly Family)			
Danaus plexippus L.	monarch butterfly	non-native	rare
PIERIDAE (White and Sulphur Butterfly Family)			
Eurema niccipe Cramer	sleepy orange butterfly	non-native	uncommon
Order ODONATA - dragonflies, damselflies			
LIBELLULIDAE (Skimmer Dragonfly Family)			
Pantala flavescens Fabricius	globe skimmer	indigenous	rare

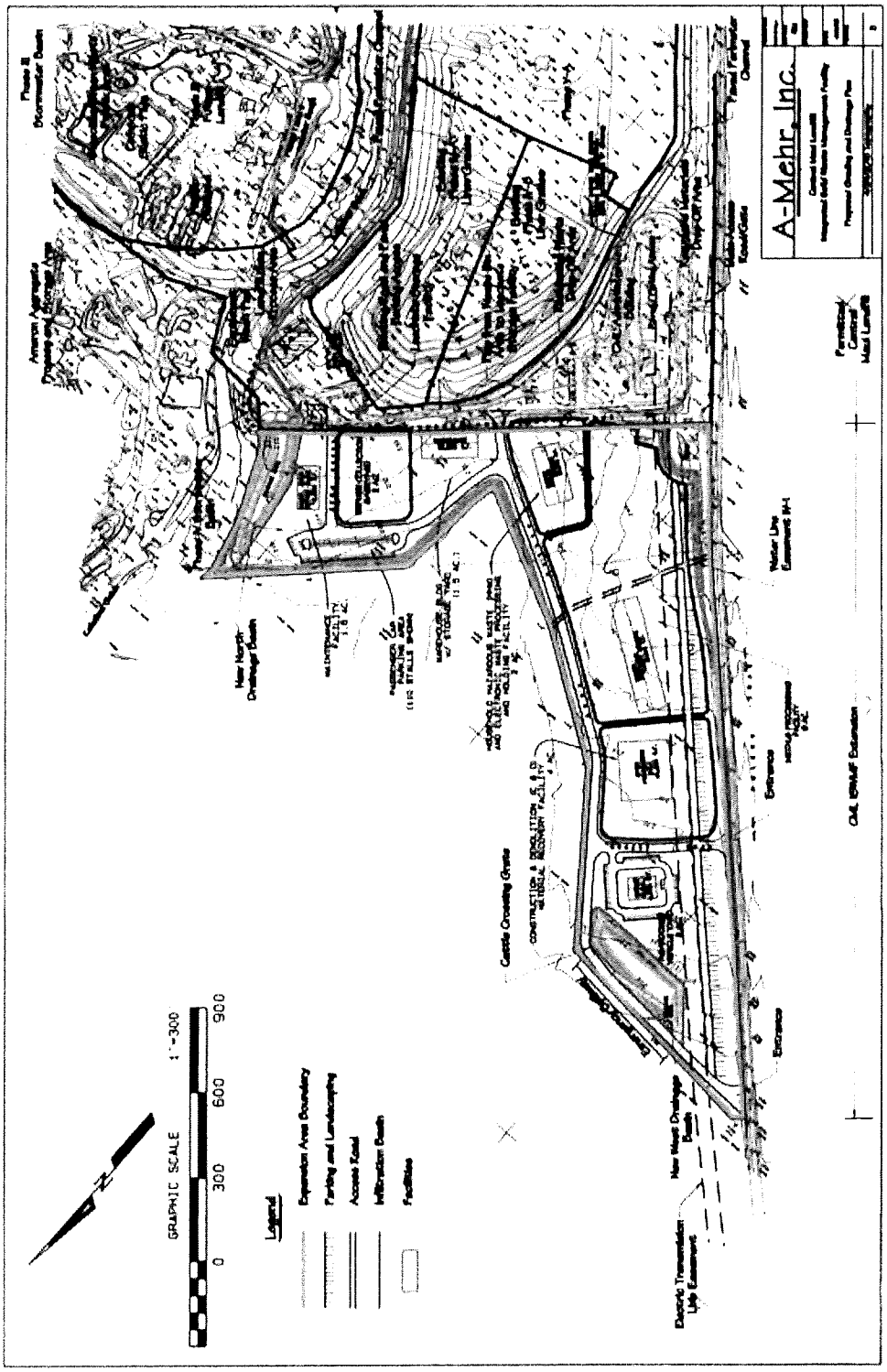

Figure 1. Project Area (40 acres) lies within the orange line TMK (2) 3-8-013:019 (por.).



Figure 2. Project Area – view northwest from the Central Maui Landfill.



Figure 3. Project Area – view west from the Central Maui Landfill.

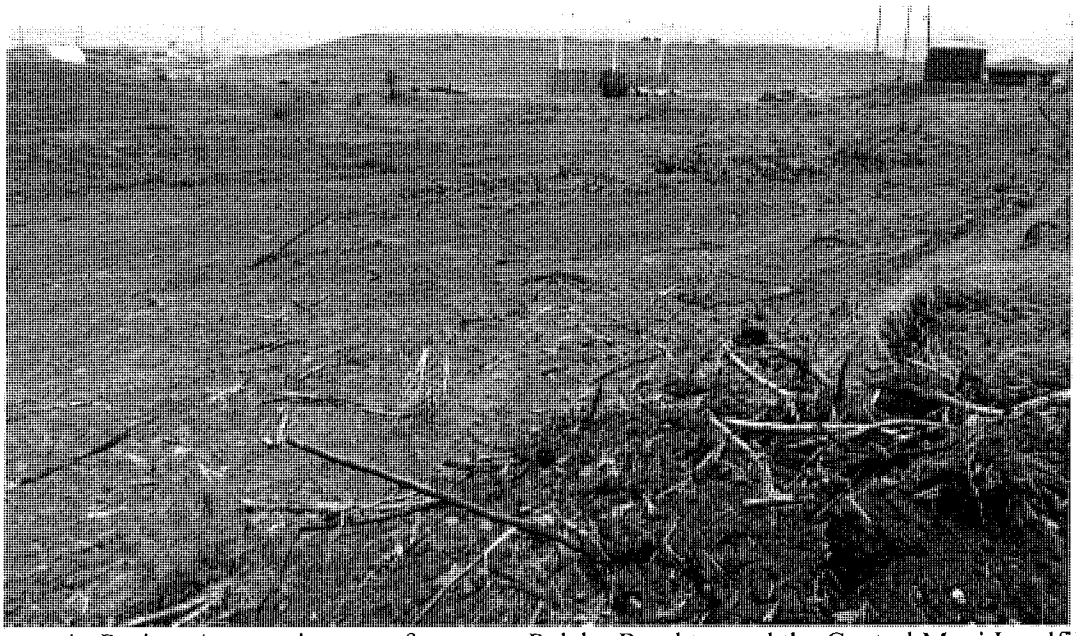

Figure 4. Project Area – view east from near Pulehu Road toward the Central Maui Landfill.

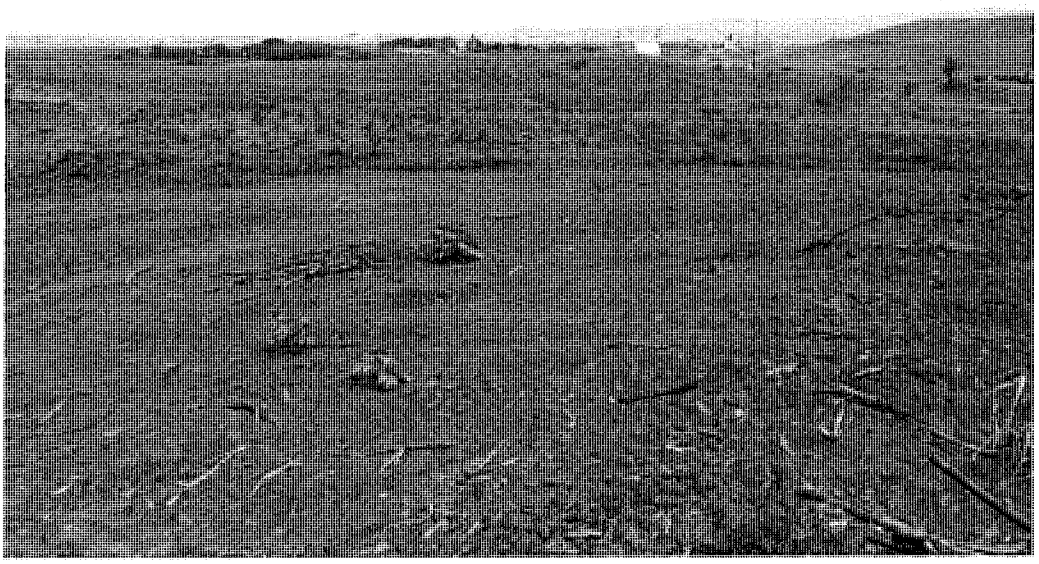

Figure 5. Project Area – view northeast from near Pulehu Road across the upper portion of the project.

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APPENDIX

F

ARCHAEOLOGICAL ASSESSMENT REPORT

SCS Project Number 1902 AA-2

AN ARCHAEOLOGICAL ASSESSMENT FOR THE CENTRAL MAUI LANDFILL EXPANSION PROJECT

WAILUKU AHUPUA'A
WAILUKU DISTRICT
MAUI ISLAND
HAWAI'I

TMK: (2) 3-8-003:019 por.

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August 2016
Revised October 2017
April 2018
FINAL

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INTRODUCTION

Scientific Consultant Services, Inc. (SCS) conducted archaeological inventory survey on a 40-acre, parcel for proposed expansion of the existing Central Maui Landfill facility by the County of Maui, Department of Environmental Management, Solid Waste Division. The project area is located in Wailuku Ahupua'a, Wailuku District, Island of Maui, Hawai'i [TMK: (2) 3-8-003:019 por.] (Figures 1 and 2). The project area occurs adjacent to the existing Central Maui Landfill facility. During fieldwork, full pedestrian survey was undertaken of the entire 40-acres and thirty stratigraphic trenches (ST-1 through ST-30) were mechanically excavated.

The project area itself has undergone extensive alteration due to sugar cane cultivation as well as private construction activities. Based on the results of previous archaeological studies, the most likely historic sites in the project area would be those associated with plantation agriculture, such the historic ditches recorded by Fredericksen and Fredericksen (1988).

SCS Archaeologists Nicole Andricci, B.A. and Ian Bassford, B.A. conducted fieldwork from June 6, 2016 through June 9th, 2016 under the direct supervision of Michael F. Dega, Ph.D., Principal Investigator. The purpose of the archaeological investigation was to identify and document all archaeological historic properties within the project area and to gather sufficient information to evaluate the significance of each historic property in accordance criteria established for the Hawai'i State Register of Historic Places (HAR§13-275-6).

This report is prepared as an archaeological assessment (AA), pursuant to HAR §13-276-5(a)/13-284-5(b)(5)(A) as no historic properties were recorded during fieldwork or noted during the course of background research within the project area.

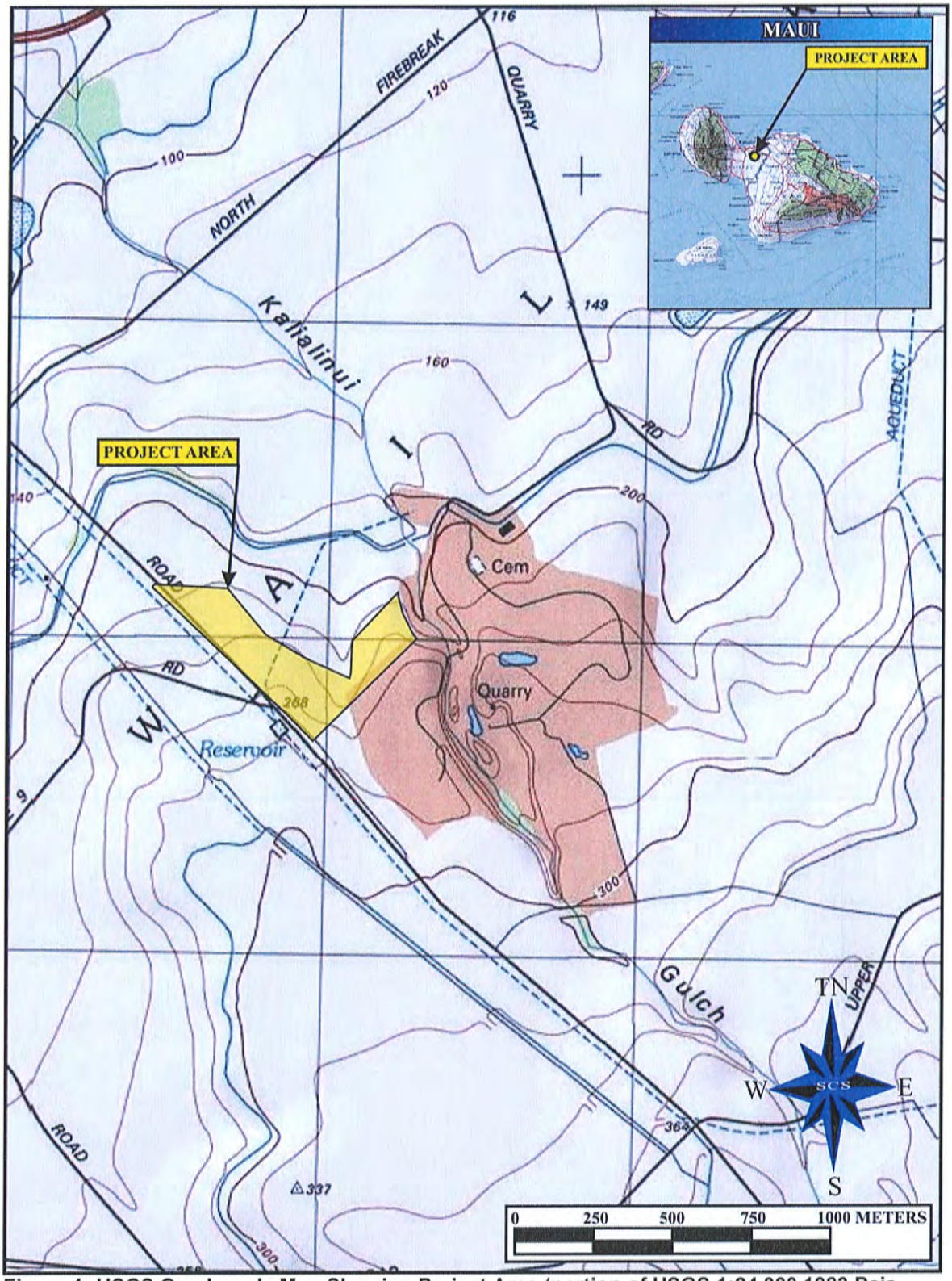

Figure 1: USGS Quadrangle Map Showing Project Area (portion of USGS 1:24,000 1983 Paia quadrangle).

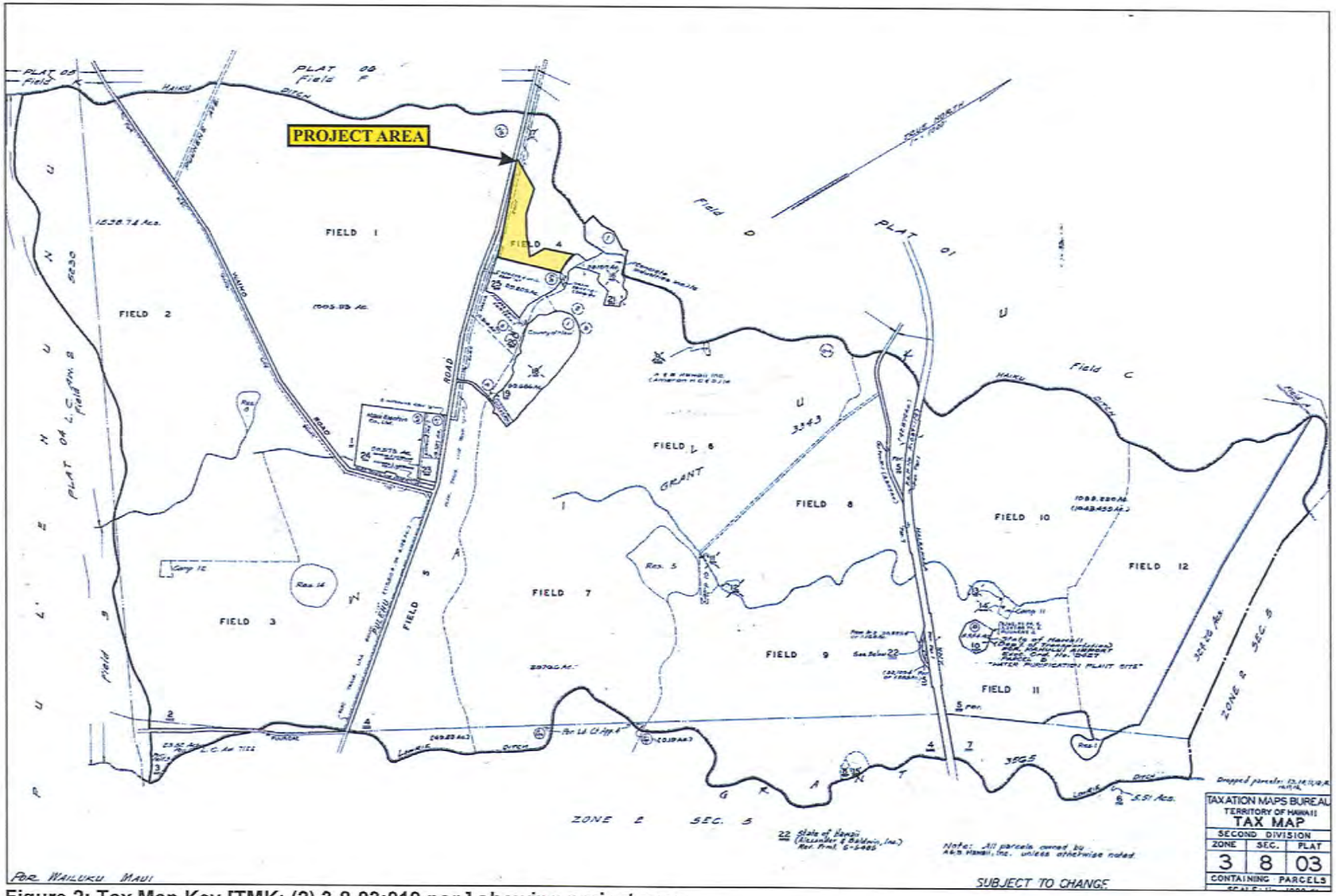

Figure 2: Tax Map Key [TMK: (2) 3-8-03:019 por.] showing project area.

ENVIRONMENTAL SETTING

The project area consists of a vacant 40-acre property previously in sugar cane cultivation and located in lower Pu'unēnē, Wailuku Ahupua'a, Wailuku District located adjacent to the existing Central Maui Landfill facility on Pulehu Road. The project area is bounded by Pulehu Road to the southwest, the existing Central Maui Landfill facility to the east, and Kalialinui gulch to the north.

RAINFALL

The area has low precipitation, with the general Pu'unēnē area receiving less than seventeen inches of rainfall per year (Giambellucca *et al.* 2013).

SOILS

Soils in the project area include the Molokai Series, which consists of Molokai silty clay loam on 3 to 7 percent slopes (MuB; 19% of the project area), and the Waiakoa Series, composed of silty clay loam on 3 to 7 percent slopes (WeB; 45%) and on 7 to 15 percent slopes (WeC; 35%). Figure 3 shows the distribution of these soils within the project area.

The Molokai Series consists of well-drained soils on uplands formed in material weathered from basic igneous rock. They are nearly level to moderately steep. This soil is associated with sugar cane, pineapple, pasture, wildlife habitat, and home sites. A representative profile for MuB includes a surface layer of dark reddish-brown silty clay loam about 15 in thick, dark reddish-brown silty clay loam subsoil that has prismatic structure, about 57 in thick, and a substratum comprised of soft, weathered rock. Permeability is moderate, runoff is slow, and the erosion hazard is slight to moderate. These soils are used for sugar cane, pineapple, pasture, wildlife habitat, and home sites. The natural vegetation consists of *kiawe*, *ilima*, *uhaloa*, feather fingergrass, and buffelgrass (Foote *et al.* 1972:96-97).

The Waiakoa Series consists of well-drained upland soils and developed from basic igneous rock. The soils are gently to moderately sloping at elevations from 100 to 1,000 feet above sea level. These soils are also associated with sugar cane, truck crops, pasture, home sites, and wildlife habitat. Two series are present in the project area, WeB and WeC, the only difference between slope. Both are composed of dark reddish brown silty clay loam with underlying saprolite. In many locations, such as the western portion of the project area, this soil has either been removed or eroded to weather rock (igneous). Typical depths to bedrock are from 33 to 37 inches below surface.

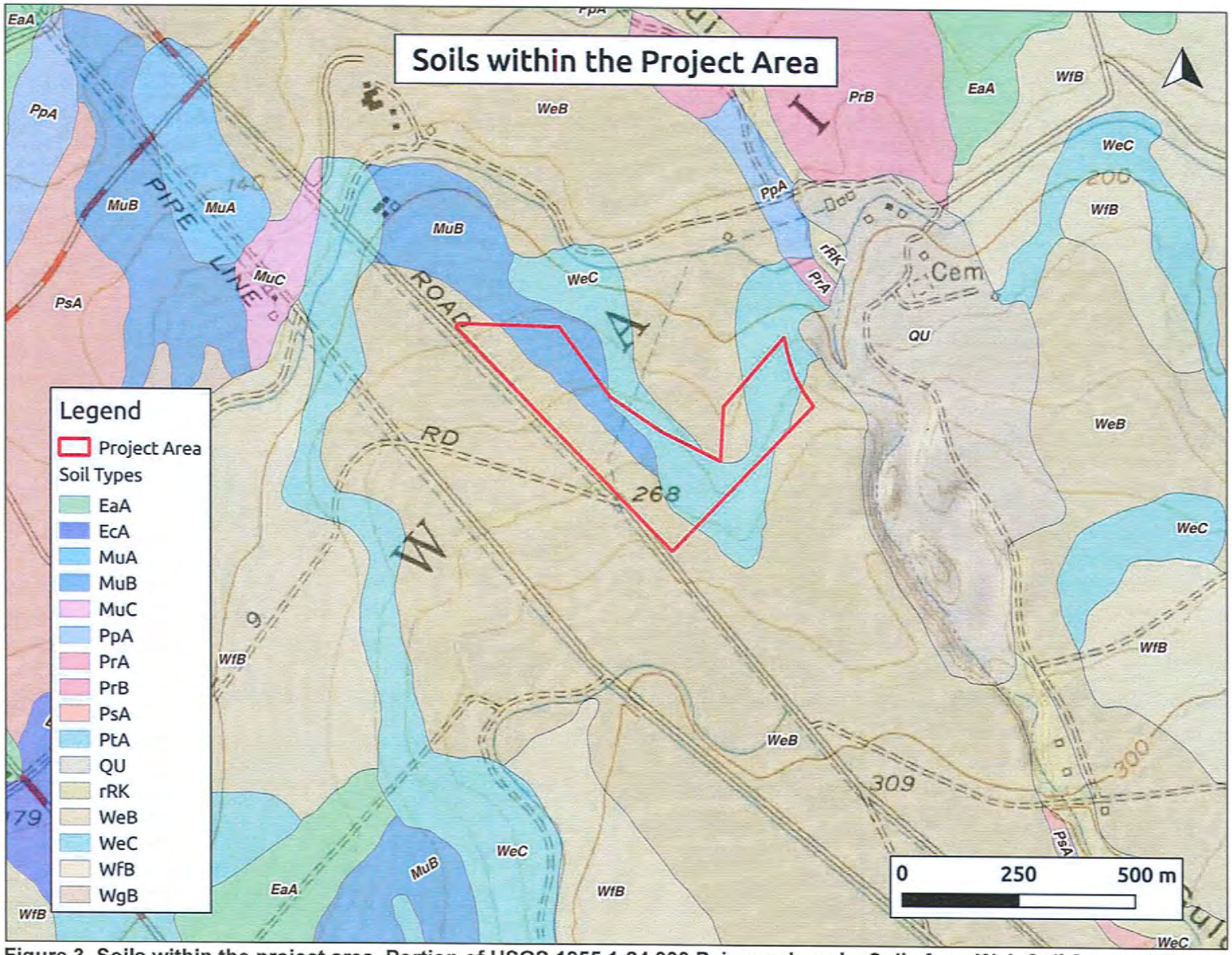

Figure 3. Soils within the project area. Portion of USGS 1955 1:24,000 Paia quadrangle. Soils from Web Soil Survey (USDA 2017).

HISTORIC BACKGROUND AND FORMER LAND USE

The project area is in an in-between region on the border of the verdant *kalo* (taro) fields of the "Four Streams" of Wailuku to the west and the productive *'uala* (sweet potato) upland area of Kula to the east (Handy 1940:496). It is likely that the project area was not utilized for native agriculture or habitation in the Pre-Contact period. The area was described in the 1860s as

> ... a complete desert, a great, barren stretch of sand and dust spread from Wailuku to Pa'ia, except for a little cattle grazing land around the present location of Spreckelsville. (Burns 1991 :72).

However, this portion of Maui was well suited to sugar cane cultivation once it was irrigated. The Hawaiian Commercial Company, formed by Claus Spreckels, developed the area around the project area. In 1880, Claus Spreckels managed to acquire fee simple title to the Wailuku Ahupua'a (approximately 440,000 acres; Grant 3343). The Haiku Ditch, completed in 1914, diverted water from east Maui (Thrum 1908). The ditch runs east-west just downslope of the project area. It appears from contemporary maps that a tributary subterranean ditch or pipe runs underneath the project area to the Haiku Ditch (see Figure 1).

The growth of the sugar industry was augmented by the indenturement of foreign labor. The diverse ethnic groups that provided needed labor to fuel a large plantation economy was reflected in the names of the labor camps in the region: Hawaiian Camp, Russian Camp, Spanish Camp, Portuguese Camp, Chinese Camp, and Japanese Camp. A total of thirteen camp communities were formed and situated throughout the sugar lands and towns were founded at Pu'unēnē to the west and Spreckelsville to the north (USGS 1922 Kihei Quad; Figure 4). Railroads constructed by the plantation provided transportation for hauling sugar cane and connecting the scattered labor camps. A cemetery is noted on a 1956 topographic quad just east of the project area across Kalialinui gulch (see Figure 3).

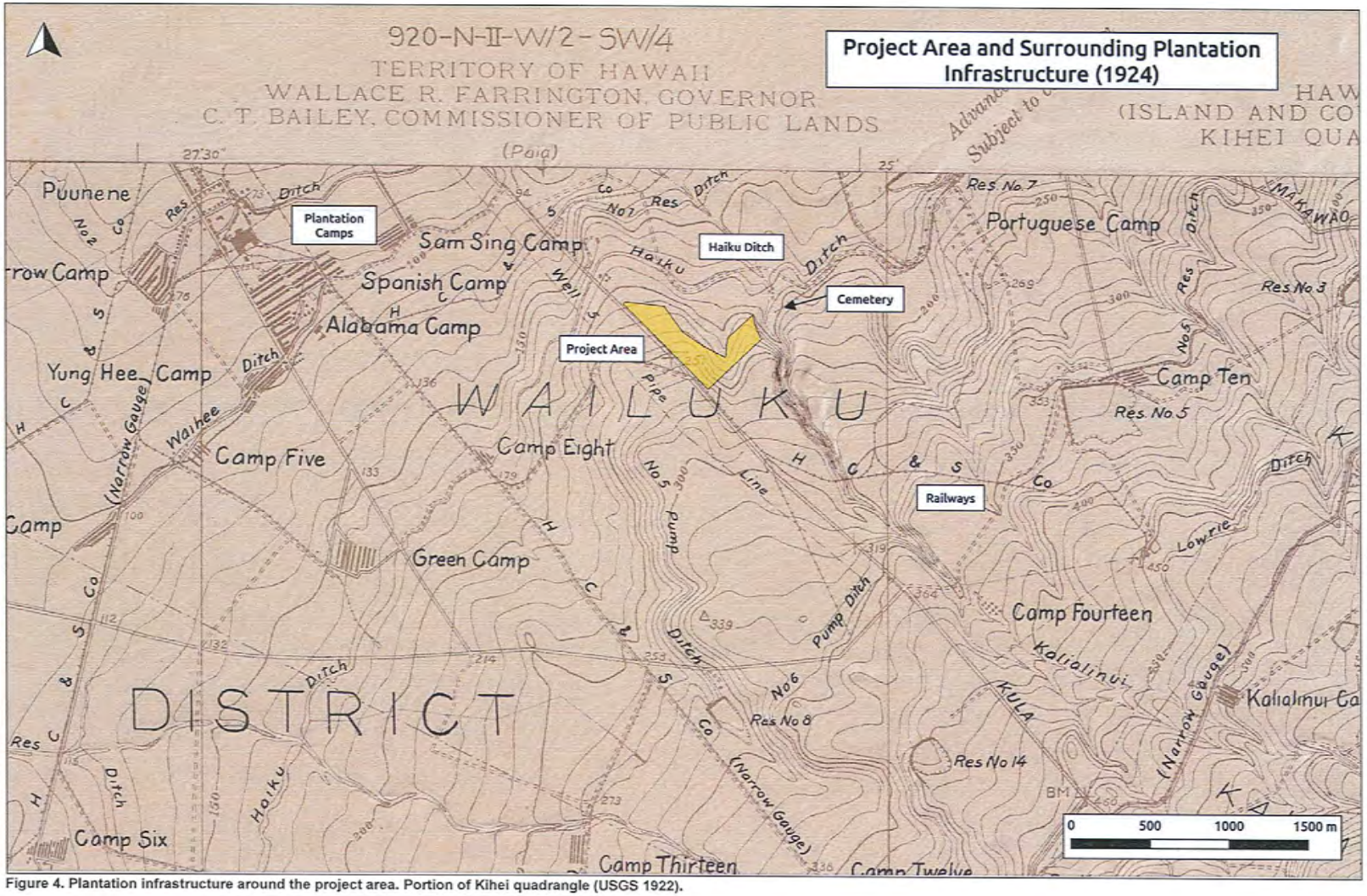

Figure 4. Plantation infrastructure around the project area. Portion of Kihei quadrangle (USGS 1922).

PREVIOUS ARCHAEOLOGY

Fredericksen and Fredericksen (1988, 1989) have conducted the only intensive study of the Pu`unēnē area, in two large lots (cumulatively 232 acres) downhill of the project area. Their inventory surveys have led to the documentation of several possible volcanic glass concentrations, historic irrigation ditches, and old stream gravels. The volcanic glass debris was later re-interpreted as slag associated with mill production. No subsurface deposits were identified.

Scientific Consultant Services, Inc. (SCS) conducted an Archaeological Inventory Survey of the Pu'unēnē Bypass and Mokulele Highway Improvements Corridors (Burgett and Spear 1997). No evidence of archaeological remains were encountered during the survey. The entire route of the Highway Improvements and Pu'unēnē Bypass corridors crossed previously altered terrain. Most of the extensive alteration in the area has been the result of sugar cane cultivation.

SCS conducted a cultural impact assessment of the parcel now occupied by the Central Maui Landfill Refuse and Recycling Center (McGerty and Spear 2008) which found that the project area has not been used for traditional Hawaiian cultural purposes within recent times.

SETTLEMENT PATTERNS AND EXPECTED FINDINGS

No pre-Contact sites are expected in the project area. However, given that the area was part of a sugar cane field system, there could be a likelihood to encounter plantation-era infrastructure or historic properties.

METHODOLOGY

FIELD METHODS

Archaeological fieldwork was conducted between June 6, 2016 and June 9, 2016 by SCS Archaeologists Nicole Andricci, B.A. and Ian Bassford, B.A., under the direct supervision of Michael F. Dega, Ph.D. (Principal Investigator). Full pedestrian survey was conducted vis both north-south and east-west transects across the project area in 3-5 m spacing. Visibility was good throughout the survey. In addition, thirty locations were selected for subsurface examination throughout the vacant 40-acres parcel during fieldwork. The thirty locations were chosen in order to provide a representative example of subsurface matrices seen throughout the project area and was also determined by backhoe access. The thirty stratigraphic trench sites are plotted on the map below (Figure 4; see Figure 3). The illustration shows a majority of the trenches having been

placed in the eastern side of the project area. The areas to the west, where no trenches are noted, was not fully tested due to the ubiquitous presence of bedrock. The backhoe simply could not penetrate the bedrock in the western half of the project area. It also appeared as though the western half had soil sediment removed, likely during modern times.

The thirty stratigraphic trenches (ST-1 through ST-30) were mechanically excavated using a backhoe (see Table 1 below for trench dimensions). All sediments were documented with photographs, stratigraphic profiles, and Munsell soil descriptions. Standard excavation and recording procedures were used during the project. As no cultural deposits or subsurface features were identified, excavated matrices were not screened.

Table 1: Stratigraphic Trench Dimensions

Stratigraphic Trench (ST)	Length (cm)	Width (cm)	Height (cm)
ST-1	390	90	120
ST-2	400	90	140
ST-3	410	100	130
ST-4	420	90	130
ST-5	380	90	120
ST-6	390	90	120
ST-7	460	100	170
ST-8	440	90	145
ST-9	450	100	157
ST-10	400	100	180
ST-11	380	90	160
ST-12	470	100	165
ST-13	450	95	170
ST-14	450	95	165
ST-15	450	100	150
ST-16	460	90	155
ST-17	420	90	145
ST-18	440	90	145
ST-19	410	90	120
ST-20	410	90	100
ST-21	440	95	160
ST-22	440	100	120
ST-23	440	90	115
ST-24	440	95	150
ST-25	440	100	140
ST-26	420	90	150
ST-27	410	90	80
ST-28	430	90	150
ST-29	440	100	160
ST-30	410	90	110

LABORATORY METHODOLOGY

All field notes and digital photographs are curated at the SCS laboratory in Honolulu. Representative stratigraphic profiles have been drafted for presentation within this report. True north compass orientation was also employed. All measurements were recorded in metric. All materials gathered during this project (including documentation) are being curated at the SCS laboratory in Honolulu. The final steps of laboratory work consisted of digitizing photographs, drafting stratigraphic profiles, and reporting.

FIELDWORK RESULTS

Full pedestrian survey of the project area did not lead to the identification of any surface sites nor deposits (midden scatters, isolated artifacts, etc). The surface represents former sugar cane lands that had been graded and used for cane over decades. No historic-era features related to this cultivation were identified.

Thirty trenches were excavated during fieldwork within the project area. No traditional or historic-period cultural deposits, artifacts, midden, or skeletal materials were identified in subsurface contexts. Stratigraphy was confirmed as composed of three different types of soil: Ewa silty clay loam (EaA), Molokai silty clay loam (MuB), and Pulehu clay loam on 0 to 3 percent slopes (PsA) (Foote *et al.* 1972:30). Bedrock was encountered in multiple trenches and represented the end of testing for that trench. Due to shallow amounts of soil and presence of bedrock near the surface in instances, some of the trenches were located close together.



Figure 5: Aerial View of Stratigraphic Trench Sites (ST-1 through ST-30).

STRATIGRAPHIC TRENCH 1 (ST-1)

Stratigraphic Trench 1 (ST-1) (390 x 90 x 120 cm) was located on a northwest/southeast axis (330°/150°). The surface of ST-1 contained sporadic sugar cane stalks, along with scattered grass patches and previously disturbed top soil. ST-1 contained two stratigraphic layers (Figure 5 and Figure 6).

Layer I (0-90 cmbs) consisted of dark reddish brown (5YR 3/4) dry, compacted silt and semi-plastic silty clay. No roots or stones were present throughout Layer I. The lower boundary was gradual and wavy.

Layer II (90-120 cmbs) consisted of light gray (2.5 Y 7/2) wet plastic. Stones were present throughout Layer II, but no Traditional or Historic artifacts were present.

STRATIGRAPHIC TRENCH 2 (ST-2)

Stratigraphic Trench 2 (ST-2) (400 x 90 x 140 cm) was located on a northeast/southwest axis (70°/250°). The surface of ST-2 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-2 contained one stratigraphic layer (Figure 8 and Figure 9).

Layer I (0-140 cmbs) consisted of dark reddish brown (5YR 3/4) dry, compacted silt and semi-plastic silty clay. No roots or stones were present throughout Layer I.

STRATIGRAPHIC TRENCH 3 (ST-3)

Stratigraphic Trench 3 (ST-3) (440 x 100 x 130 cm) was located on a northeast/southwest axis (70°/250°). The surface of ST-3 contained sporadic sugar cane stalks, along with scattered grass patches and previously disturbed top soil. ST-3 contained two stratigraphic layers (Figure 10 and Figure 11).

Layer I (0-90 cmbs) consisted of dark reddish brown (5YR 3/2) dry, compacted silt and semi-plastic silty clay. No roots or stones were present throughout Layer I. The lower was gradual and wavy.

Layer II (90-130 cmbs) consisted of gray (5YR 3/2) compacted wet plastic. Stones were present throughout Layer II, but no Traditional or Historic artifacts were present in Layer II.



Figure 6: Photographic View of Stratigraphic Trench 1 (ST-1). View to North.

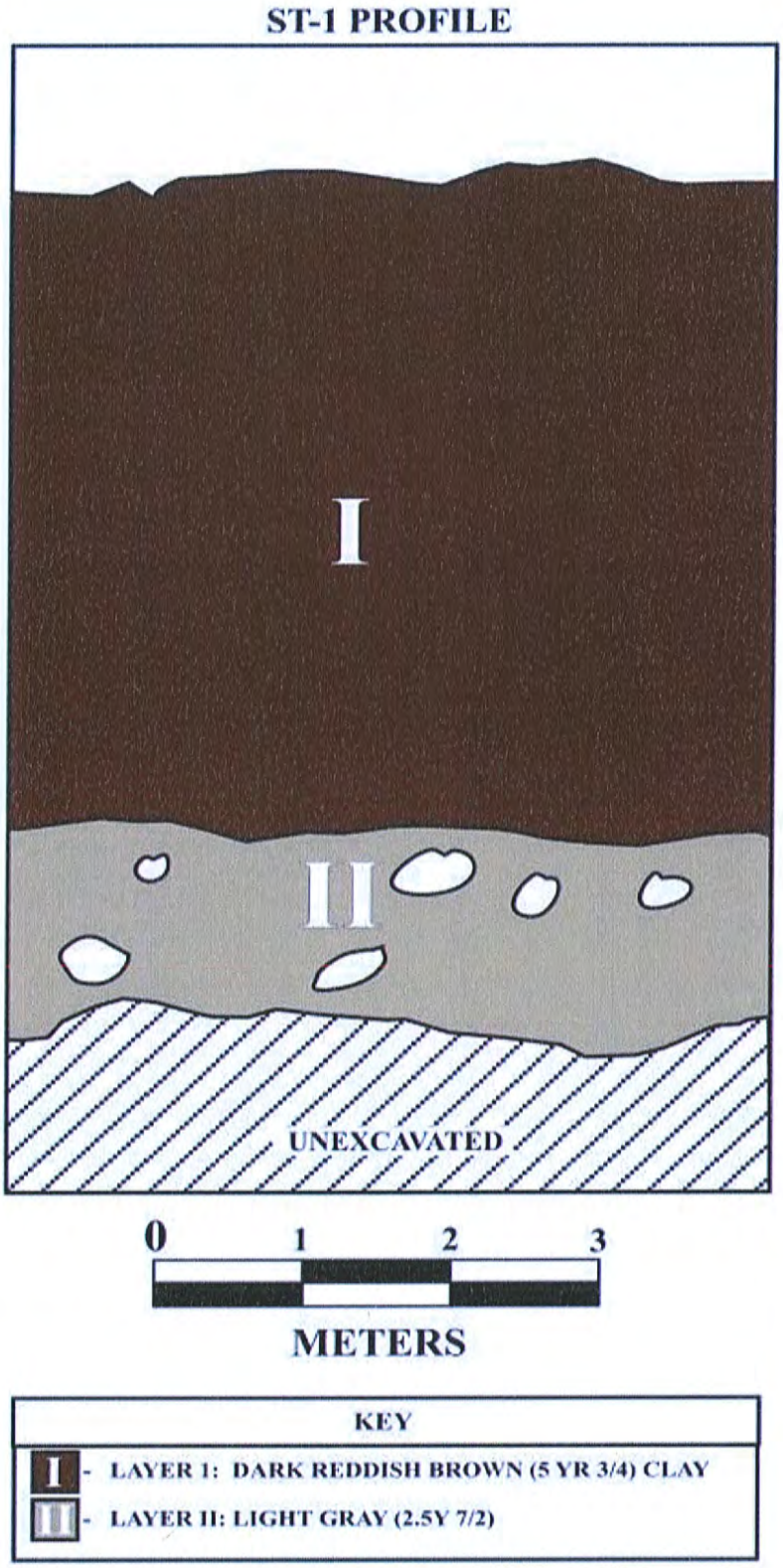

Figure 7: Stratigraphic Trench 1 (ST-1) Profile.

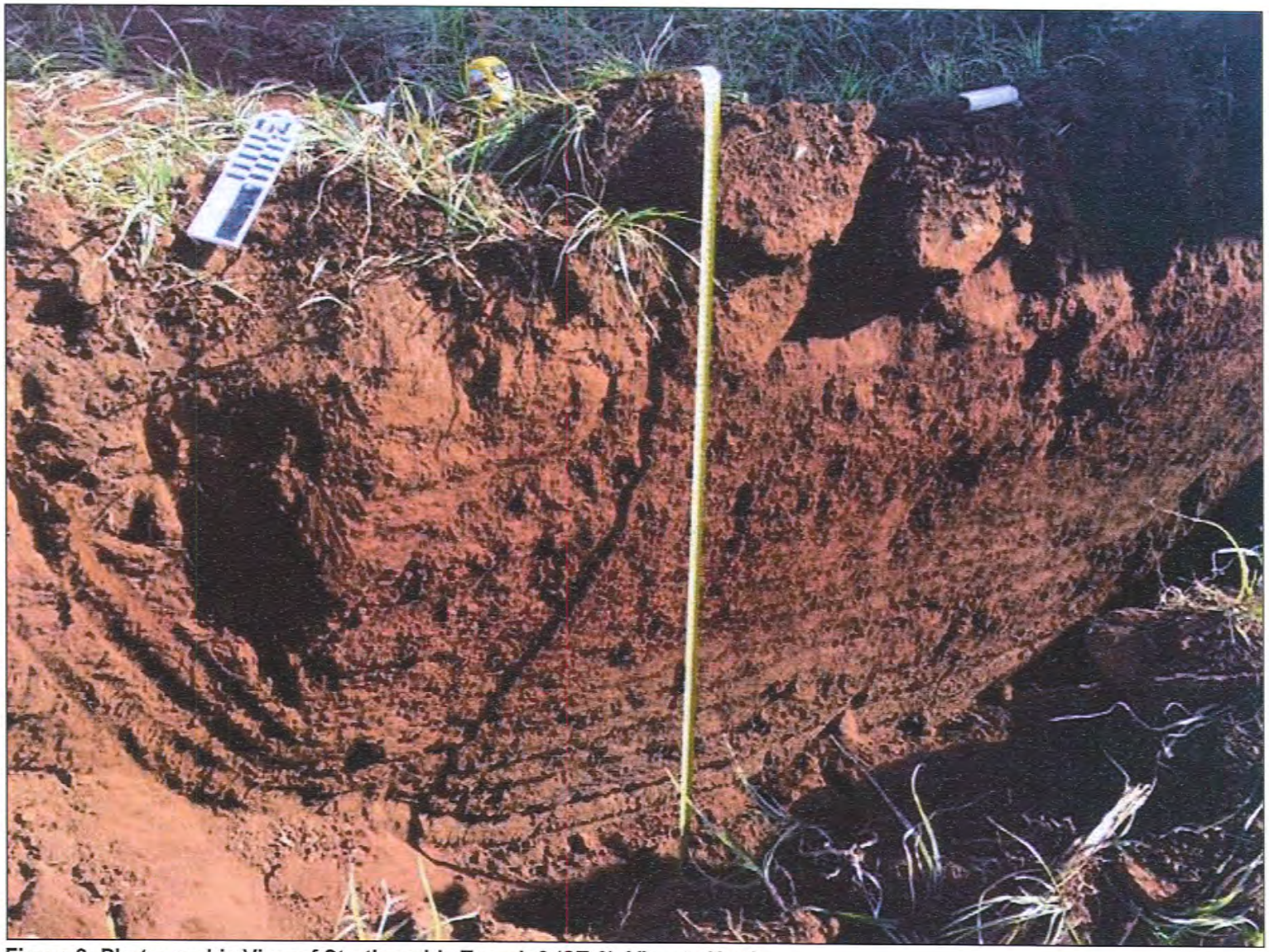

Figure 8: Photographic View of Stratigraphic Trench 2 (ST-2). View to North.



Figure 9: Stratigraphic Trench 2 (ST-2) Profile.



Figure 10: Photographic View of Stratigraphic Trench 3 (ST-3). View to Northwest.

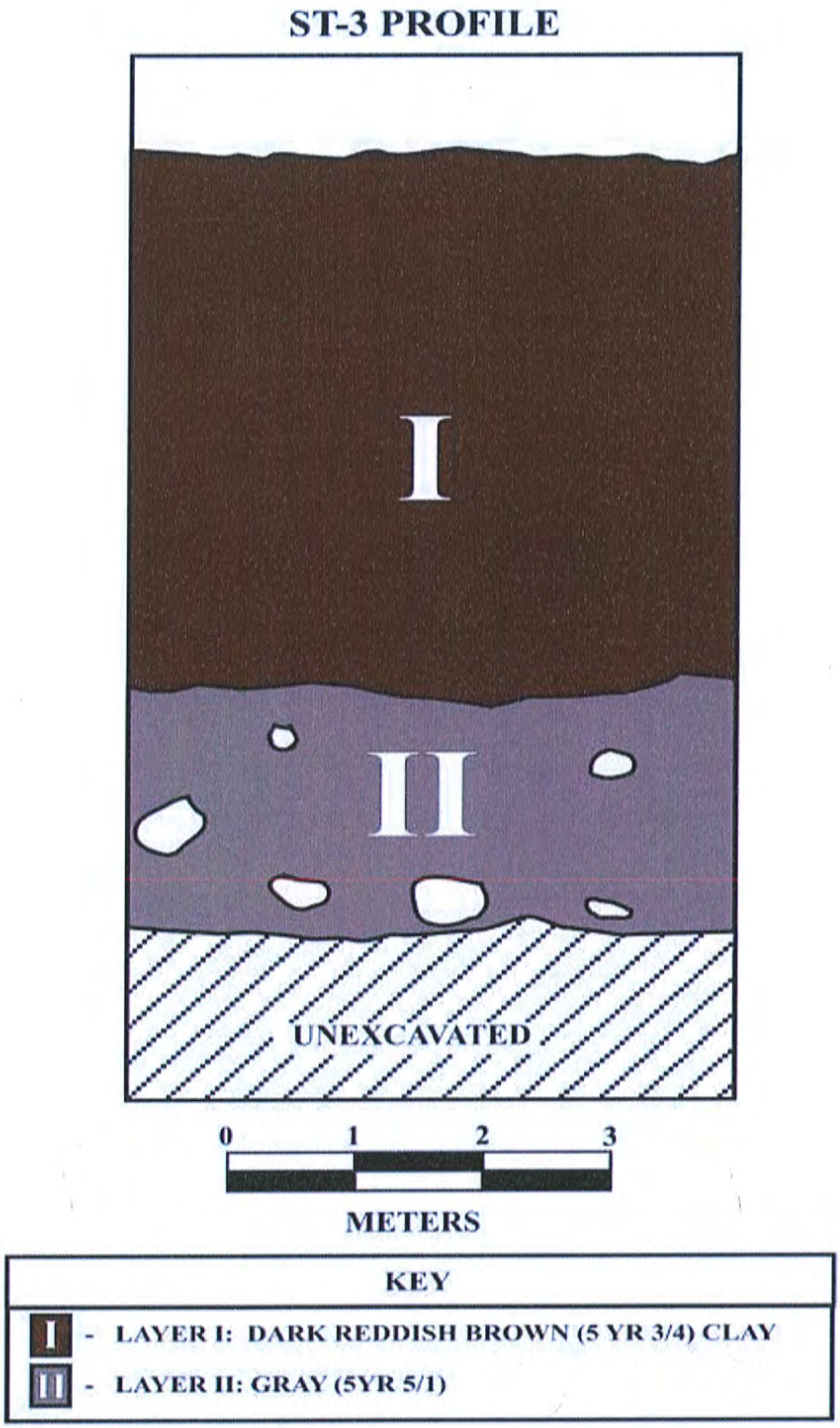

Figure 11: Stratigraphic Trench 3 (ST-3) Profile.

STRATIGRAPHIC TRENCH 4 (ST-4)

Stratigraphic Trench 4 (ST-4) (420 x 90 x 130 cm) was located on an east/west axis (90°/270°). The surface of ST-4 contained sporadic sugar cane stalks, along with scattered grass patches and previously disturbed top soil. ST-4 contained one stratigraphic layer (Figure 12 and Figure 13).

Layer I (0-130 cmbs) consisted of dark reddish brown (5YR 3/4) dry, compacted silt and semi-plastic silty clay. No roots or stones were present within Layer I.

STRATIGRAPHIC TRENCH 5 (ST-5)

Stratigraphic Trench 5 (ST-5) (380 x 90 x 120 cm) was located on a southeast/northwest axis (132°/312°). The surface of ST-5 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-5 contained one stratigraphic layer (Figure 14 and Figure 15).

Layer I (0-120 cmbs) consisted of dark reddish brown (5YR 3/4) compacted silt and semi-plastic silty clay. No roots or stones were present within Layer I.

STRATIGRAPHIC TRENCH 6 (ST-6)

Stratigraphic Trench 6 (ST-6) (390 x 90 x 120 cm) was located on a northeast/southwest axis (30°/210°). The surface of ST-6 contained sporadic sugar cane vegetation, along with scattered grass patches and previously disturbed top soil. ST-6 contained two stratigraphic layers (Figure 16 and Figure 17).

Layer I (0-75 cmbs) consisted of dark reddish brown (5YR 3/2) dry, compacted silt and semi-plastic silty clay. No roots or stones were present throughout Layer I. The lower boundary was gradual and wavy.

Layer II (75-120 cmbs) consisted of gray (5YR 5/1) wet plastic. Stones and bedrock were present throughout Layer II and terminated excavation.



Figure 12: Photographic View of Stratigraphic Trench 4 (ST-4). View to Northwest.



Figure 13: Stratigraphic Trench 4 (ST-4) Profile.

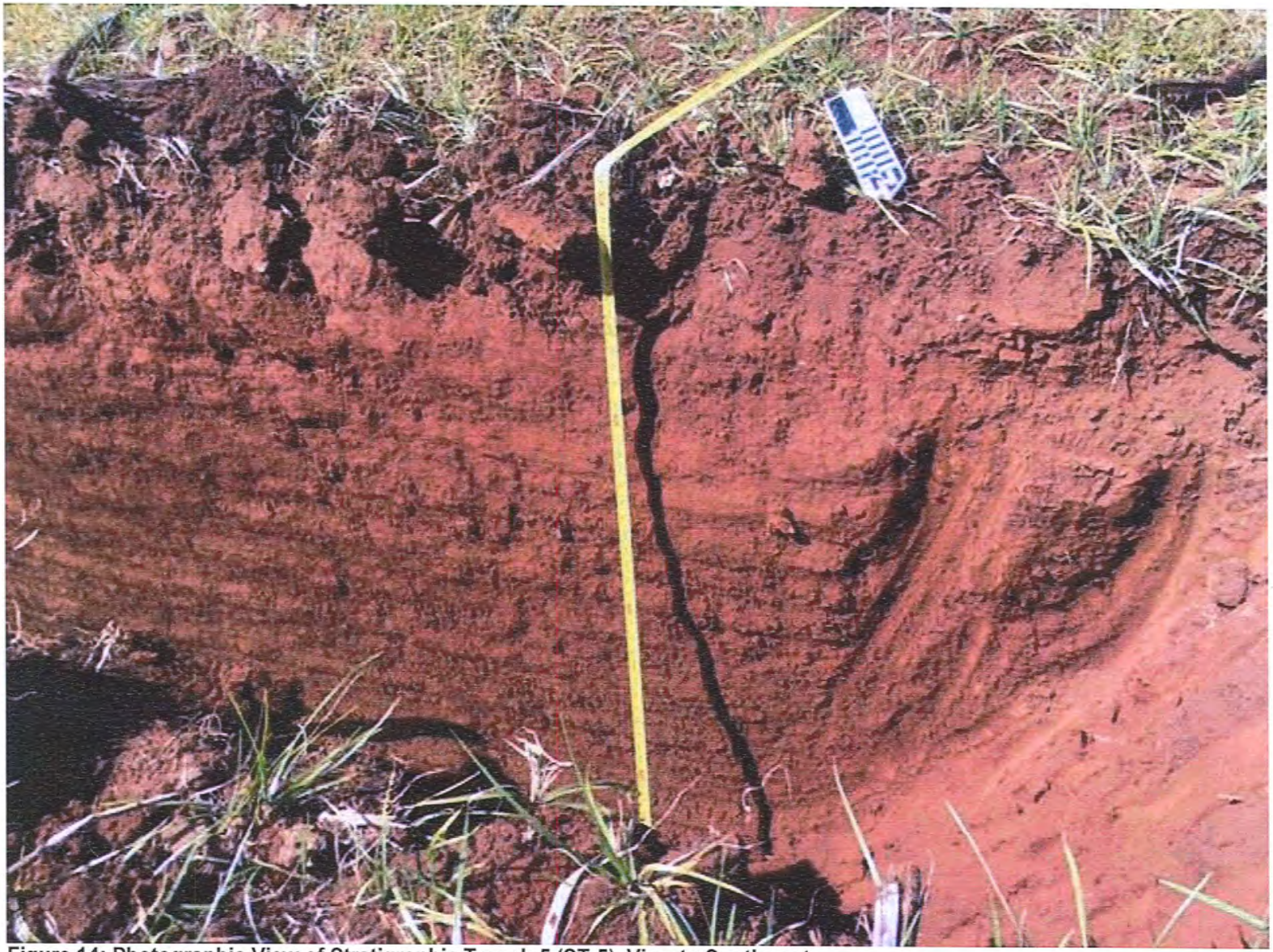

Figure 14: Photographic View of Stratigraphic Trench 5 (ST-5). View to Southwest.



Figure 15: Stratigraphic Trench 5 (ST-5) Profile.



Figure 16: Photographic View of Stratigraphic Trench 6 (ST-6). View to East.



Figure 17: Stratigraphic Trench 6 (ST-6) Profile.

STRATIGRAPHIC TRENCH 7 (ST-7)

Stratigraphic Trench 7 (ST-7) (460 x 100 x 170 cm) was located on a northwest/southeast axis (130°/310°). The surface of ST-7 contained sporadic sugar cane stalks, along with scattered grass patches and previously disturbed top soil. ST-7 contained two stratigraphic layers (Figure 18 and Figure 19).

Layer I (0-150 cmbs) consisted of dark reddish brown (5YR 3/2) dry, compacted silt and semi-plastic silty clay. No roots or stones were present throughout Layer I. The lower boundary was gradual and wavy.

Layer II (150-170 cmbs) consisted of gray (5YR 5/1) wet plastic. Stones were present throughout Layer II and ended the excavation.

STRATIGRAPHIC TRENCH 8 (ST-8)

Stratigraphic Trench 8 (ST-8) (440 x 90 x 145 m) was located on a northeast/southwest axis (20°/200°). The surface of ST-8 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-8 contained two stratigraphic layers (Figure 20 and Figure 21).

Layer I (0-90 cmbs) consisted of dark reddish brown (5YR 3/3) dry, compacted silt and semi-plastic silty clay. No roots or stones were present throughout Layer I. The lower boundary was gradual and wavy.

Layer II (90-145 cmbs) consisted of reddish gray (5YR 5/2) compacted silt and semi-plastic silty clay. No roots or stones were present throughout Layer II.

STRATIGRAPHIC TRENCH 9 (ST-9)

Stratigraphic Trench 9 (ST-9) (440 x 90 x 145 cm) was located on a northeast/southwest axis (20°/200°). The surface of ST-9 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-9 contained two stratigraphic layers (Figure 22 and Figure 23).

Layer I (0-90 cmbs) consisted of dark reddish brown (5YR 3/3) dry, compacted silt and semi-plastic silty clay. No roots or stones were present throughout Layer I. The lower boundary was gradual and wavy.

Layer II (90-145 cmbs) consisted of gray (5YR 5/2) compacted silt and semi-plastic silty clay. No roots or stones were present throughout Layer II.

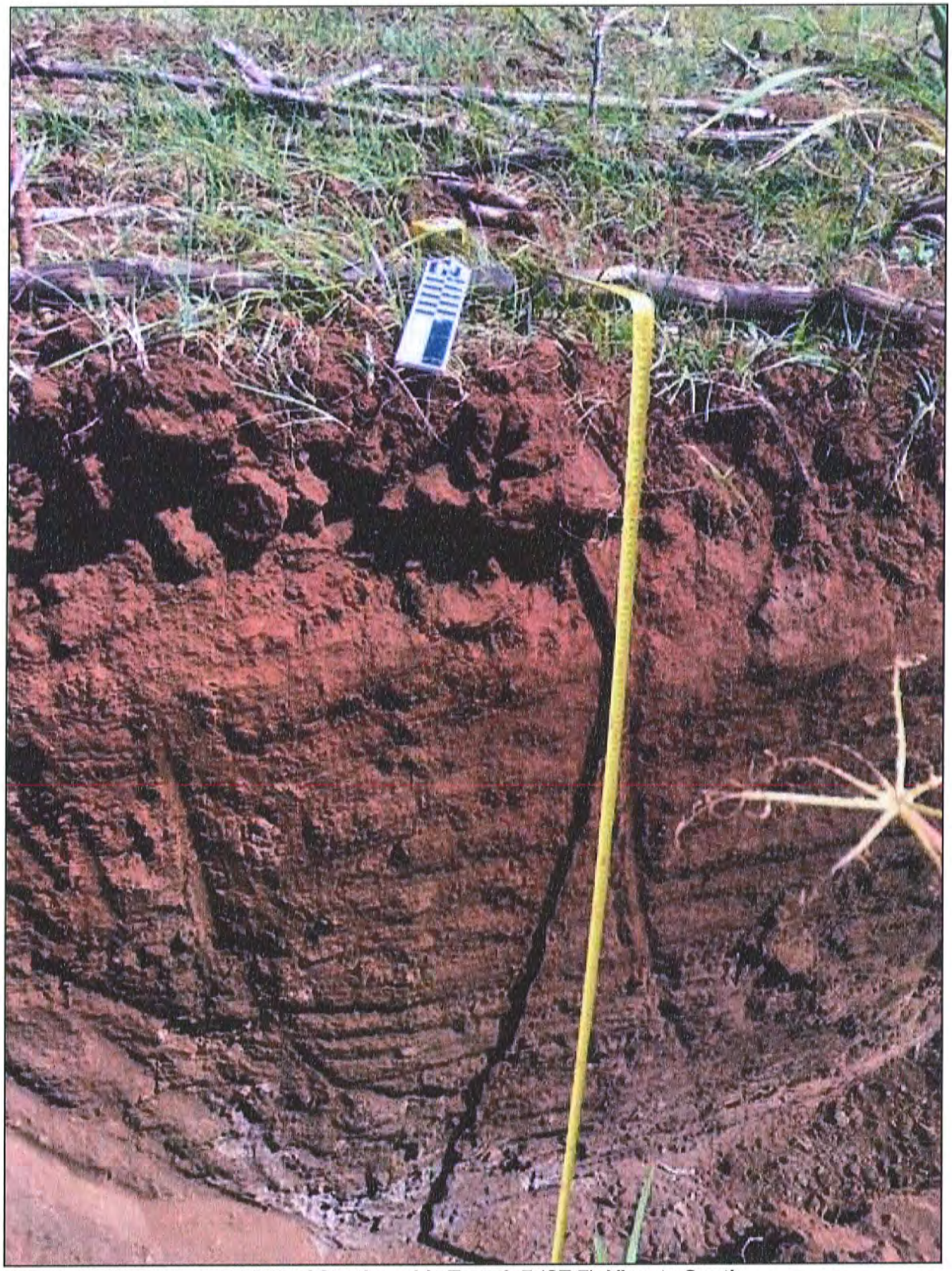

Figure 18: Photographic View of Stratigraphic Trench 7 (ST-7). View to South.

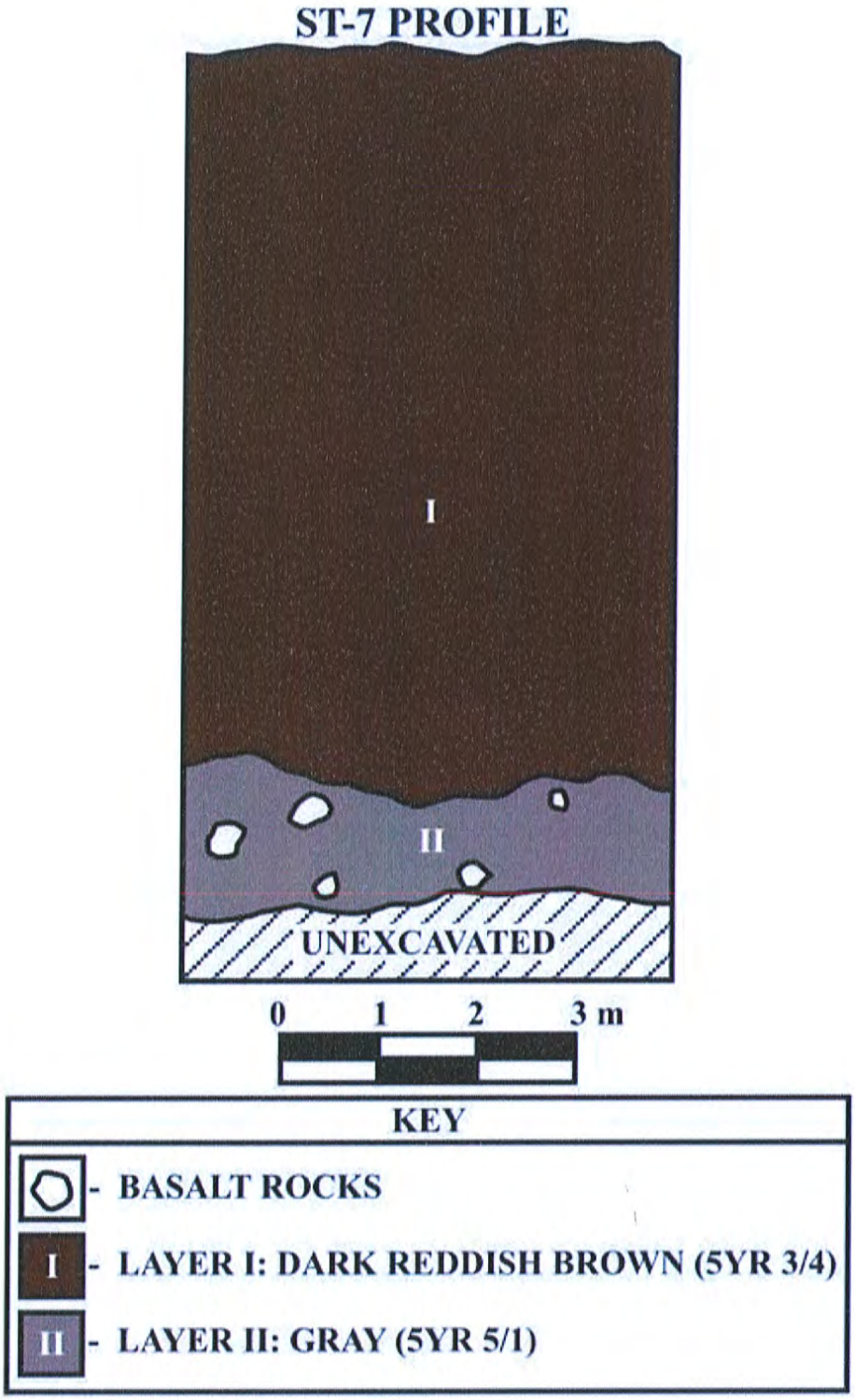

Figure 19: Stratigraphic Trench 7 (ST-7) Profile.



Figure 20: Photographic View of Stratigraphic Trench 8 (ST-8). View to Northwest.

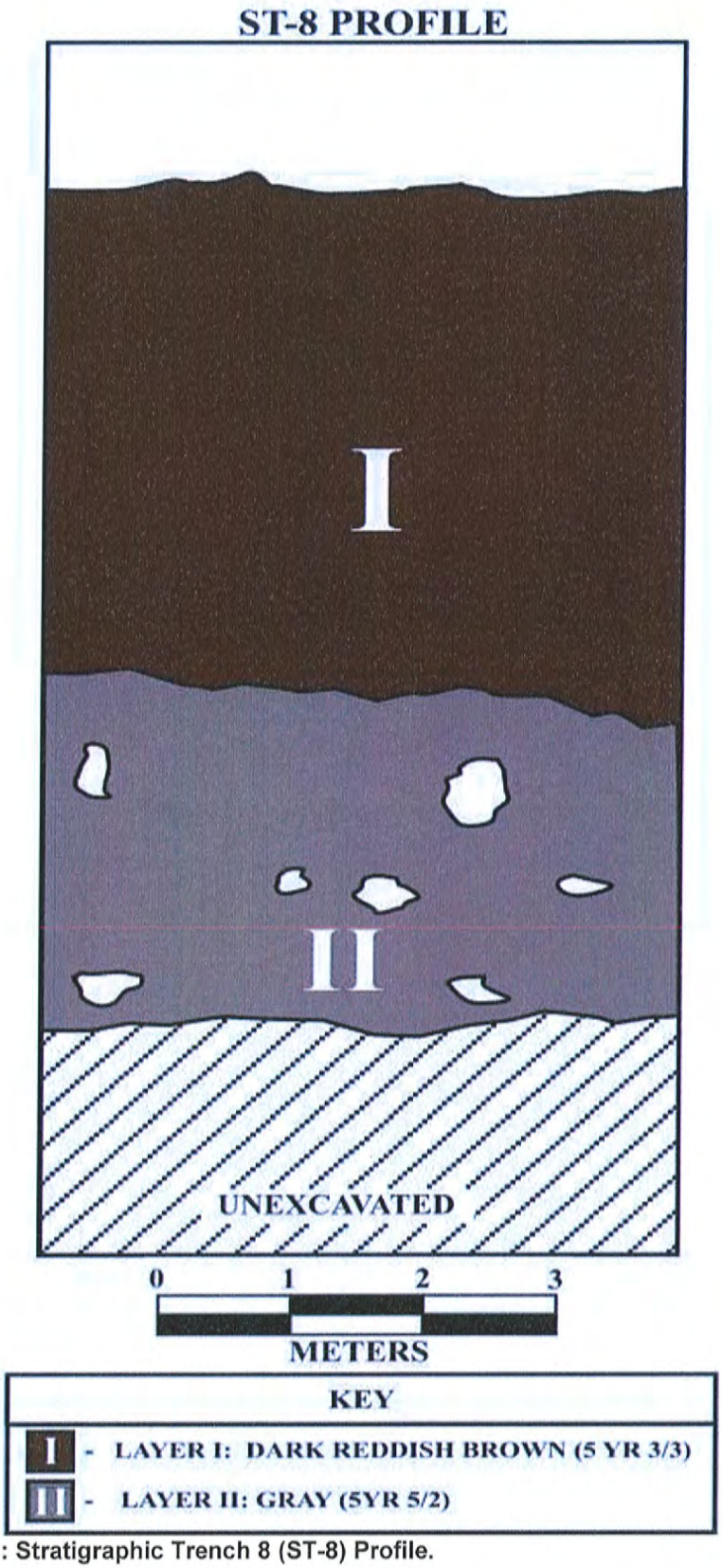

Figure 21: Stratigraphic Trench 8 (ST-8) Profile.



Figure 22: Photographic View of Stratigraphic Trench 9 (ST-9). View to South.

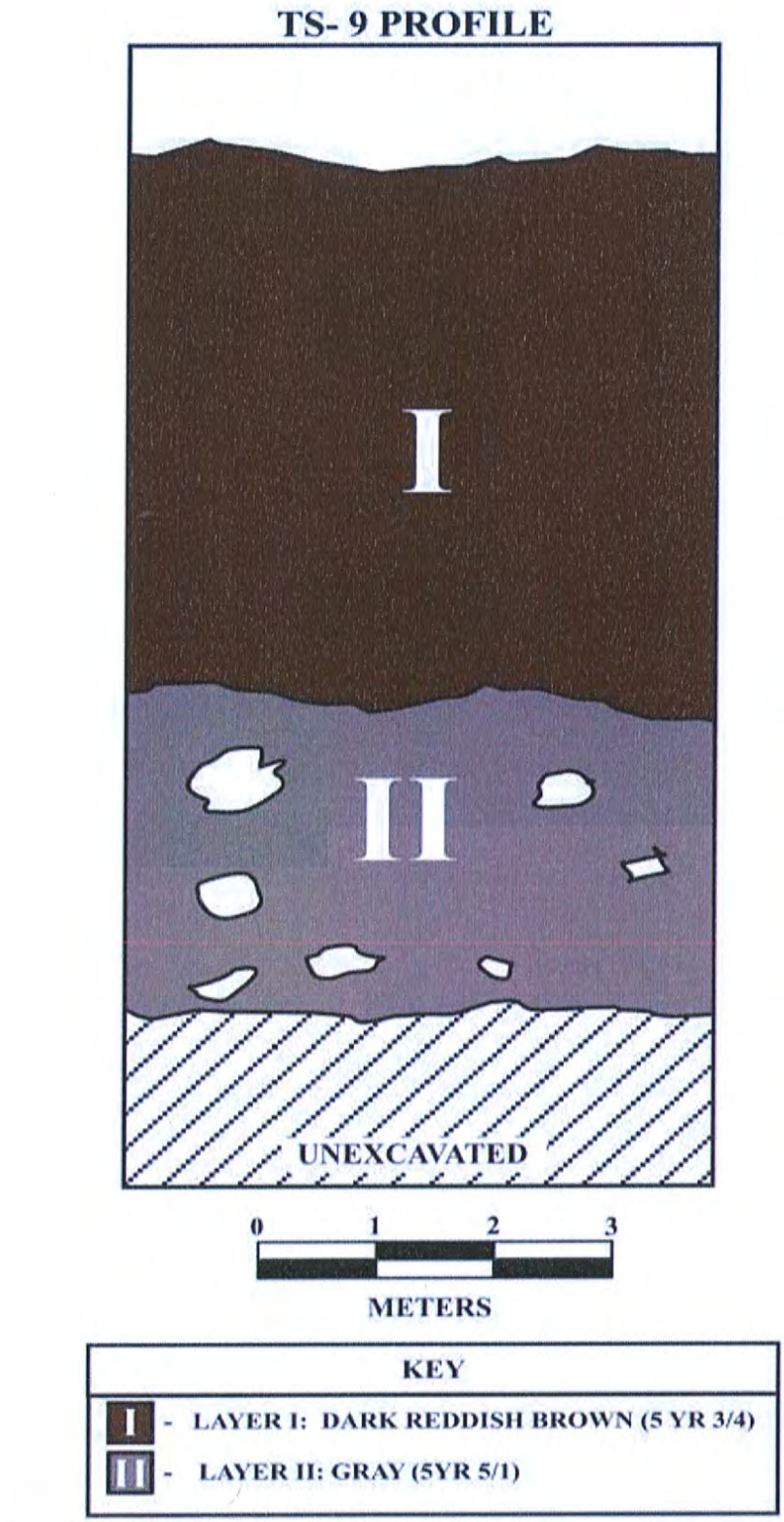

Figure 23: Stratigraphic Trench 9 (ST-9) Profile.

STRATIGRAPHIC TRENCH 10 (ST-10)

Stratigraphic Trench 10 (ST-10) (400 x 100 x 180 cm) was located on a northeast/southwest axis (20°/200°). The surface of ST-10 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-10 contained two stratigraphic layers (Figure 24 and Figure 25).

Layer I (0-100 cmbs) consisted of dark reddish brown (5YR 3/2) dry, compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I. The lower boundary was abrupt and smooth.

Layer II (100-180 cmbs) consisted of gray (10YR 5/1) compacted silt and semi-plastic silty clay. Stones were present throughout Layer II.

STRATIGRAPHIC TRENCH 11 (ST-11)

Stratigraphic Trench 11 (ST-11) (380 x 90 x 160 cm) was located on a northwest/southeast axis (340°/160°). The surface of ST-11 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-11 contained two stratigraphic layers (Figure 26 and Figure 27).

Layer I (0-80 cmbs) consisted of dark reddish brown (5YR 3/2) dry, compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I. The lower boundary was abrupt and smooth.

Layer II (80-160 cmbs) consisted of gray (10YR 5/1) compacted silt and semi-plastic silty clay. Stones were present throughout Layer II.

STRATIGRAPHIC TRENCH 12 (ST-12)

Stratigraphic Trench 12 (ST-12) (470 x 100 x 165 cm) was located on a southeast/northwest axis (160°/340°). The surface of ST-12 contained sporadic sugar cane stalks, along with scattered grass patches and previously disturbed top soil. ST-12 contained two stratigraphic layers (Figure 28 and Figure 29).

Layer I (0-80 cmbs) consisted of dark reddish brown (2.5YR 3/4) dry, compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I. The lower boundary was abrupt and smooth.

Layer II (80-165 cmbs) consisted of gray (5YR 3/3) compacted silt and semi-plastic silty clay. Stones were present throughout Layer II.

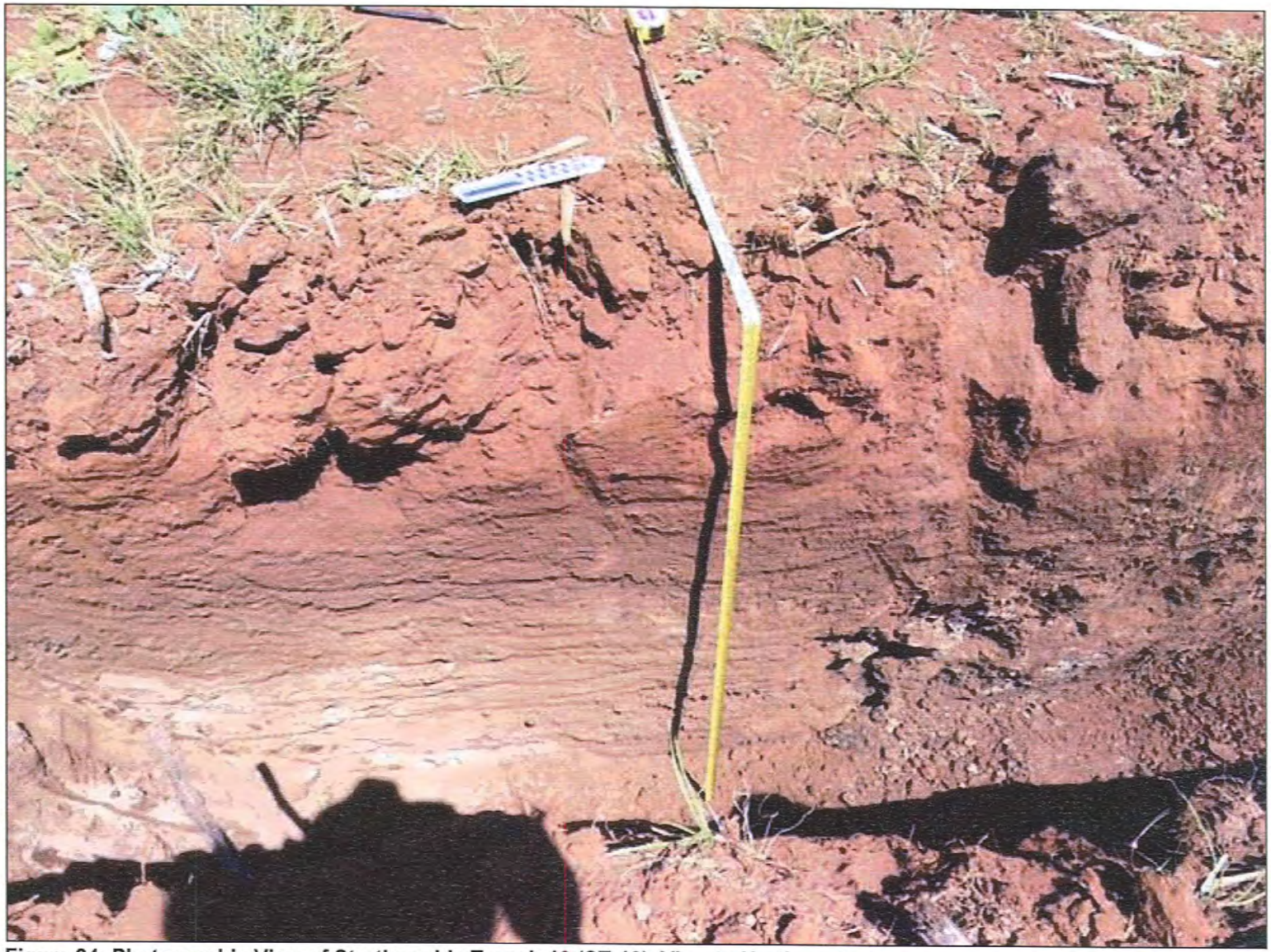

Figure 24: Photographic View of Stratigraphic Trench 10 (ST-10). View to Northwest.

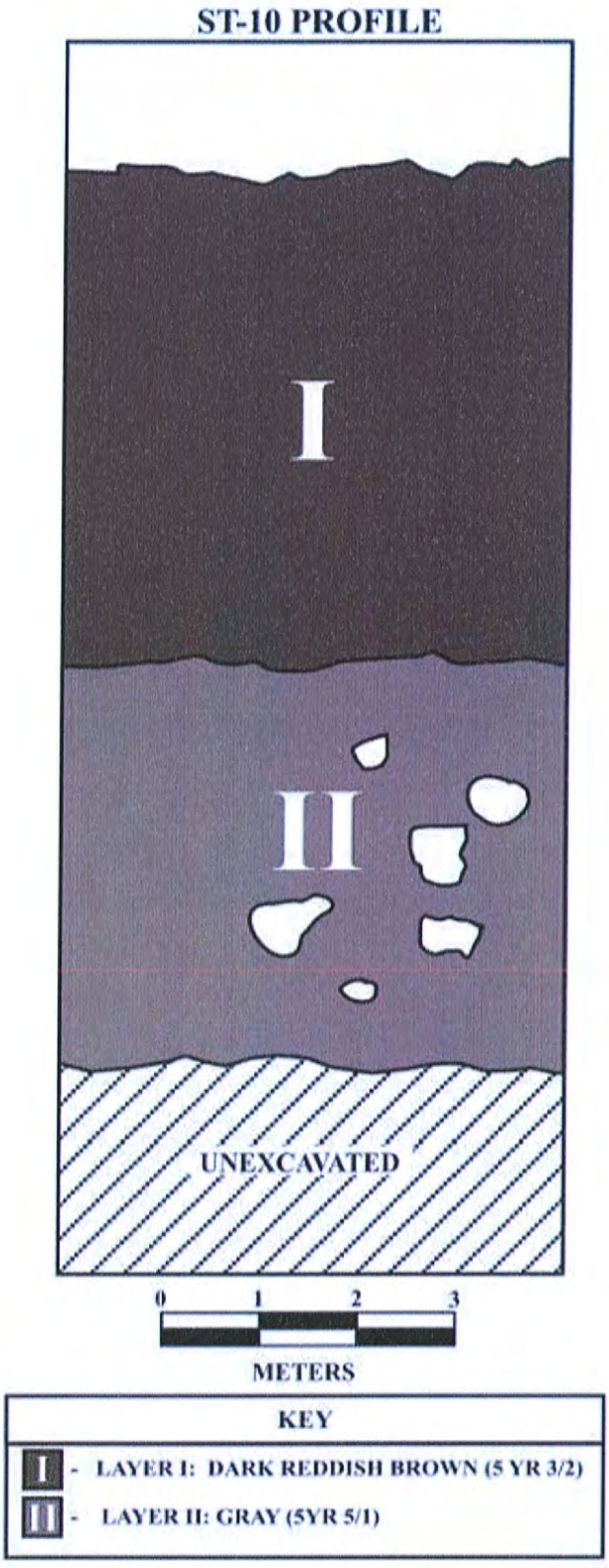

Figure 25: Stratigraphic Trench 10 (ST-10) Profile.

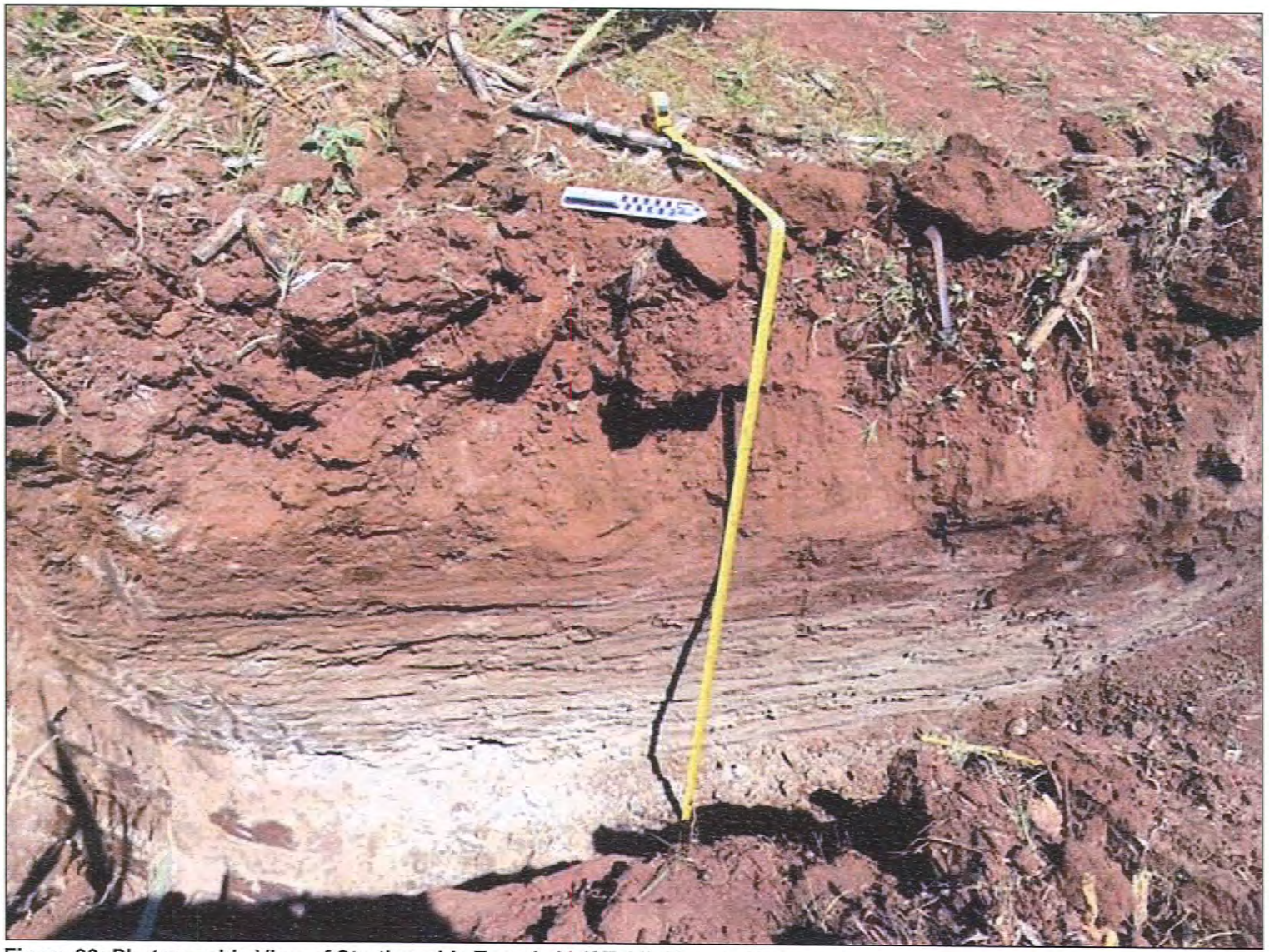

Figure 26: Photographic View of Stratigraphic Trench 11 (ST-11). View to Northwest.

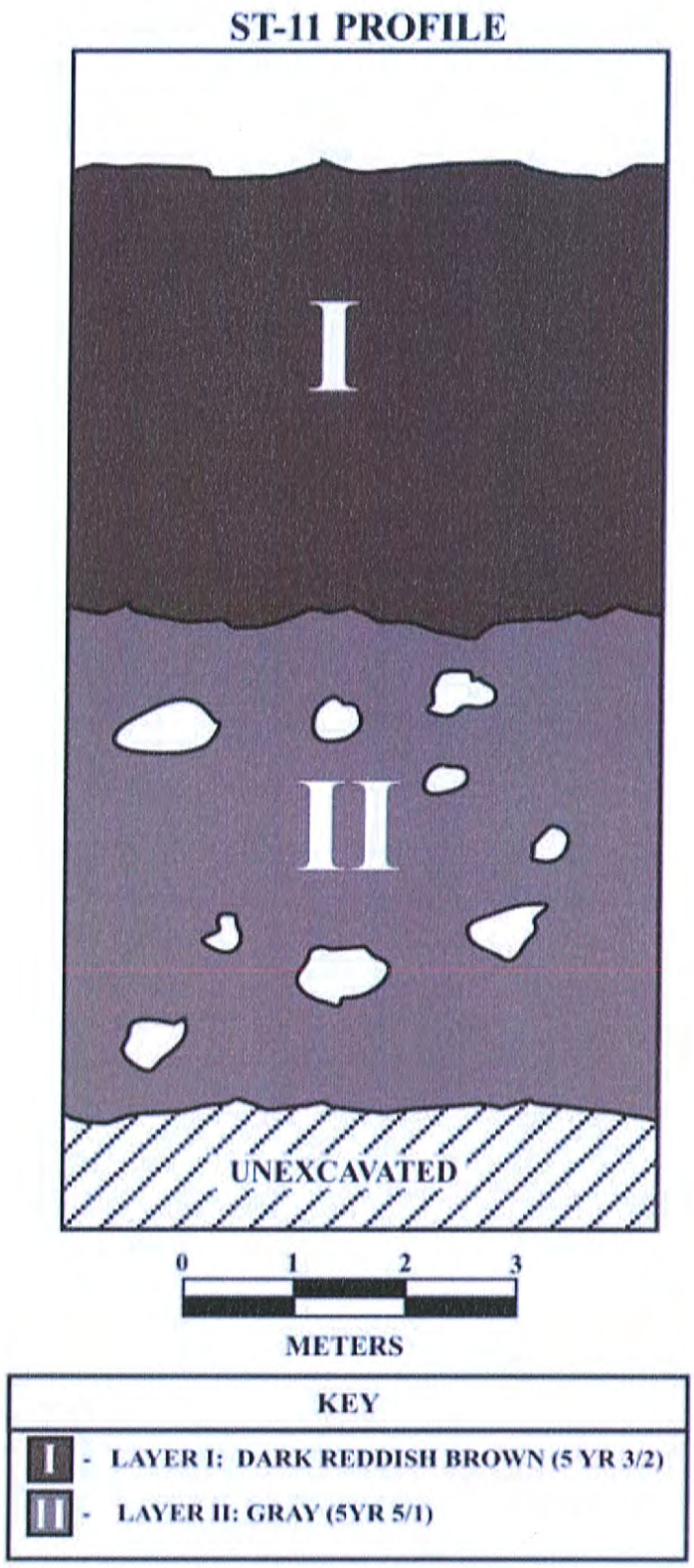

Figure 27: Stratigraphic Trench 11 (ST-11) Profile.

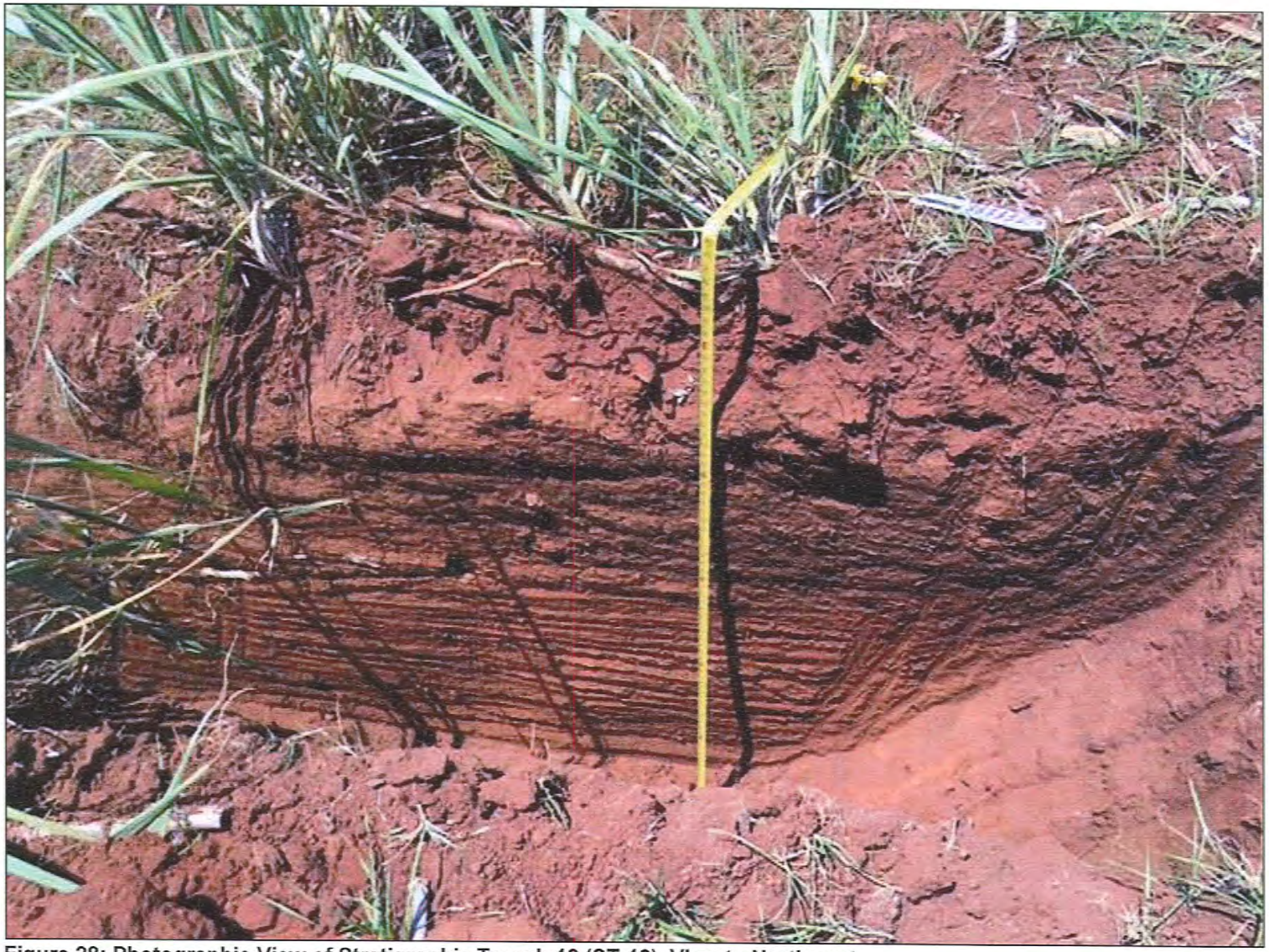

Figure 28: Photographic View of Stratigraphic Trench 12 (ST-12). View to Northwest.

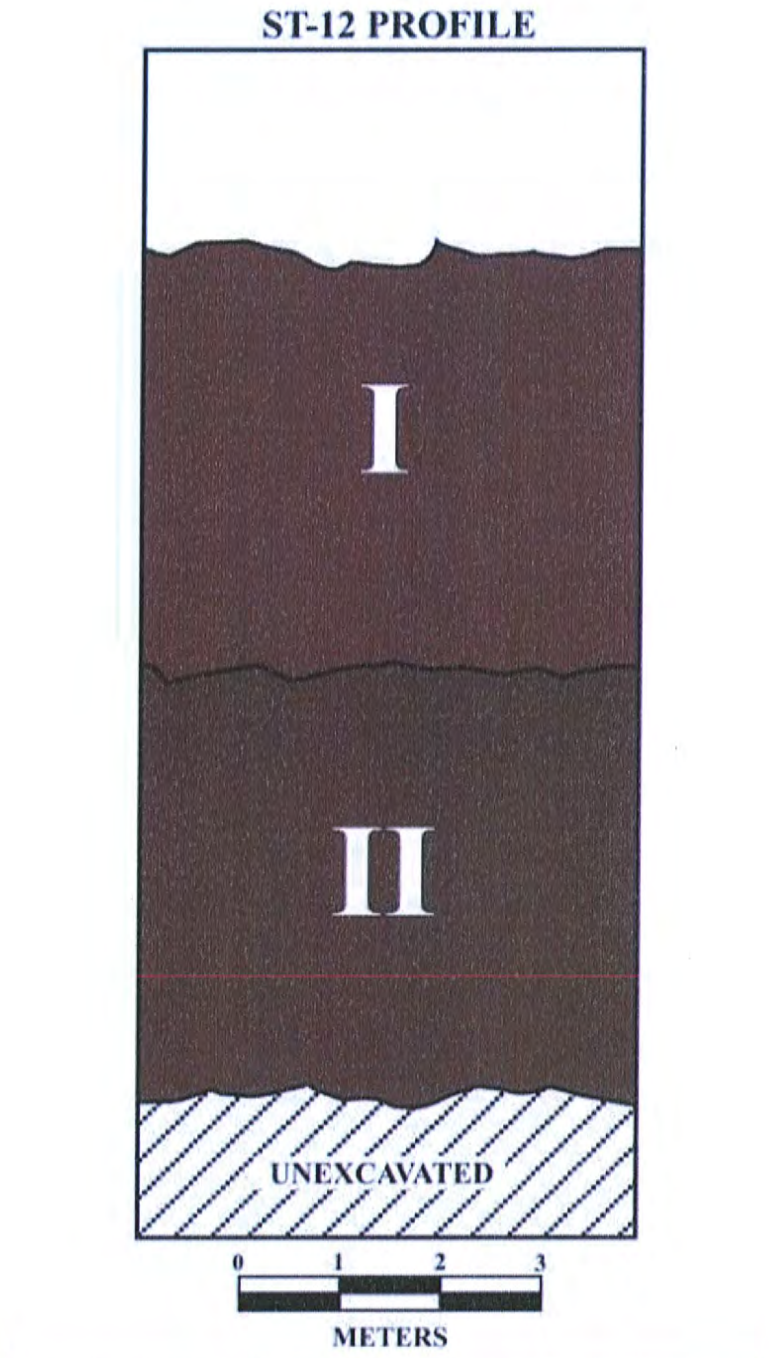

Figure 29: Stratigraphic Trench 12 (ST-12) Profile.

STRATIGRAPHIC TRENCH 13 (ST-13)

Stratigraphic Trench 13 (ST-13) (450 x 95 x 170 m) was located on a southeast/northwest axis (120°/300°). The surface of ST-13 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-13 contained one stratigraphic layer (Figure 30 and Figure 31).

> Layer I (0-170 cmbs) consisted of dark reddish brown (2.5YR 3/3) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.

STRATIGRAPHIC TRENCH 14 (ST-14)

Stratigraphic Trench 14 (ST-14) (450 x 95 x 165 cm) was located on a northeast/southwest axis (50°/230°). The surface of ST-14 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-14 contained one stratigraphic layer (Figure 32 and Figure 33).

> Layer I (0-165 cmbs) consisted of dark reddish brown (2.5YR 3/3) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.

STRATIGRAPHIC TRENCH 15 (ST-15)

Stratigraphic Trench 15 (ST-15) (450 x 100 x 150 cm) was located on a southeast/northwest axis (10°/190°). The surface of ST-15 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-15 contained one stratigraphic layer (Figure 34 and Figure 35).

> Layer I (0-150 cmbs) consisted of dark reddish brown (5YR 3/4) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.

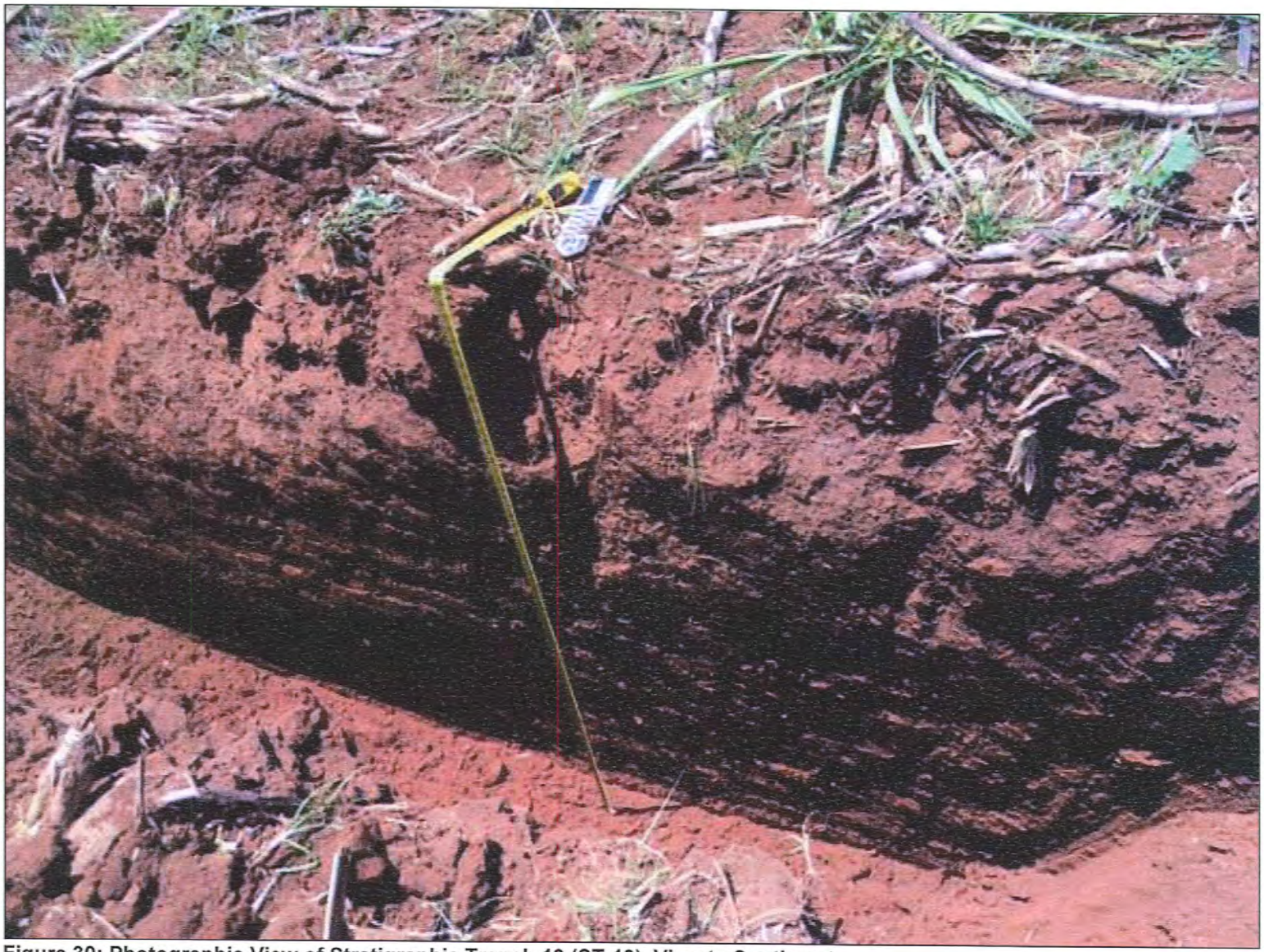

Figure 30: Photographic View of Stratigraphic Trench 13 (ST-13). View to Southeast.

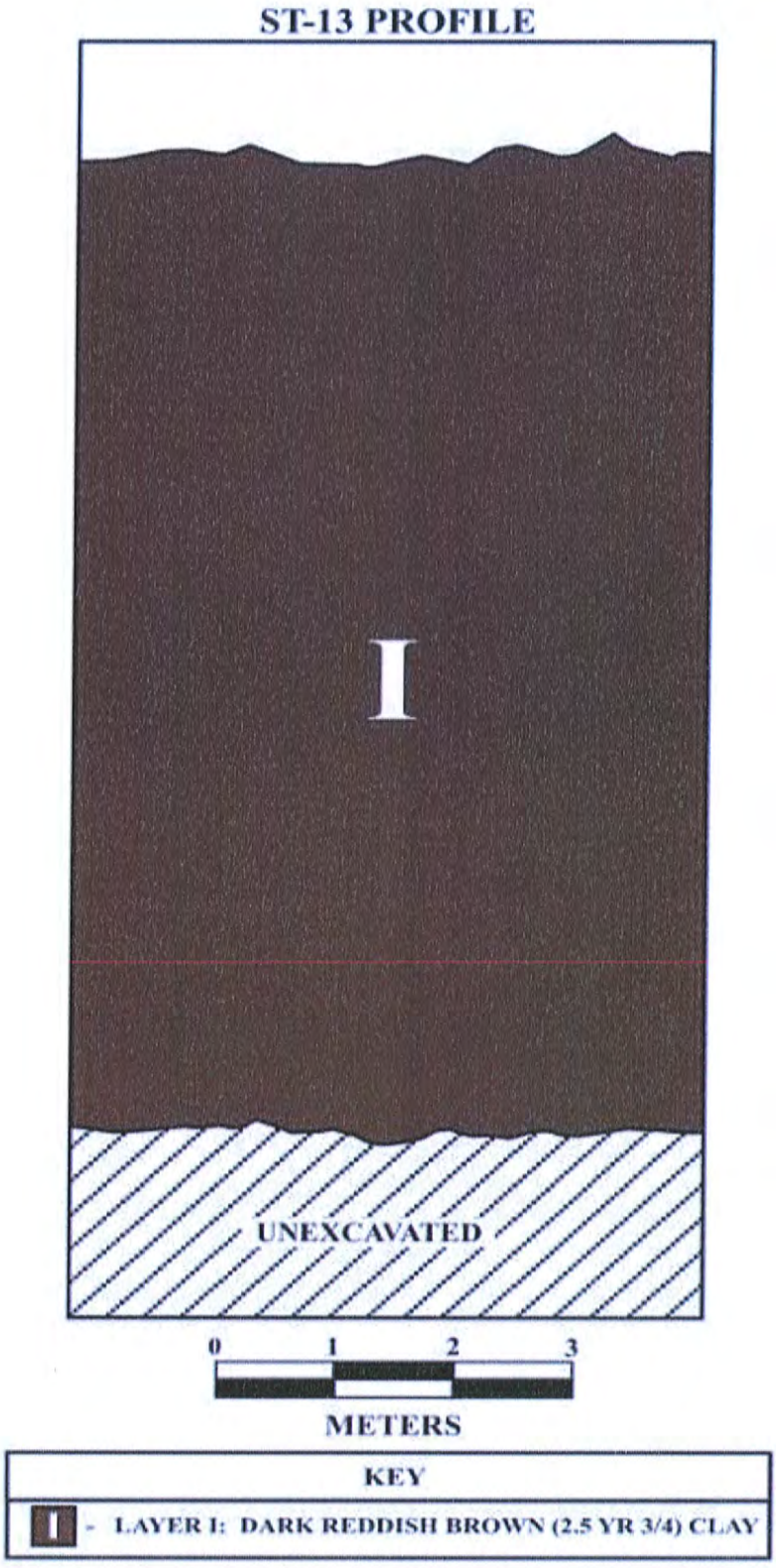

Figure 31: Stratigraphic Trench 13 (ST-13) Profile.

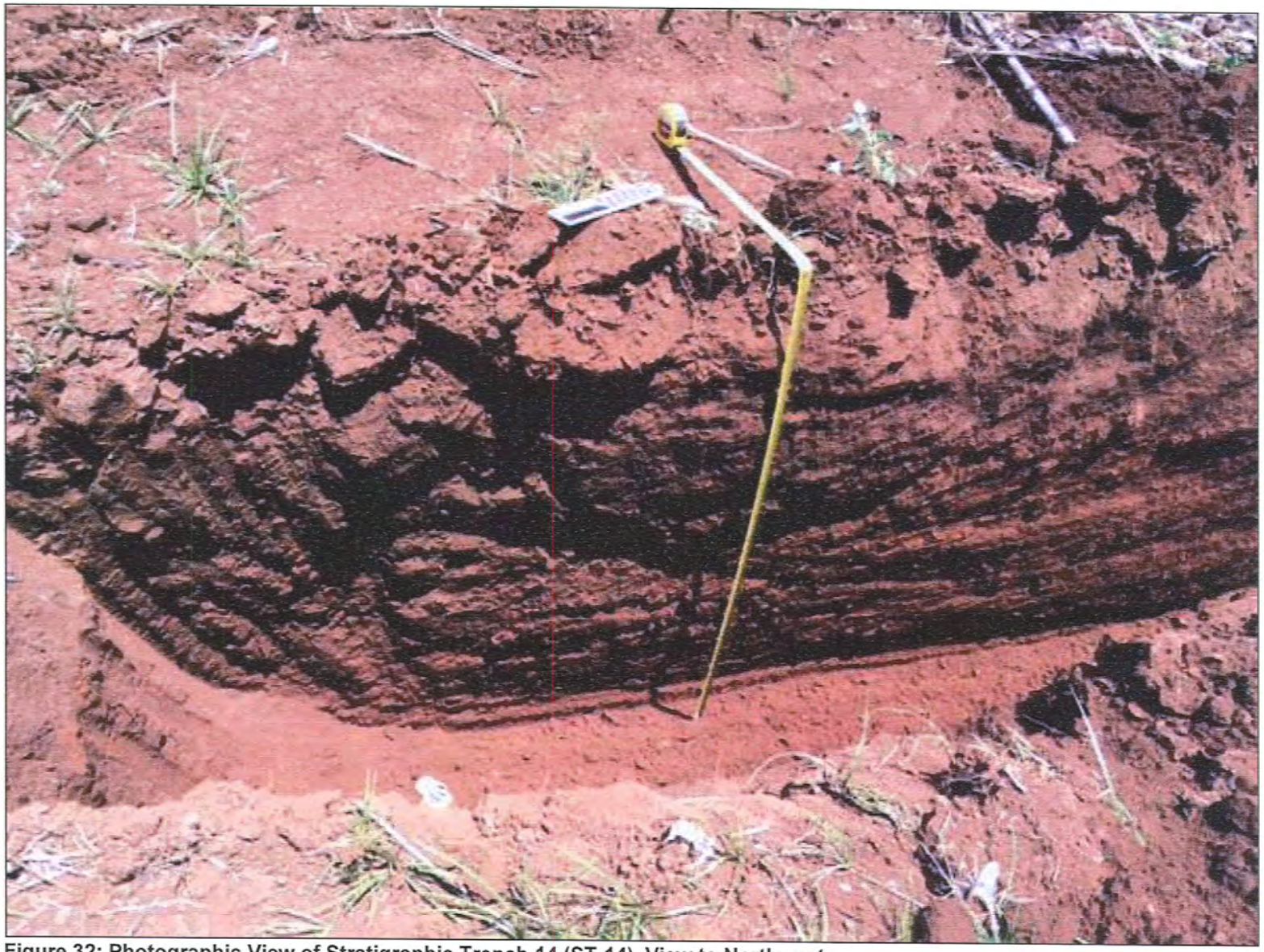

Figure 32: Photographic View of Stratigraphic Trench 14 (ST-14). View to Northwest.

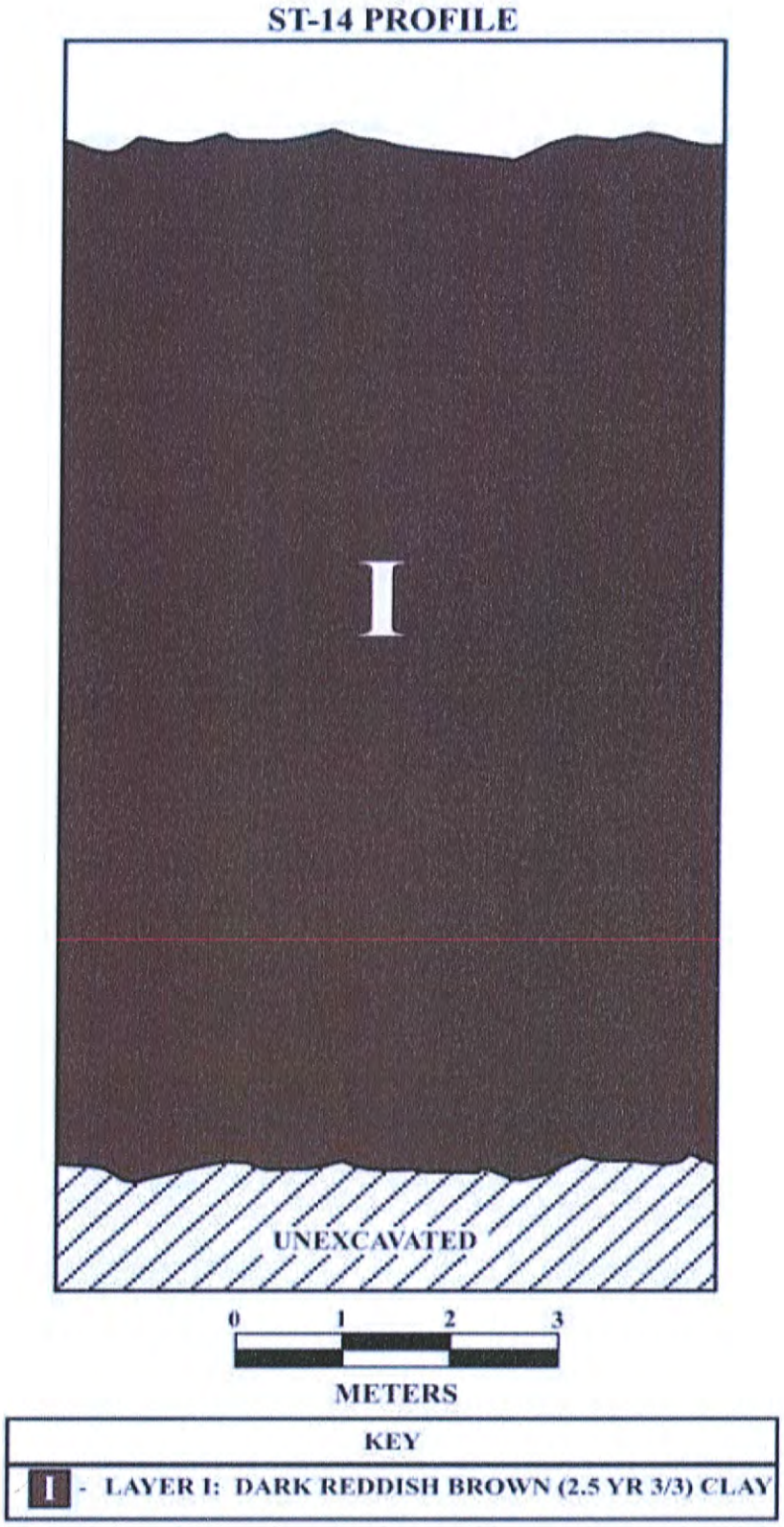

Figure 33: Stratigraphic Trench 14 (ST-14) Profile.

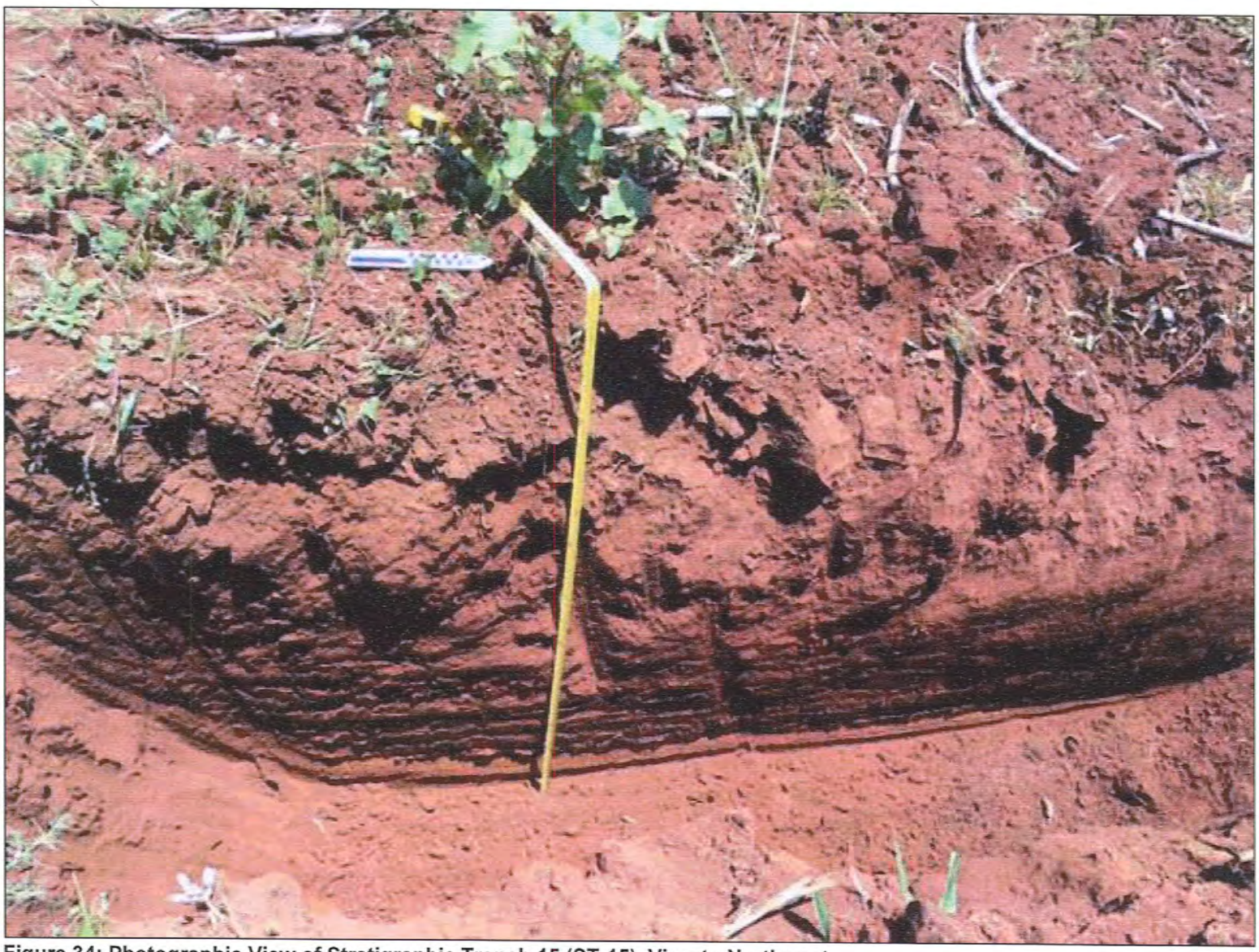

Figure 34: Photographic View of Stratigraphic Trench 15 (ST-15). View to Northwest.

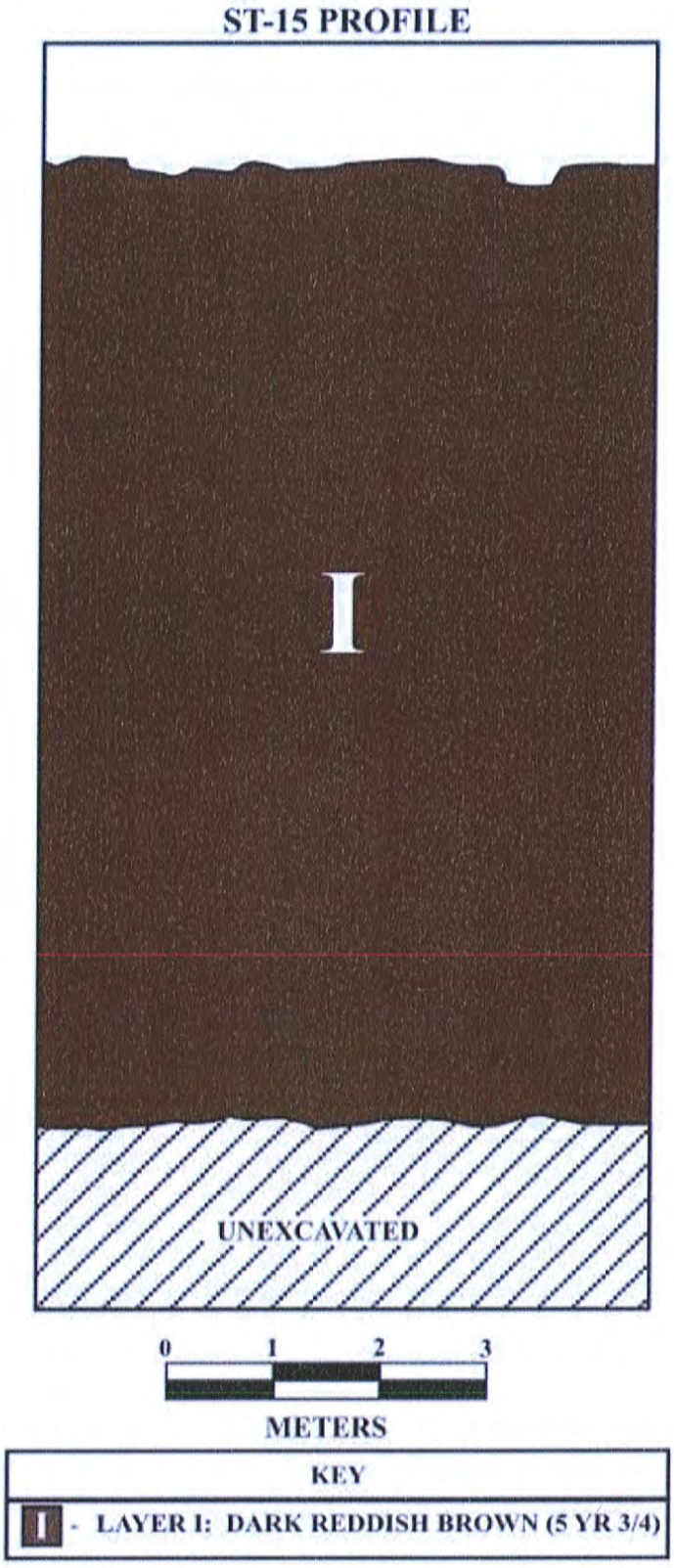

Figure 35: Stratigraphic Trench 15 (ST-15) Profile.

STRATIGRAPHIC TRENCH 16 (ST-16)

Stratigraphic Trench 16 (ST-16) (460 x 90 x 155 cm) was located on an east/west axis (90°/270°). The surface of ST-16 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-16 contained one stratigraphic layer (Figure 36 and Figure 37).

> Layer I (0-155 cmbs) consisted of dark reddish brown (2.5YR 3/4) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.

STRATIGRAPHIC TRENCH 17 (ST-17)

Stratigraphic Trench 17 (ST-17) (420 x 90 x 145 cm) was located on a northeast/southwest axis (70°/250°). The surface of ST-17 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-17 contained one stratigraphic layer (Figure 38 and Figure 39).

> Layer I (0-145 cmbs) consisted of dark reddish brown (2.5YR 3/4) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.

STRATIGRAPHIC TRENCH 18 (ST-18)

Stratigraphic Trench 18 (ST-18) (440 x 90 x 145 cm) was located on a northwest/southeast axis (340°/160°). The surface of ST-18 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-18 contained one stratigraphic layer (Figure 40 and Figure 41).

> Layer I (0-145 cmbs) consisted of dark reddish brown (2.5YR 3/4) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.

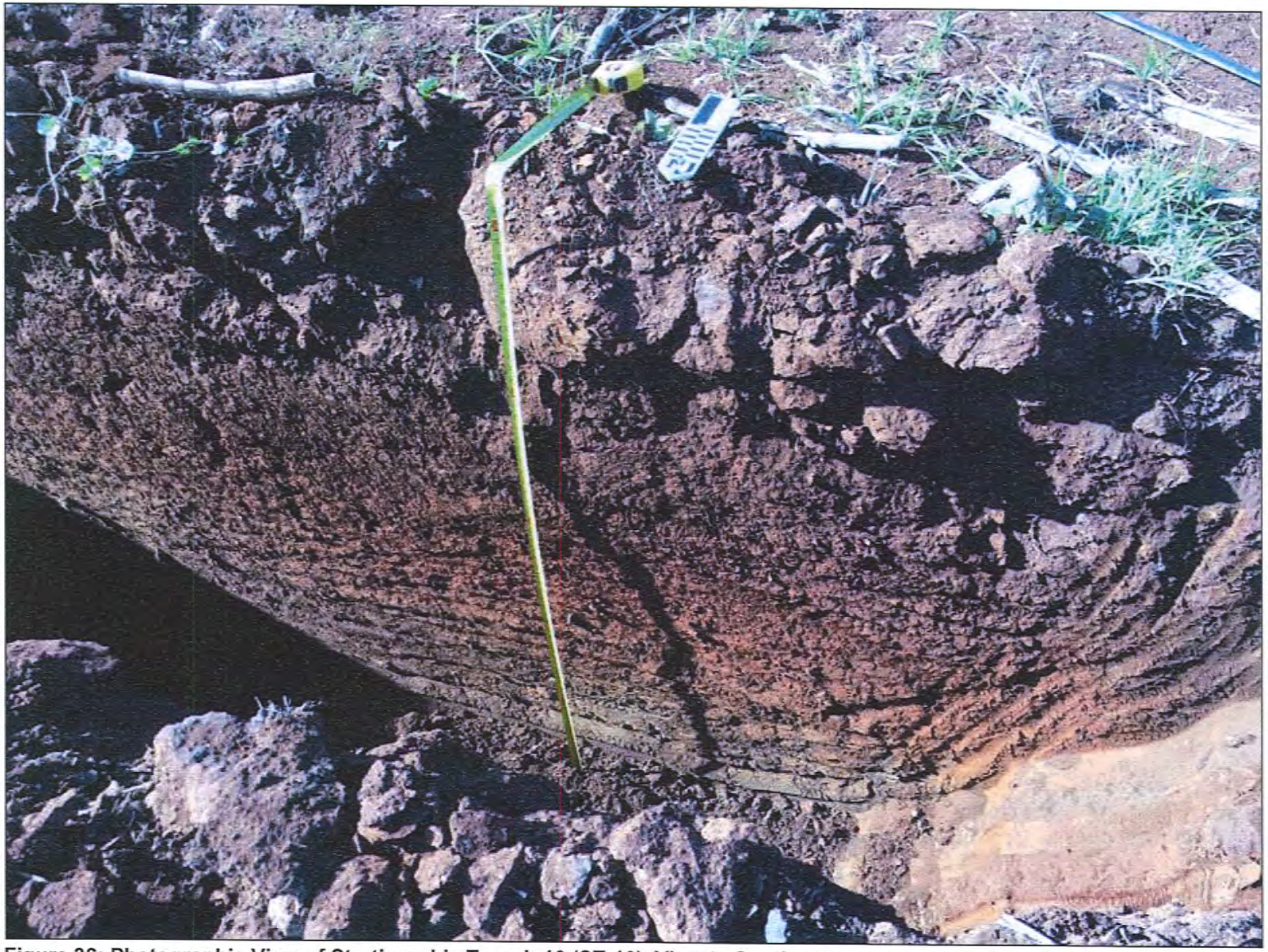

Figure 36: Photographic View of Stratigraphic Trench 16 (ST-16). View to Southeast.

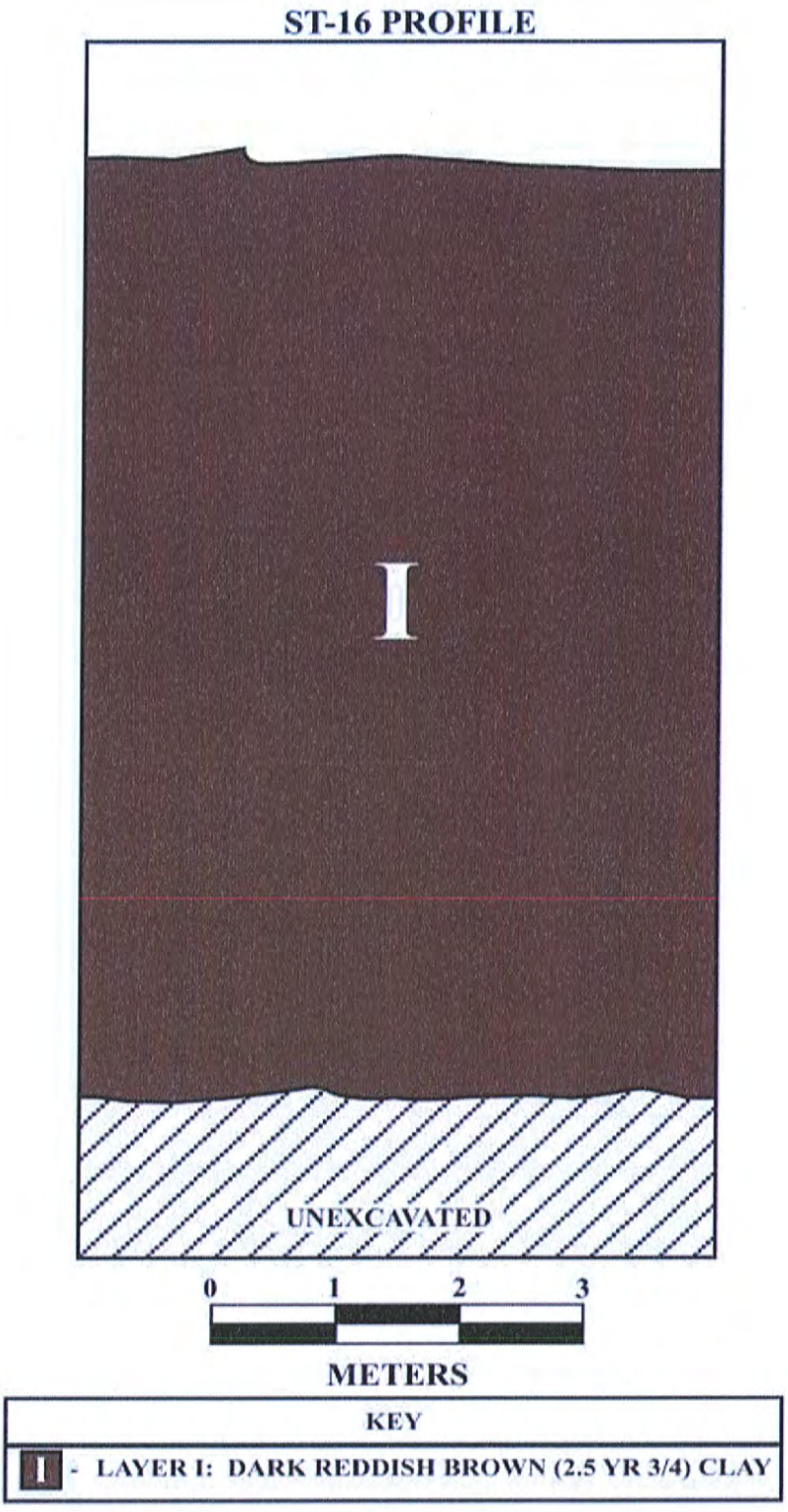

Figure 37: Stratigraphic Trench 16 (ST-16) Profile.



Figure 38: Photographic View of Stratigraphic Trench 17 (ST-17). View to North.

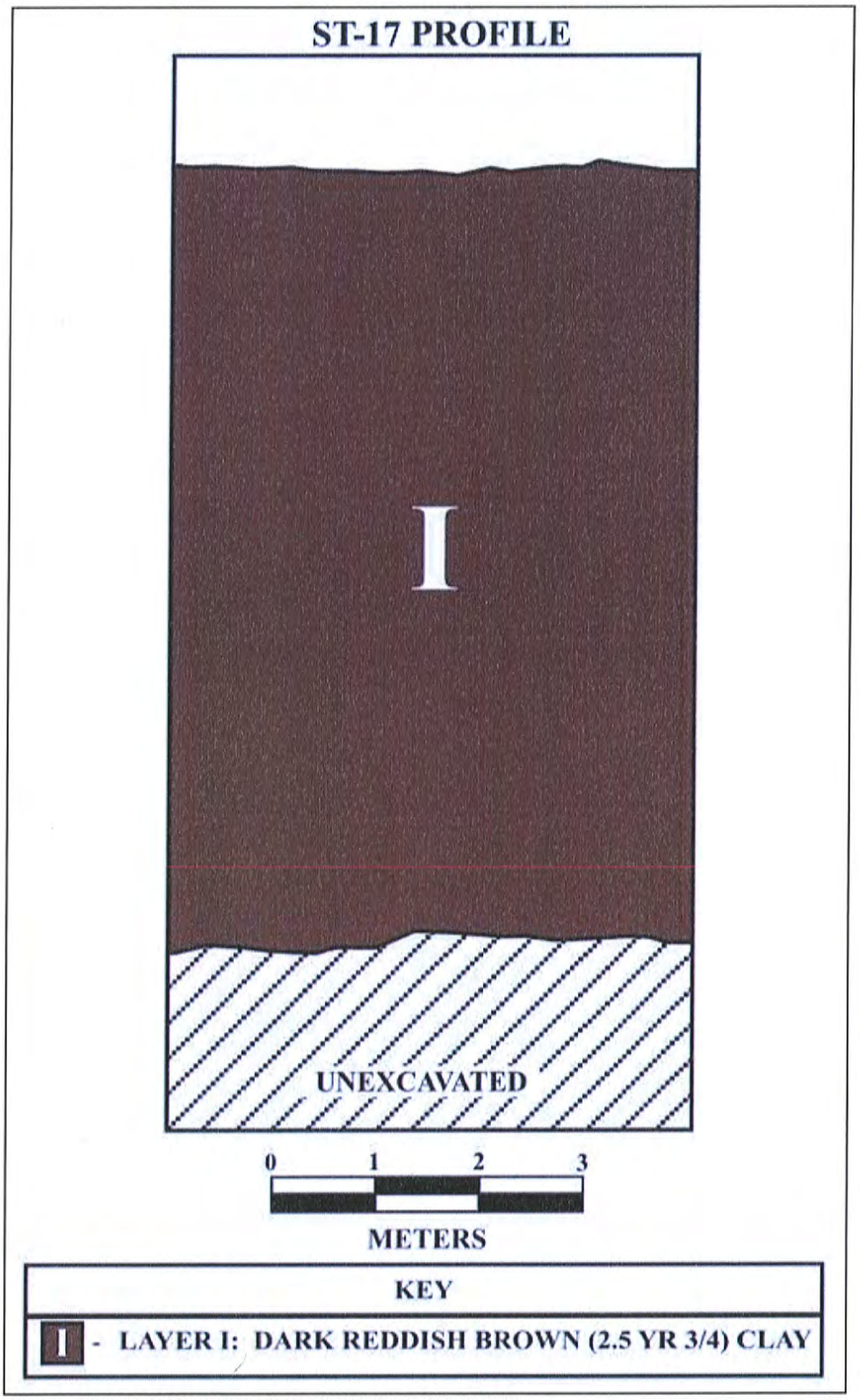

Figure 39: Stratigraphic Trench 17 (ST-17) Profile.

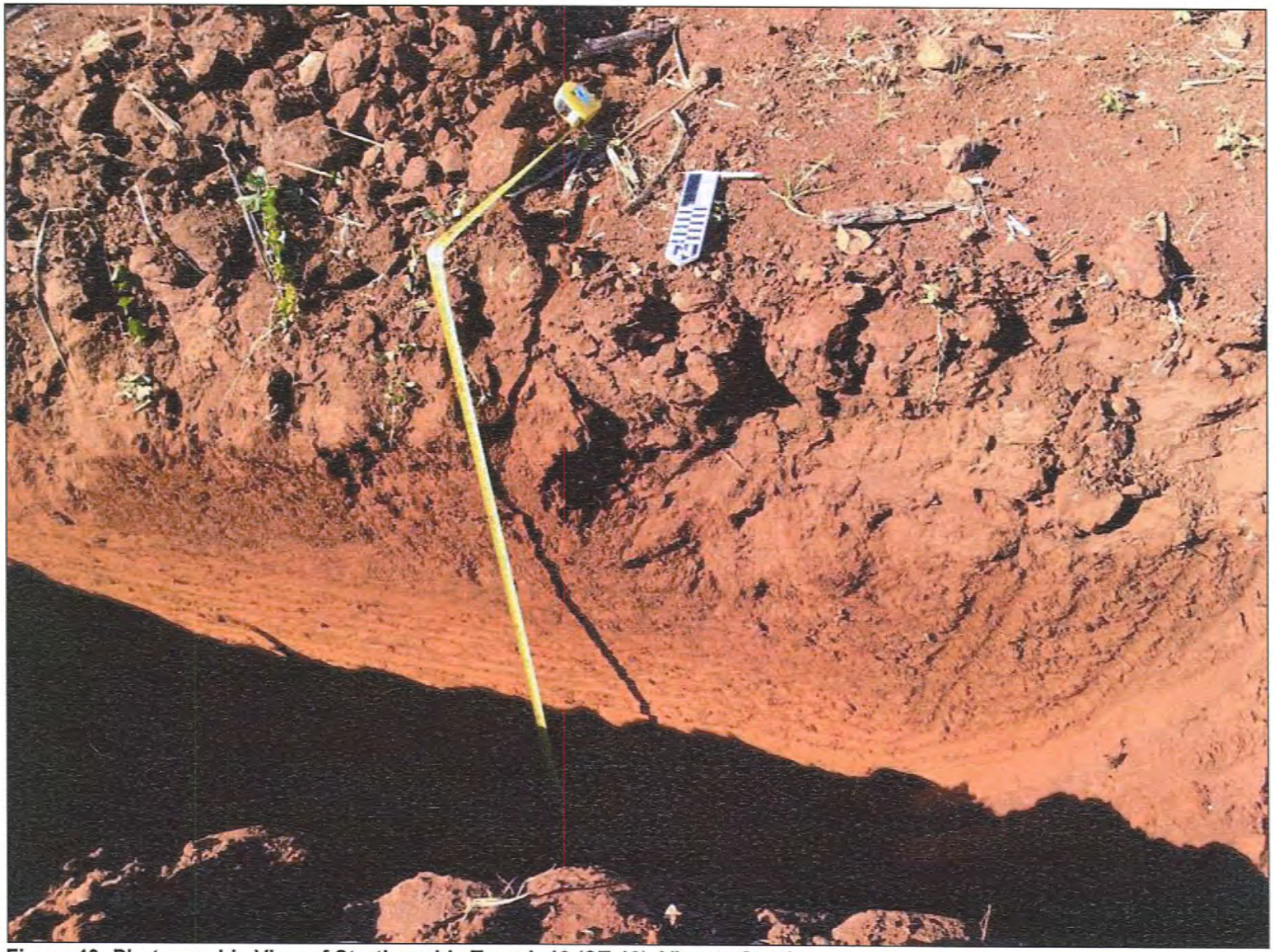

Figure 40: Photographic View of Stratigraphic Trench 18 (ST-18). View to Southeast.

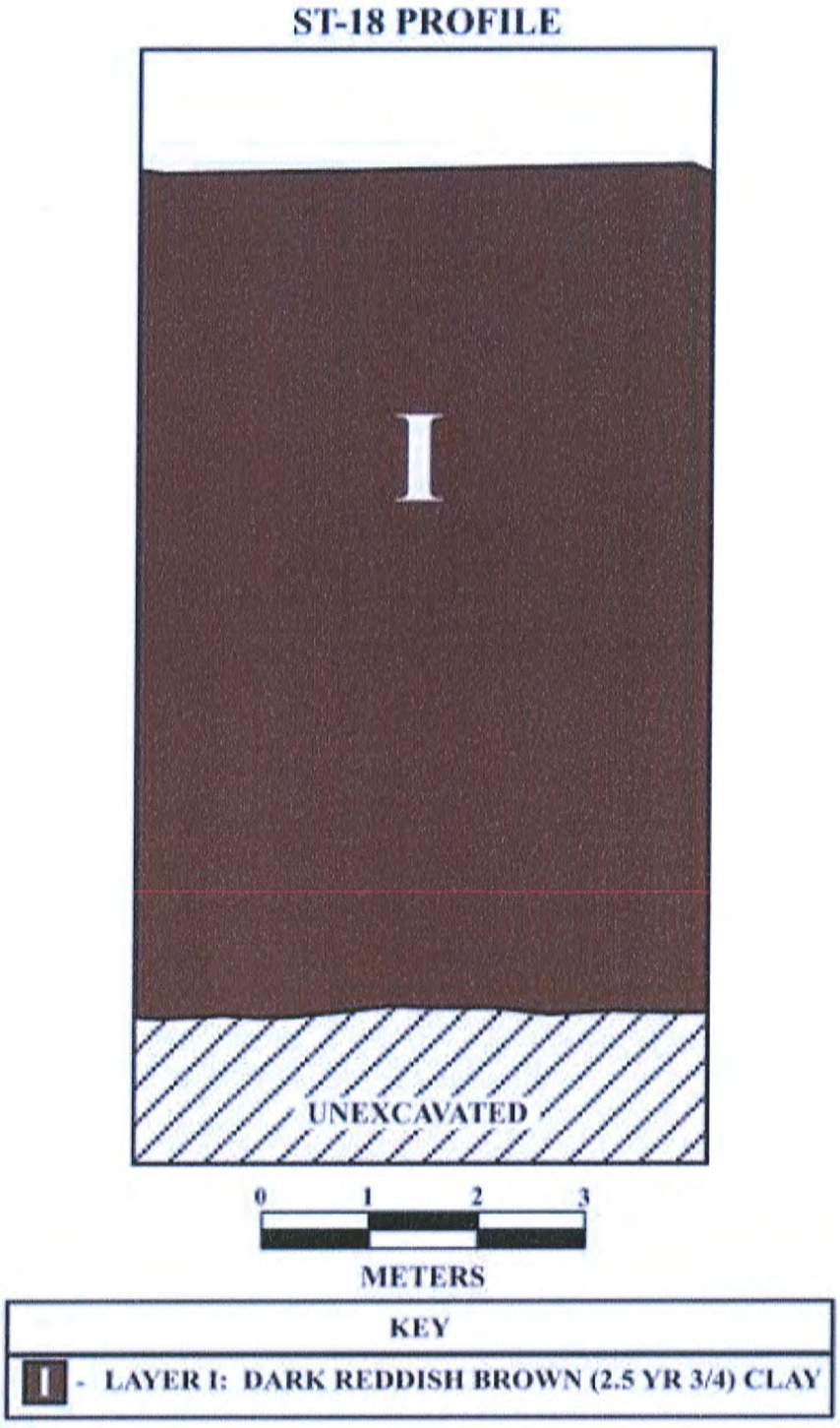

Figure 41: Stratigraphic Trench 18 (ST-18) Profile.

STRATIGRAPHIC TRENCH 19 (ST-19)

Stratigraphic Trench 19 (ST-19) (410 x 90 x 120 cm) was located on an east/west axis (100°/280°). The surface of ST-19 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-19 contained two stratigraphic layers (Figure 42 and Figure 44).

> Layer I (0-80 cmbs) consisted of dark reddish brown (5YR 3/2) dry, compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I. The lower boundary was abrupt and smooth.
>
> Layer II (80-120 cmbs) consisted of gray (5YR 5/1) compacted silt and semi-plastic silty clay. Stones were present throughout Layer II.

STRATIGRAPHIC TRENCH 20 (ST-20)

Stratigraphic Trench 20 (ST-20) (410 x 90 x 100 cm) was located on a southeast/northwest axis (120°/300°). The surface of ST-1 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-20 contained two stratigraphic layers (Figure 44 and Figure 45).

> Layer I (0-65 cmbs) consisted of dark reddish brown (5YR 3/2) dry, compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I. The lower boundary was abrupt and smooth.
>
> Layer II (80-100 cmbs) consisted of gray (5YR 5/1) compacted silt and semi-plastic silty clay. Stones and bedrock were present throughout Layer II, which made it impossible to dig, and in turn ended the excavation.

STRATIGRAPHIC TRENCH 21 (ST-21)

Stratigraphic Trench 21 (ST-21) (440 x 95 x 160 cm) was located on an east/west axis (80°/260°). The surface of ST-21 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-21 contained one stratigraphic layer (Figure 46 and Figure 47).

> Layer I (0-160 cmbs) consisted of dark reddish brown (2.5YR 3/4) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.



Figure 42: Photographic View of Stratigraphic Trench 19 (ST-19). View to Northeast.

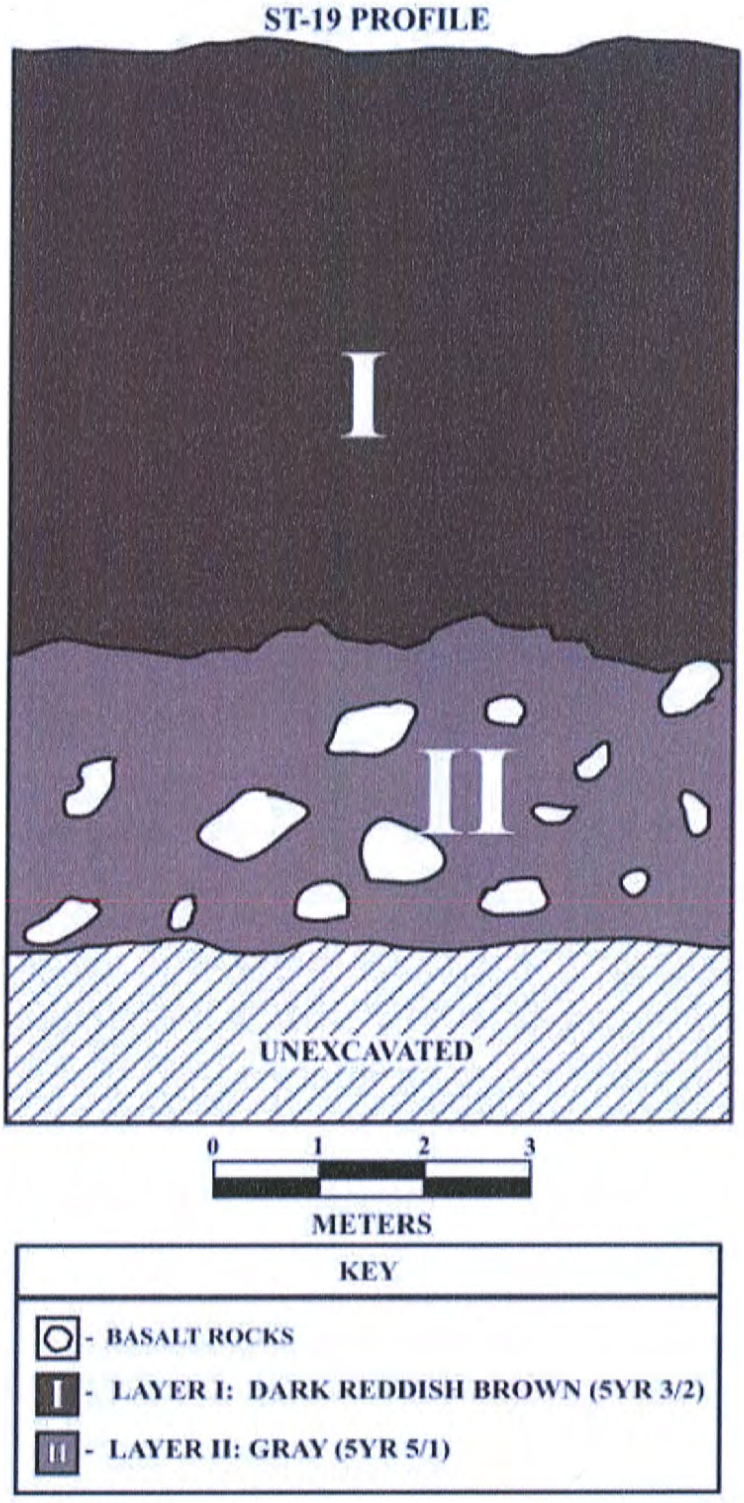

Figure 43: Stratigraphic Trench 19 (ST-19) Profile.



Figure 44: Photographic View of Stratigraphic Trench 20 (ST-20). View to North.

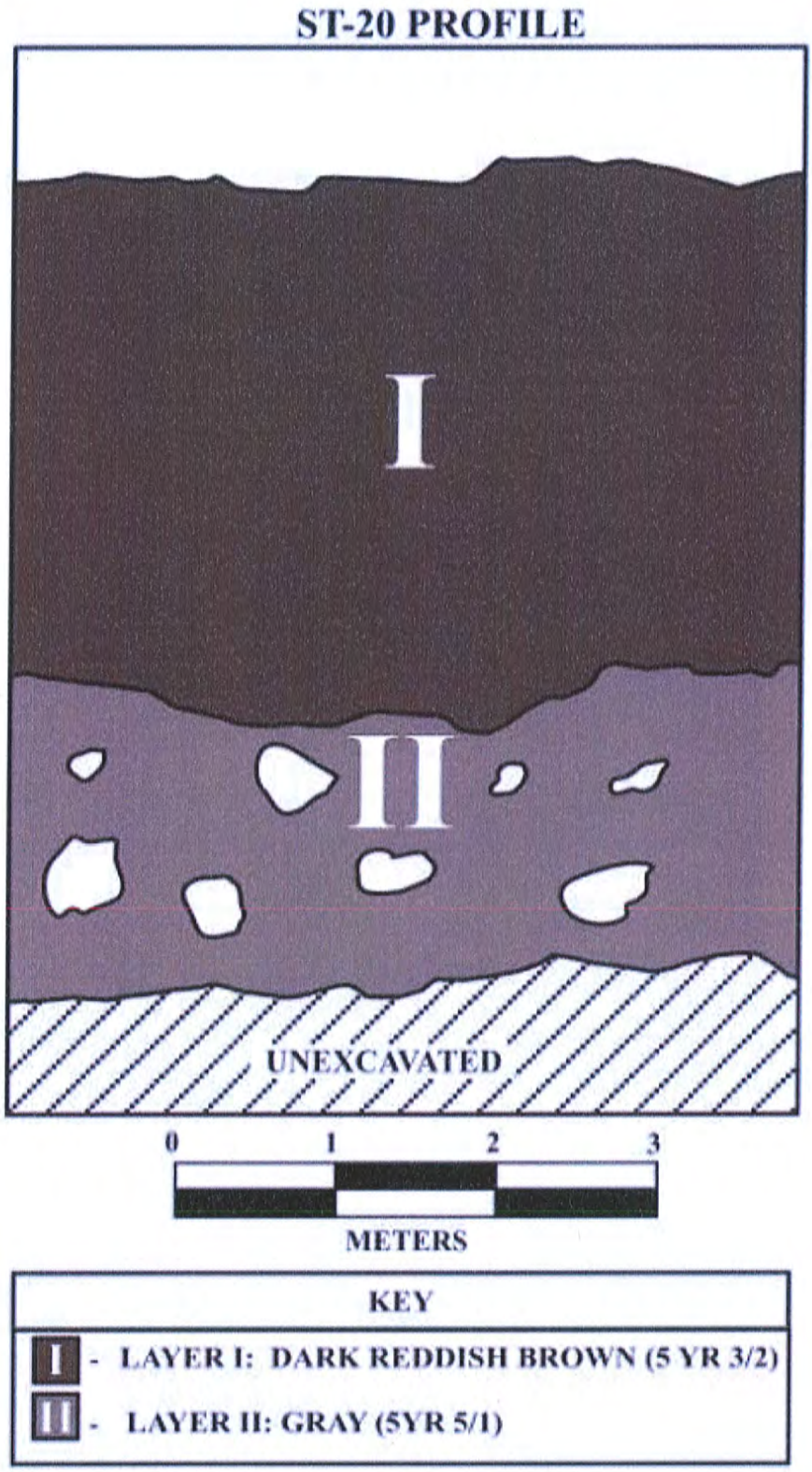

Figure 45: Stratigraphic Trench 20 (ST-20) Profile.



Figure 46: Photographic View of Stratigraphic Trench 21 (ST-21). View to Northwest.

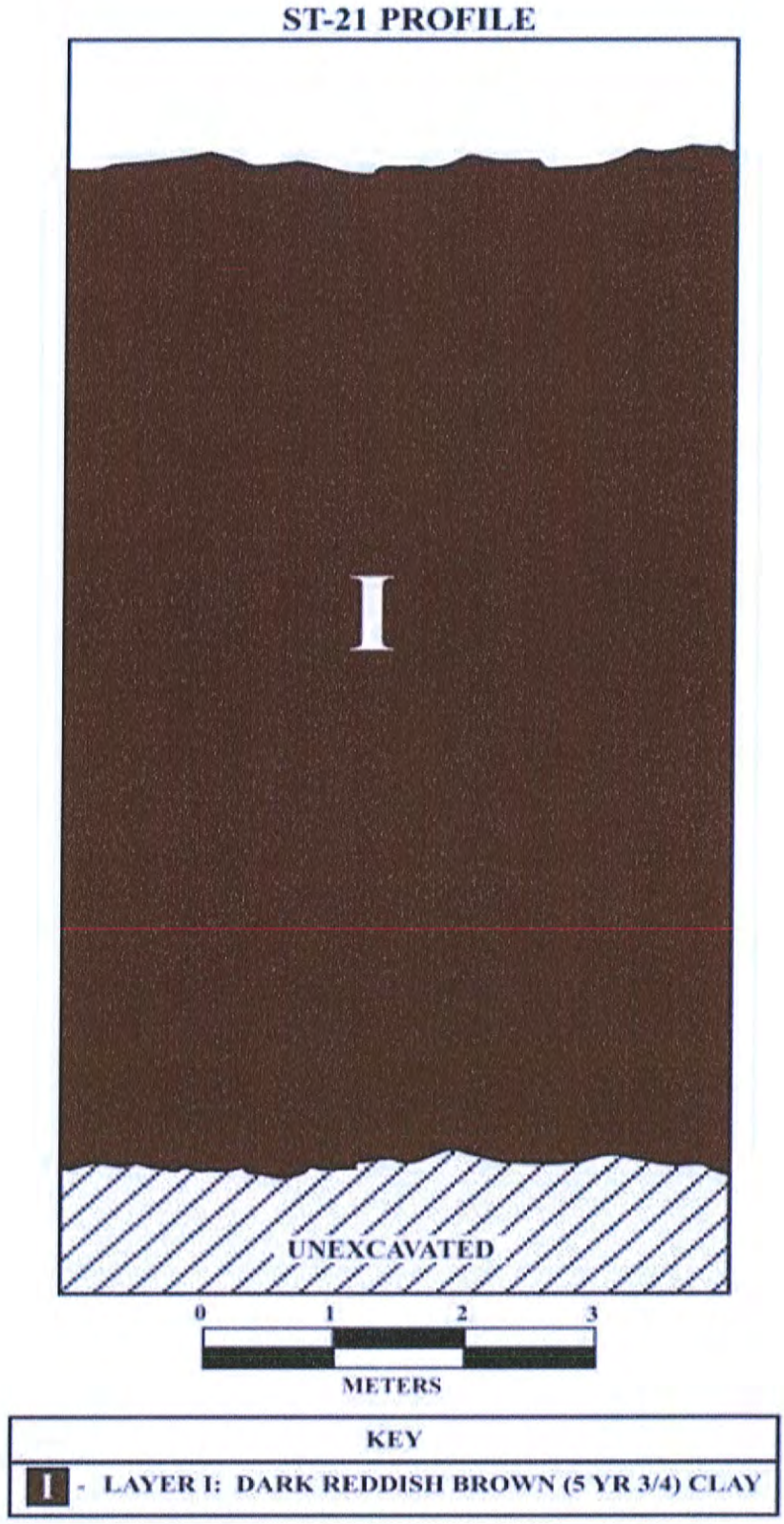

Figure 47: Stratigraphic Trench 21 (ST-21) Profile.

STRATIGRAPHIC TRENCH 22 (ST-22)

Stratigraphic Trench 22 (ST-22) (440 x 100 x 120 cm) was located on a north/south axis (10°/190°). The surface of ST-22 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-22 contained one stratigraphic layer (Figure 48 and Figure 49).

> Layer I (0-120 cmbs) consisted of dark reddish brown (5YR 3/4) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.

STRATIGRAPHIC TRENCH 23 (ST-23)

Stratigraphic Trench 23 (ST-23) (440 x 90 x 115 cm) was located on a north/south axis (20°/200°). The surface of ST-23 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-23 contained one stratigraphic layer (Figure 50 and Figure 51).

> Layer I (0-115 cmbs) consisted of dark reddish brown (2.5YR 3/4) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.

STRATIGRAPHIC TRENCH 24 (ST-24)

Stratigraphic Trench 24 (ST-24) (440 x 95 x 150 cm) was located on an east/west axis (80°/260°). The surface of ST-24 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-24 contained one stratigraphic layer (Figure 52 and Figure 53).

> Layer I (0-150 cmbs) consisted of dark reddish brown (2.5YR 3/4) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.

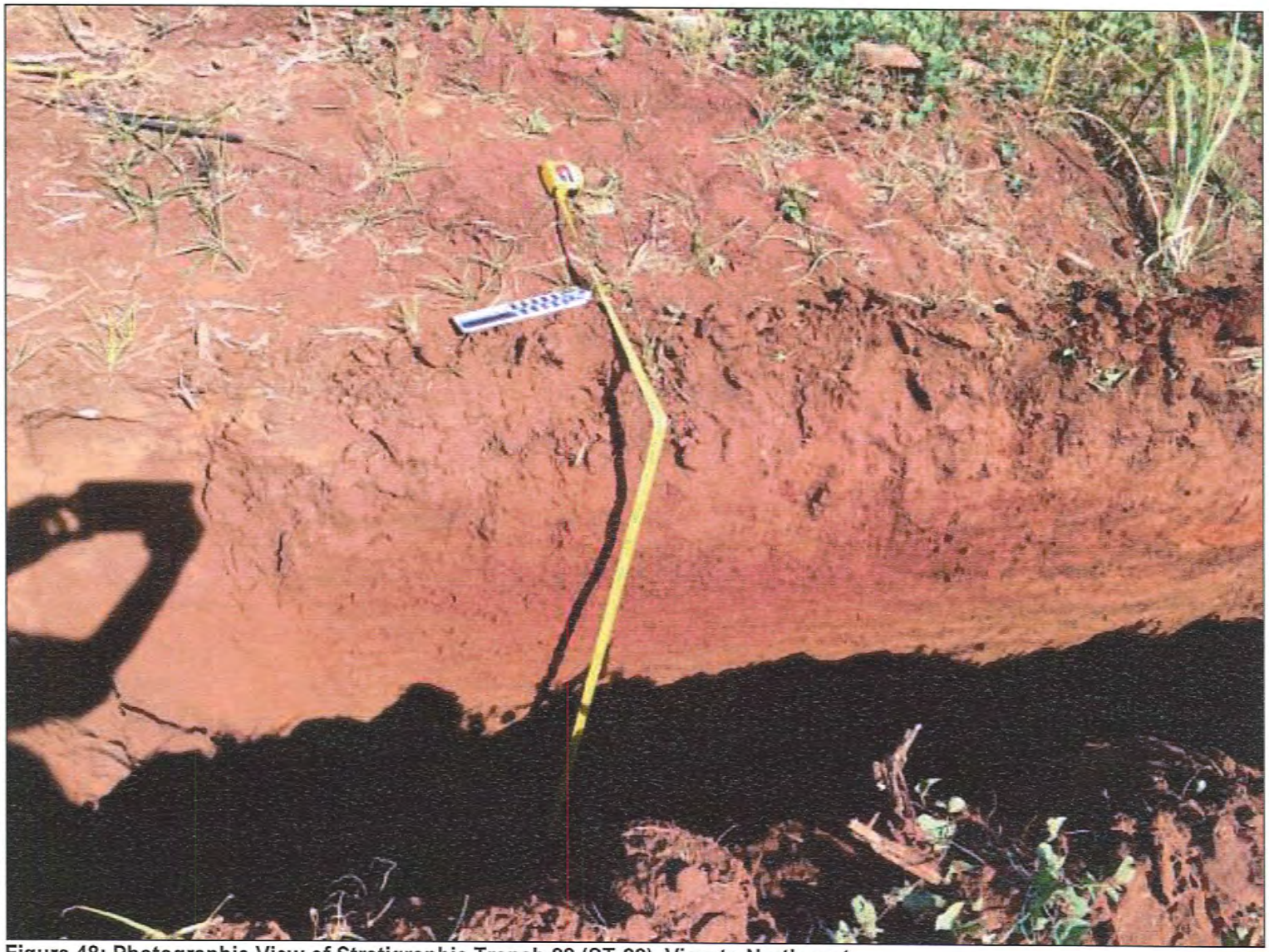

Figure 48: Photographic View of Stratigraphic Trench 22 (ST-22). View to Northwest.



Figure 49: Stratigraphic Trench 22 (ST-22) Profile.



Figure 50: Photographic View of Stratigraphic Trench 23 (ST-23). View to Northwest.

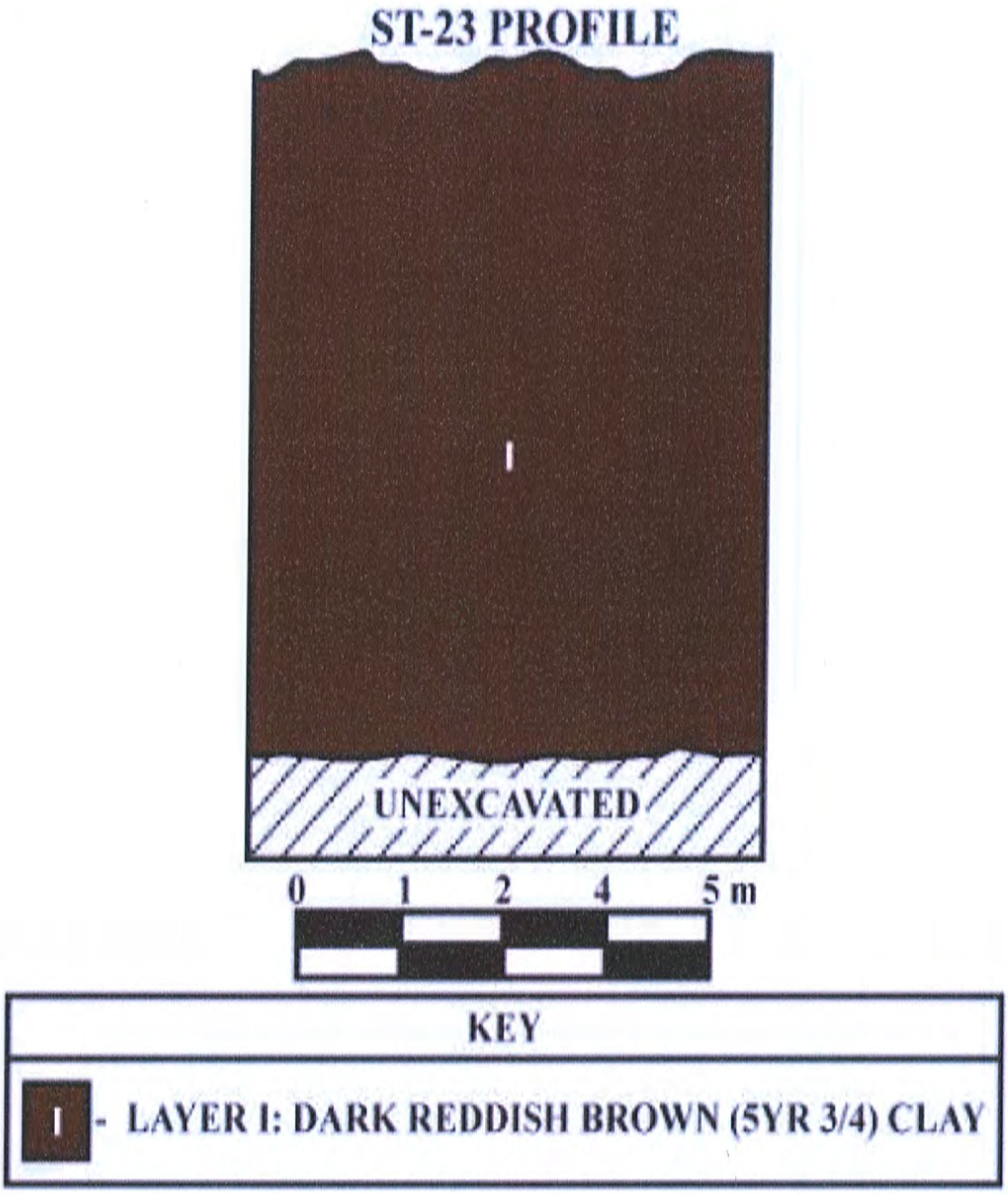

Figure 51: Stratigraphic Trench 23 (ST-23) Profile.

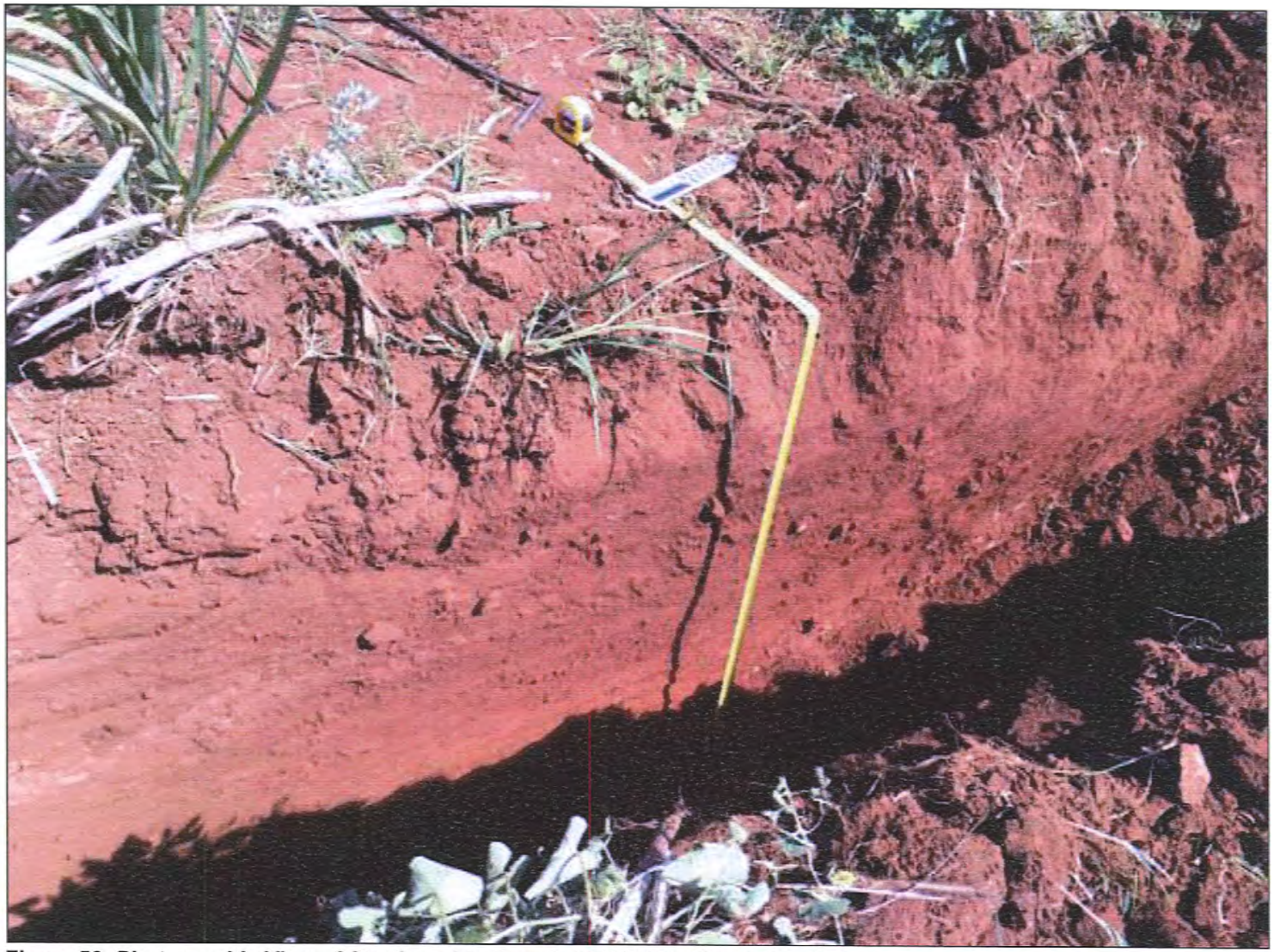

Figure 52: Photographic View of Stratigraphic Trench 24 (ST-24). View to Northwest.



Figure 53: Stratigraphic Trench 24 (ST-24) Profile.

STRATIGRAPHIC TRENCH 25 (ST-25)

Stratigraphic Trench 25 (ST-25) (440 x 100 x 140 cm) was located on a northeast/southwest axis (70°/250°). The surface of ST-25 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-25 contained one stratigraphic layer (Figure 54 and Figure 55).

> Layer I (0-140 cmbs) consisted of dark reddish brown (2.5YR 3/4) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.

STRATIGRAPHIC TRENCH 26 (ST-26)

Stratigraphic Trench 26 (ST-26) (420 x 90 x 150 cm) was located on an east/west axis (100°/280°). The surface of ST-26 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-26 contained one stratigraphic layer (Figure 56 and Figure 57).

> Layer I (0-150 cmbs) consisted of dark reddish brown (5YR 3/4) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.

STRATIGRAPHIC TRENCH 27 (ST-27)

Stratigraphic Trench 27 (ST-27) (410 x 90 x 80 cm) was located on an east/west axis (80°/260°). The surface of ST-27 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-27 contained one stratigraphic layer (Figure 58 and Figure 59).

> Layer I (0-150 cmbs) consisted of dark reddish brown (2.5YR 3/4) compacted and wet semi-plastic silty clay. Stones were present throughout Layer I, which ended the excavation early, due to encountered bedrock.



Figure 54: Photographic View of Stratigraphic Trench 25 (ST-25). View to North.



Figure 55: Stratigraphic Trench 25 (ST-25) Profile.



Figure 56: Photographic View of Stratigraphic Trench 26 (ST-26). View to North.



Figure 57: Stratigraphic Trench 26 (ST-26) Profile.



Figure 58: Photographic View of Stratigraphic Trench 27 (ST-27). View to Northwest.

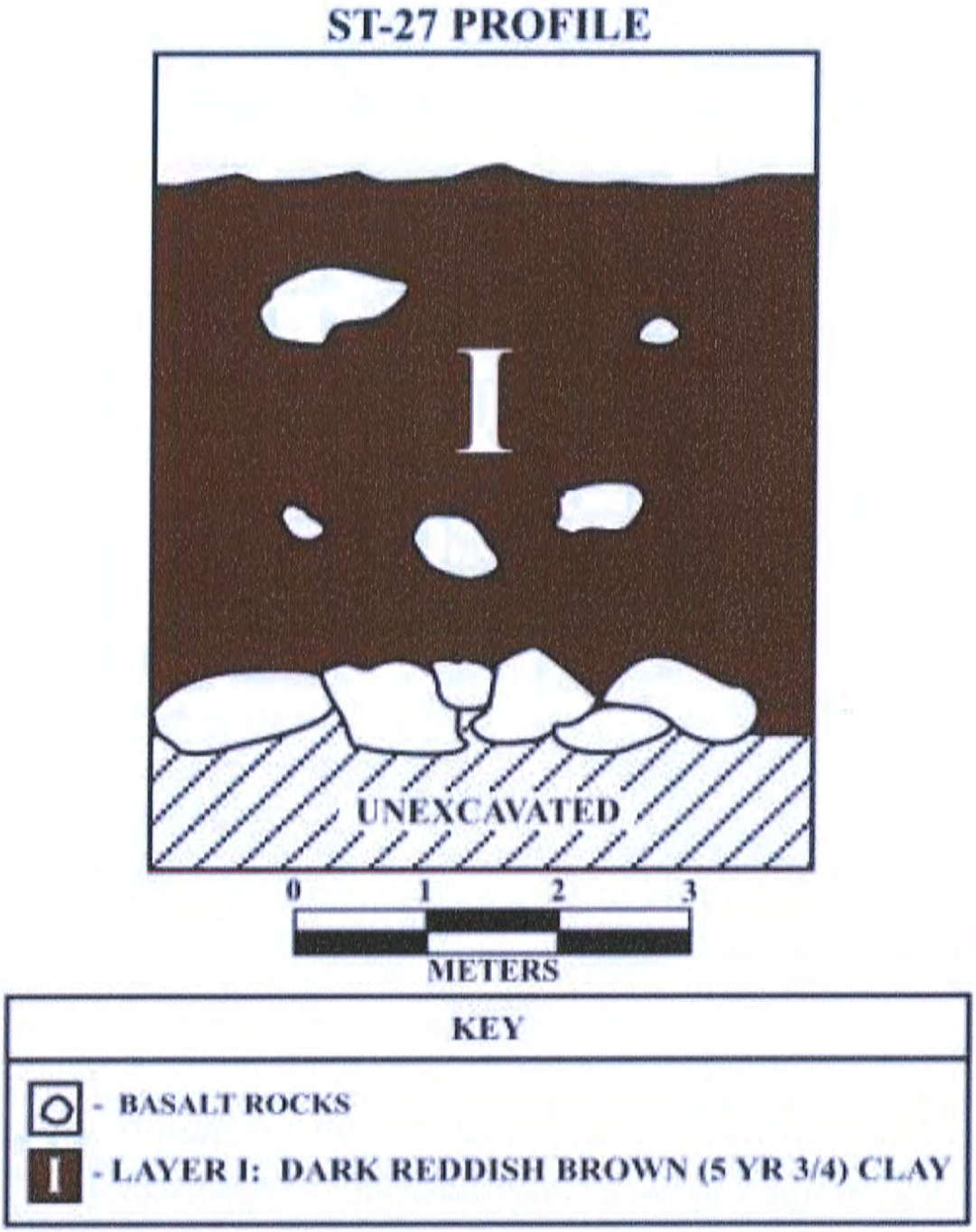

Figure 59: Stratigraphic Trench 27 (ST-27) Profile.

STRATIGRAPHIC TRENCH 28 (ST-28)

Stratigraphic Trench 28 (ST-28) (430 x 95 x 150 cm) was located on a northwest/southeast axis (340°/160°). The surface of ST-28 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-28 contained one stratigraphic layer (Figure 60 and Figure 61).

Layer I (0-150 cmbs) consisted of dark reddish brown (5YR 3/4) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.

STRATIGRAPHIC TRENCH 29 (ST-29)

Stratigraphic Trench 29 (ST-29) (440 x 100 x 160 cm) was located on a northeast/southwest axis (70°/250°). The surface of ST-29 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-29 contained one stratigraphic layer (Figure 62 and Figure 63).

Layer I (0-160 cmbs) consisted of very dark brown (7.5YR 2.5/2) compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I.

STRATIGRAPHIC TRENCH 30 (ST-30)

Stratigraphic Trench 30 (ST-30) (410 x 90 x 110 cm) was located on a northwest/southeast axis (310°/130°). The surface of ST-30 contained sporadic sugar cane, along with scattered grass patches and previously disturbed top soil. ST-30 contained two stratigraphic layers (Figure 64 and Figure 65).

Layer I (0-87 cmbs) consisted of strong brown (7.5YR 4/6) dry, compacted and wet semi-plastic silty clay. No roots or stones were present throughout Layer I. The lower boundary was abrupt and smooth.

Layer II (87-110 cmbs) consisted of gray (5YR 5/1) dry, compacted silt and semi-plastic silty clay. Stones and bedrock were present throughout Layer II, which made it impossible to dig, and in turn ended the excavation.



Figure 60: Photographic View of Stratigraphic Trench 28 (ST-28). View to Northwest.



Figure 61: Stratigraphic Trench 28 (ST-28) Profile.



Figure 62: Photographic View of Stratigraphic Trench 29 (ST-29). View to North.



Figure 63: Stratigraphic Trench 29 (ST-29) Profile.

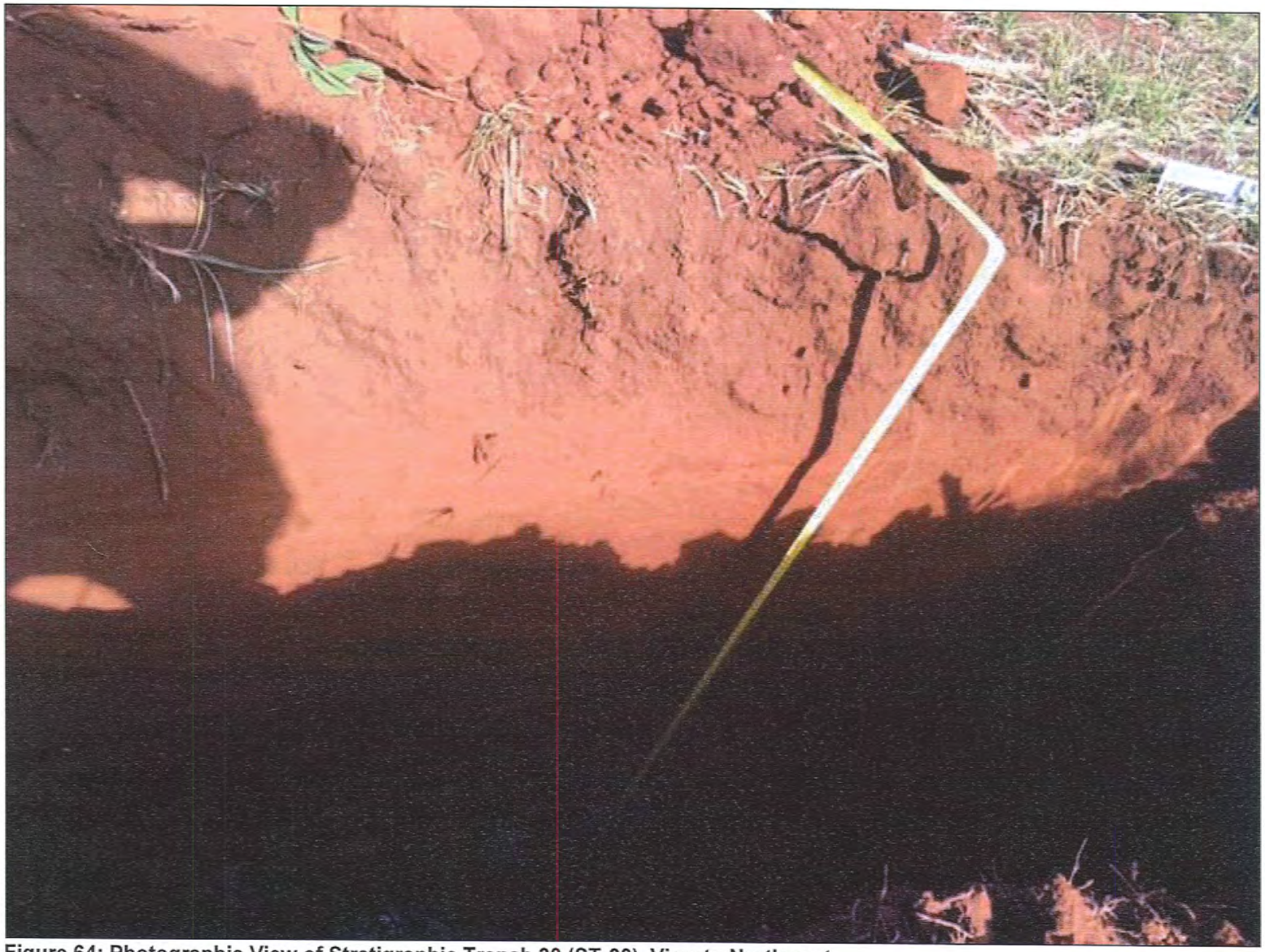

Figure 64: Photographic View of Stratigraphic Trench 30 (ST-30). View to Northwest.

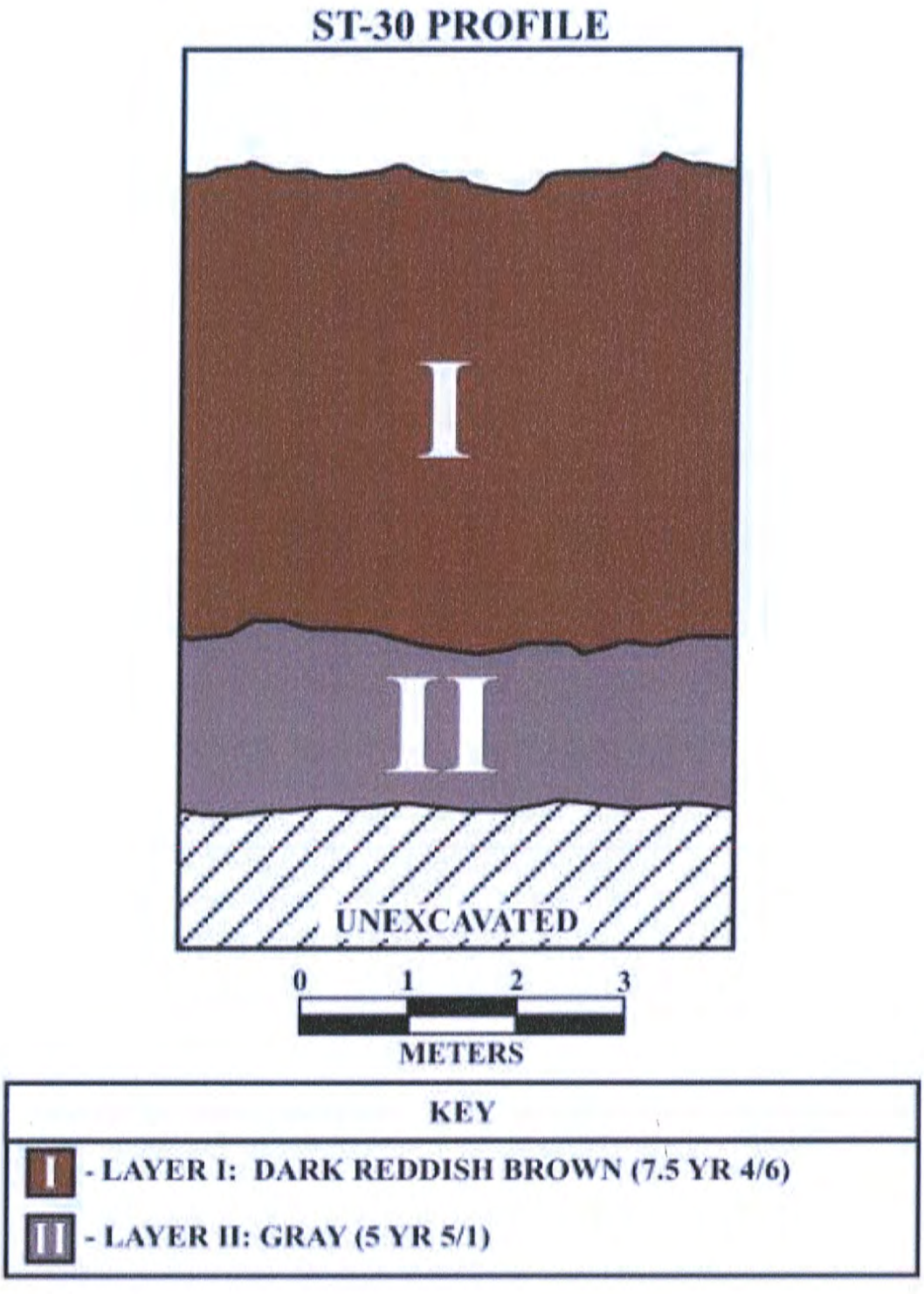

Figure 65: Stratigraphic Trench 30 (ST-30) Profile.

RESULTS AND DISCUSSION

Archaeological Inventory Survey-level investigations were conducted on a 40-acre property adjacent to the current Central Maui Landfill. Full pedestrian survey and excavation of 30 trenches in a portion of the project area did not yield evidence for any historic properties, in either context. In the events that pre-Contact activities previously occurred in the project area, they likely were disturbed/erased by intensive, industrial-level sugar cane cultivation in the past 100 years. It is doubtful, however, that intensive pre-Contact activities would have occurred in this area, given its location on the far periphery of direct water sources, good soils, or exploitation environments (marine, uplands).

RECOMMENDATIONS

Based on the absence of any historic properties in the project area, as well as the shallow, sterile soils encountered during trenching, no further archaeological work is recommended for this project area.

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1955. Paia Quadrangle. 1:24,000 scale.

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STATE HISTORIC PRESERVATION DIVISION ACCEPTANCE LETTER DATED MARCH 15, 2018

APPENDIX F-1

DAVID Y. IGE
GOVERNOR OF
HAWAII

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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

March 15, 2018

IN REPLY REFER TO:
Log No. 2018.00184
Doc. No. 1803MBF01
Archaeology

Stewart Stant
Solid Waste Management & Recycling Division
recycle.maui@mauicounty.gov

Lesli L. Otani, P.E., L.S.
Development Services Administration
Department of Public Works
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Stant and Ms. Otani:

SUBJECT: **Chapter 6E-8 Historic Preservation Review –**
County of Maui Grading & Grubbing Permit G T2018-0006
Archaeological Assessment for the Central Maui Landfill Expansion Project
Wailuku Ahupua'a, Pū'ali Komohana District, Island of Maui
TMK: (2) 3-8-003:019 por.

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject permit application and supporting archaeological survey draft document titled, *Archaeology Assessment for the Central Maui Landfill Expansion Project; Wailuku Ahupua'a, Wailuku District, Maui Island; TMK: (2) 3-8-003:019 por.* (Andricci and Dega, October 2017). The SHPD received the revised report on October 5, 2017 (Log No. 2017.02268), and the permit application on January 30, 2018 (Log No. 2018.00184).

The project area is approximately 40 acres of undeveloped land adjacent to the current existing Central Maui Landfill. The proposed project is expansion of the facility by the County of Maui, Department of Environmental Management, Solid Waste Division. The project area itself has undergone extensive alteration due to sugarcane cultivation. As the results of the archaeological inventory survey (AIS) were negative, the AIS report was submitted to SHPD as an archaeological assessment (AA) report in accordance with HAR §13-275-5(b)(5)(A).

Due to negative findings, the project effect determination is **no historic properties affected**, pursuant to HAR §13-275-7(a)(1). The unsolicited archaeological monitoring plan (AMP) submitted for the subject project (Log No. 2017.02461), it will not be reviewed.

Pursuant to HAR§ 13-275-7(e), when SHPD agrees that the project will not affect any significant historic properties, this is SHPD's written concurrence and the historic preservation review process ends. **The historic preservation review process for the subject project has ended**. No archaeological monitoring is required.

The revised draft AA meets the minimum requirements, pursuant to HAR §13-276-5. **It is accepted.** Please send two hardcopies of the document, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office, attention SHPD Library.

You may contact Dr. Matthew Barker Fariss at matthew.b.fariss@hawaii.gov, or by phone at (808) 243-4626, for any questions regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Michael Dega
Scientific Consultant Services
mike@scshawaii.com

APPENDIX G

CULTURAL IMPACT ASSESSMENT REPORT

FINAL

Cultural Impact Assessment for the Central Maui Landfill Facilities Project, Wailuku Ahupua'a, Wailuku District, Maui Island, TMK: (2) 3-8-003:019 (por.)

Prepared for

A-Mehr, Inc.

on behalf of the County of Maui

Prepared by

Erika Nielsen, M.A.

Nicole Ishihara, B.A.

and

Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawai'i, Inc.

Kailua, Hawai'i

(Job Code: WAILUKU 52)

February 2019

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Management Summary

Reference	Cultural Impact Assessment for the Central Maui Landfill Facilities Project, Wailuku Ahupua'a, Wailuku District, Maui Island, TMK: (2) 3-8-003:019 (por.) (Nielsen et al. 2018)
Date	January 2019
Project Number(s)	Cultural Surveys Hawai'i, Inc. (CSH) Job Code: WAILUKU 52
Agencies	State of Hawai'i, Department of Health, Office of Environmental Quality Control (DOH-OEQC)
Land Jurisdiction	County of Maui
Project Proponent	County of Maui, Department of Environmental Management
Project Funding	County of Maui
Project Location	The project area is located on the north side of Pūlehu Road between Kahului and Kula, in Wailuku Ahupua'a, Wailuku District, Maui Island, TMK: (2) 3-8-003:019 (por.). The project area is depicted on a portion of the 1997 Paia USGS 7.5-minute topographic quadrangle.
Project Description	The County of Maui, Department of Environmental Management (DEM) proposes to expand their integrated solid waste management and recycling/diversion facilities on the expanded Central Maui Landfill (CML) property, which will serve to reduce the amount of waste entering the landfill. The proposed facilities include the following: Office, abandoned vehicles area, open construction and demolition material recovery area, household hazardous waste and electronic waste receiving and storage area, metals processing area, warehouse building and storage area, refuse collection office, truck parking, and maintenance area.
Project Acreage	The current project area includes approximately 40 acres (16.5 hectares).
Document Purpose	This CIA was prepared to comply with the State of Hawai'i's environmental review process under Hawai'i Revised Statutes (HRS) §343, which requires consideration of the proposed project's potential effect on cultural beliefs, practices, and resources. Through document research and cultural consultation efforts, this report provides information compiled to date pertinent to the assessment of the proposed project's potential impacts to cultural beliefs, practices, and resources (pursuant to the Office of Environmental Quality Control's *Guidelines for Assessing Cultural Impacts*) which may include

	Traditional Cultural Properties (TCPs). These TCPs may be significant historic properties under State of Hawai'i significance criterion "e," pursuant to Hawai'i Administrative Rules (HAR) §13-275-6 and §13-284-6. Significance criterion "e" refers to historic properties that "have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with 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 group's history and cultural identity" (HAR §13-275-6 and §13-284-6). The document will likely also support the project's historic preservation review under HRS §6E and HAR §13-275 and §13-284. The document is intended to support the project's environmental review and may also serve to support the project's historic preservation review under HRS §6E-8 and HAR §13-284.
Results of Background Research	Background research for this project yielded the following results (presented in approximate chronical order): 1. The *ahupua'a* (traditional land division) of Wailuku is located in the larger *moku* (district) of Wailuku on central isthmus of the island of Maui. 2. Names of rain referencing the *ahupua'a* and *moku* of Wailuku include *Hō'eha'ili*, the skin-hurting rain of Waiehu (Akana and Gonzalez 2015:36); *Kili*, a delicate gentle rain associated with Waihe'e (Akana and Gonzalez 2015:81); and *Kili'o'opu* found at Waihe'e, Waiehu, Wailuku, and Waikapū (Akana and Gonzalez 2015:83). 3. Wailuku Ahupua'a was included in the traditional *'okana* (subdistrict) of Na Wai Eha, or "The Four Streams". This area is home to the four largest streams found on the windward coast of Maui. 4. In Pukui and Curtis's *The Water of Kāne* (1994) the naming of Wailuku is recounted in the *mo'olelo* (story) of the battle of the owls. Following a fierce battle between the owls of the Hawaiian Islands and a cruel man, Wailuku earned its name meaning, "Water-of-killing" (Pukui and Curtis 1994:189). 5. The *wahi pana* (storied place) of 'Īao Valley is the subject of a number of *ka'ao* (fanciful tale) and *mo'olelo*. One legend tells of a women named Luahinepi'i who came to her end after a false rumor caused her to jump from Kūkaemoku, the 2,250 foot peak also known as the 'Īao Needle. 6. On the north shore of the central isthmus in Wailuku Ahupua'a lie the *loko i'a* (fishpond) named Mau'oni and Kanahā.

	According to tradition, construction of the pond walls was begun by an O'ahu chief, but finished by Kamehamehanui, king of Maui in the mid-1700's. 7. In ancient times Wailuku, specifically the area around Kahului Bay, was known as a chosen gathering and residential site for Maui *ali'i* (royalty) and chiefs (James 2001). Handy and Handy (1972) add that, "in ancient times [Wailuku District] was the largest continuous area of wet-taro cultivation in the islands" (Handy and Handy 1972:496). 8. The 1790 invasion of Maui by Kamehameha the Great of Hawai'i Island, is referenced by many place names within Wailuku. The Battle of 'Īao is also known as the Battle of Kepaniwai, meaning the "Dammed Stream". 9. An account by the American missionary Rufus Anderson (1864) portrays the obstacle of landing in Wailuku District during the early historic period: "We were bound to Wailuku, situated near the western side of the isthmus connecting West and east Maui. After crossing the channel the wind increased, and so rough was the sea that our landing seemed not quite safe" (Anderson 1864:176). 10. A common crop on nearly all major Hawaiian Islands was sugar cane. Among the early government grants in the upland area of Wailuku Ahupua'a were lands set aside for the Wailuku Sugar Company, a plantation first organized in 1862 by James Robinson & Company, Thomas Cummins, J. Fuller, and agent C. Brewer & Company. 11. Hawaiian Commercial & Sugar Company opened Pu'u Nēnē sugar mill in 1902 (Bartholomew 1994:121). From the time it opened and for a several years after, Pu'u Nēnē was home to the largest sugar mill in the world. At the height of its production, Pu'u Nēnē mill covered a vast 33,000 acres. 12. The early postwar years (1946-1950) saw the increased construction of urban infrastructure in Wailuku, including the Maui Memorial Hospital in Wailuku and the Kahului master-planned community. Areas of Wailuku once occupied by the military returned to cattle ranching, and pineapple and sugar cultivation in post-war years. 13. The current land-use of the corridor connecting Kahului with Wailuku includes a mix of residential, warehousing, light industrial and commercial, with retail sales centered primarily in Kahului. Until December 2016 when HC&S announced its

	closure, most of the land area of Wailuku Ahupua'a was in sugar cultivation.
Results of Community Consultation	CSH attempted to contact NHO's, agencies, and community members. Below is a list of individuals who responded about the project area and Wailuku Ahupua'a: 1. Foster Ampong, 'Aha Moku o Wailuku 2. Holly Buland, Operations Administrator, Alexander & Baldwin Sugar Museum 3. Bryan Esmeralda, Planner, Department of Hawaiian Homelands (DHHL) – Maui 4. Hokulani Holt-Padilla, *Kumu Hula*, Pā'ū o Hi'iaka; Cultural Specialist 5. Leonard Kimokeo Kapahulehua, Founder, Kimokeo Foundation 6. Kea'aumoku Kapu, CEO, Aha Moku o Maui; Koani Foundation 7. Annalise Kehler, Cultural Resource Planner, County of Maui 8. Leslie Kuloloi'a, *Kupunakāne* (grandfather) 9. Ikaika Nakahashi, Cultural Historian, State of Hawai'i – State Historic Preservation Division (SHPD) 10. Sarah Nakihei, Maui Homestead Farmers and Ranchers Association 11. Roy Kalani Oliveira, President, Waiehu Kou Phase 3 Association
Impacts and Recommendations	Based on information gathered from the cultural and historic background, previous archaeological research, and community consultation, we found there are no potential cultural impacts associated with the proposed project. However, in the event inadvertent cultural finds, including human remains are found: 1. Community participant, Foster Ampong, pointed out that the Battle of Kakanilua occurred in the isthmus and that an early missionary survey noted thousands of human remains, which were most likely of the fallen warriors. Historian, Samuel Kamakau, specifically places the battle between Waikapu and Wailuku. However, due to years of sugar cane production and development, there is a high probability that *iwi kūpuna* (ancestral bones) have been destroyed or are highly disturbed. Mr. Ampong believes that the central plain was ideal for battles and that an expansion to the landfill or any subsurface work could possibly

	unearth *iwi kūpuna*. He highly recommends an archaeological monitor during all construction activities occurring at the landfill. 2. CSH notes that in 2016, Scientific Consultant Services conducted an archaeological inventory survey (AIS) for the subject project that included a 100 percent pedestrian inspection and the excavation of 30 test excavations (Andricci and Dega 2017). No historic properties were identified and as such, the study was titled an archaeological assessment. In a 15 March 2018 Chapter 6E-8 historic preservation review letter, the SHPD concurred with a determination of "no historic properties affected" for the project and accepted the archaeological assessment (SHPD Log No. 2018.00184; Doc. No. 1803MBF01; Appendix A). Furthermore, the SHPD indicated it would not review the project's archaeological monitoring plan (Log No. 2017.02461). The SHPD indicates that no archaeological monitoring is required for this project. 3. In an effort to address Mr. Ampong's recommendation, CSH recommends that all personnel involved in project construction be informed of the possibility of inadvertent cultural finds (including funerary objects and *iwi kūpuna*) during a pre-construction meeting. In the event that any potential historic properties are identified during construction activities, all activities will cease and the SHPD will be notified pursuant to HAR §13-280-3. In the event that *iwi kūpuna* are identified, all earth moving activities in the area will stop, the area will be cordoned off, and the SHPD and Police Department will be notified pursuant to HAR §13-300-40. Additionally, project proponents should consult with cultural and lineal descendants of the area to develop a reinterment plan and cultural preservation plan for proper cultural protocol, curation, and long-term maintenance.

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Section 1 Introduction

1.1 Project Background

At the request of A-Mehr, Inc., on behalf of the County of Maui, Cultural Surveys Hawai'i, Inc. (CSH) is conducting a cultural impact assessment (CIA) for the Central Maui Landfill Facilities Project, Wailuku Ahupua'a, Wailuku District, Maui Island, TMK: (2) 3-8-003:019 (por.). The project area is depicted on a portion of the 1997 U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1), a tax map plat (Figure 2), and a 2016 aerial photograph (Figure 3). The total project area is approximately 40 acres.

The County of Maui, Department of Environmental Management (DEM) proposes to develop their integrated solid waste management and recycling/diversion facilities on the expanded Central Maui Landfill (CML) property, which will serve to increase recycling and diversion of valuable resources and reduce the amount of waste entering the landfill. The project area is located on former sugar cane farmland situated on the north side of Pūlehu Road and northwest of the existing CML facility, between Kahului and Kula. The project area is bounded by agricultural lands owned by Hawaiian Commercial and Sugar Company (HC&S). The HC&D, LLC Quarry operation is located northeast of the project area.

The DEM currently operates the CML on a portion of TMK (2) 3-8-003:019 (Parcel 19). The CML has been in operation since 1986 through State Land Use Commission (SLUC) Special Permits encompassing approximately 126 acres of Parcel 19. The proposed expansion of the CML will increase the CML property by approximately 32 percent. The project includes the following proposed facilities and related activities:

- Abandoned Vehicles Area
- Office Structure: 8,000 square feet (sf) with a parking lot;
- Construction and Demolition (C&D) Material Recovery Area: including an open materials processing area;
- Metals Processing Area: including a processing area with canopy cover;
- Household Hazardous Waste (HHW) and Electronic Waste (E-Waste) Collection and Storage Area: including a roofed structure;
- Warehouse and Storage Area: with a warehouse structure;
- Refuse Collection Office, Truck Parking, and Maintenance Area: including a structure with office and maintenance area, refuse collection vehicle parking area, and an adjacent automobile parking lot;
- Water Tank: at the highest site location (southwest corner of expansion parcel);
- Parking Stalls: for truck-type vehicles

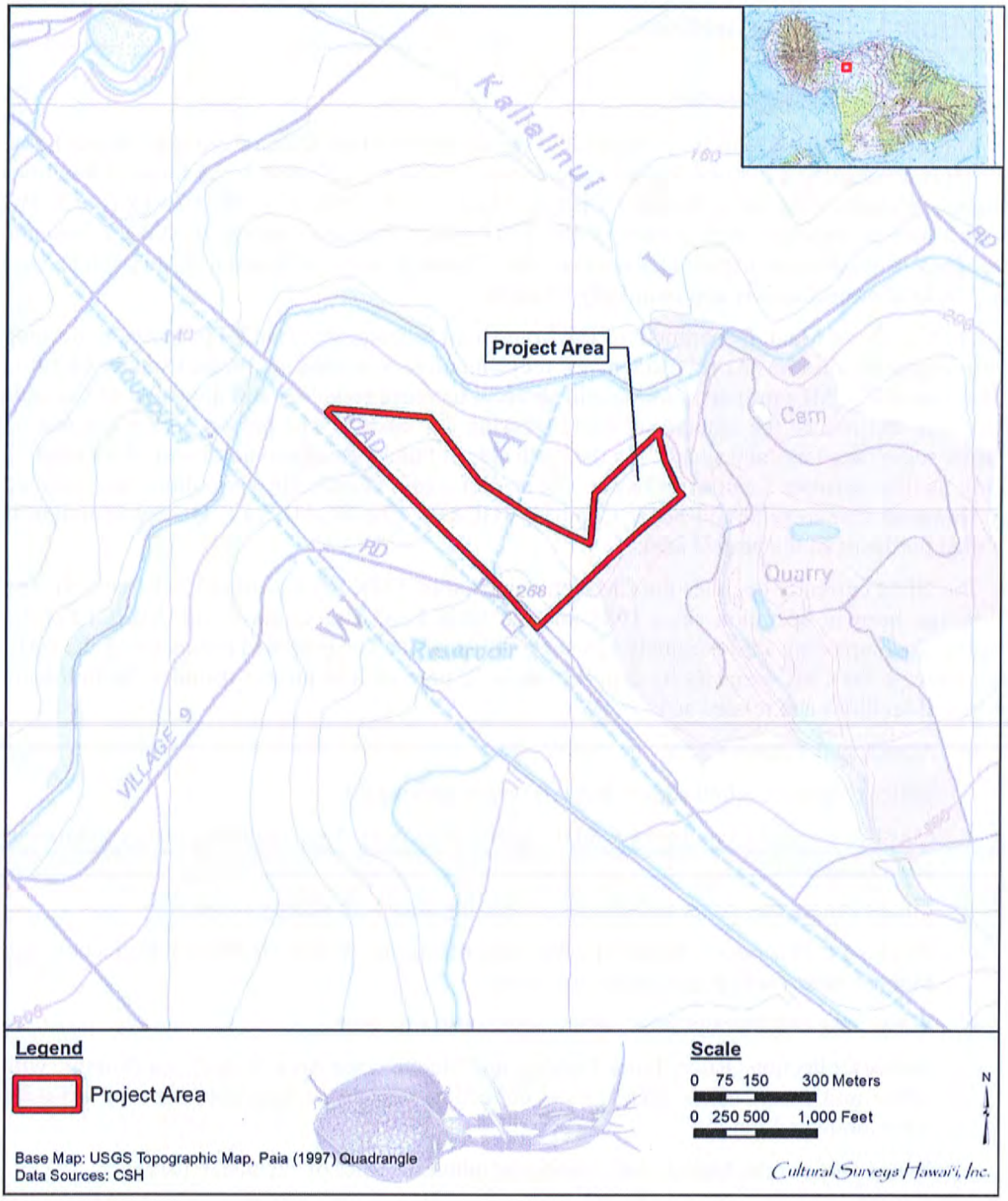

Figure 1. Portion of the 1997 Paia USGS 7.5-minute topographic quadrangle showing the location of the project area

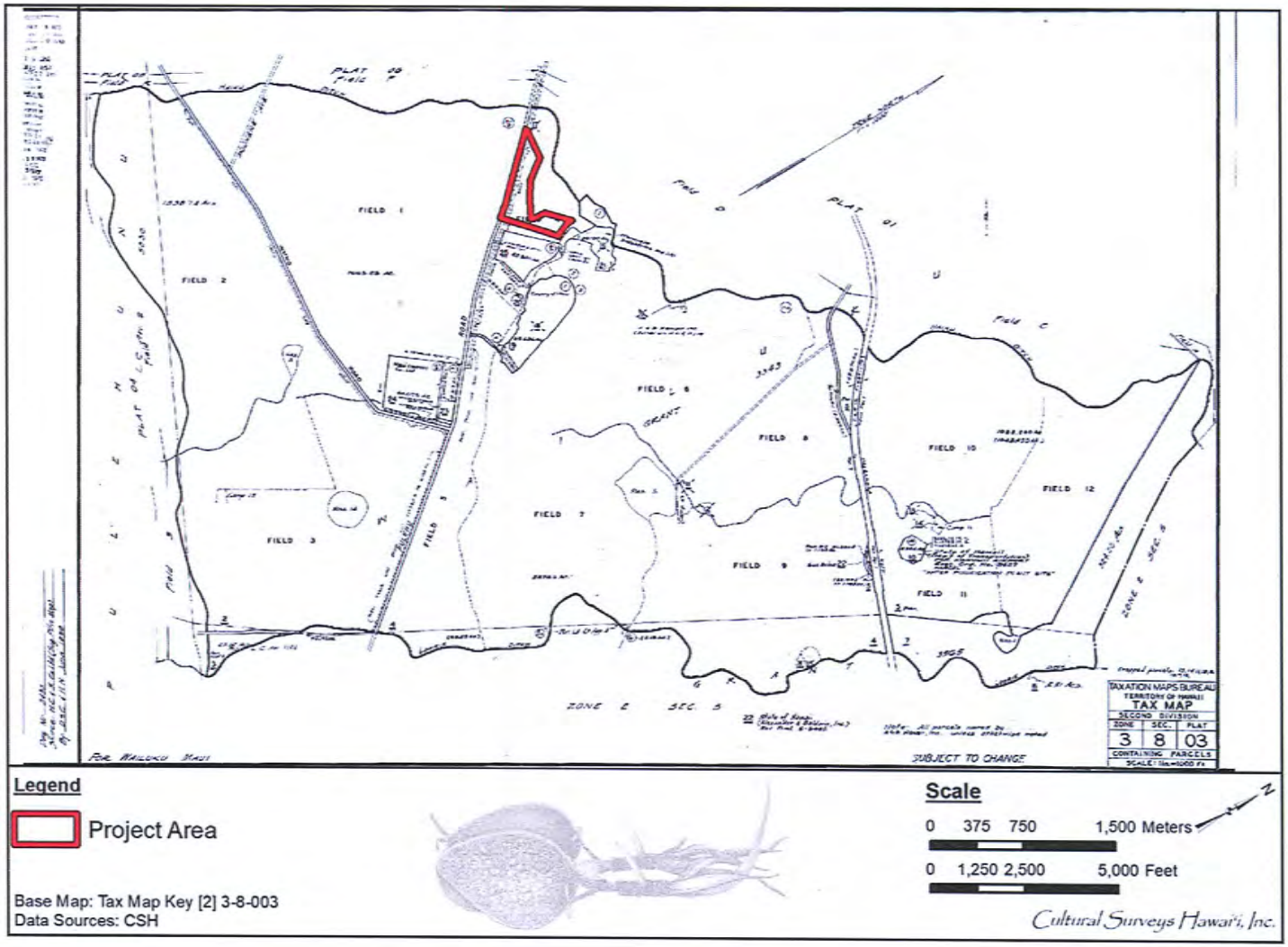

Figure 2. Tax Map Key (TMK) [2] 3-8-003 showing the project area (Hawai'i TMK 2014)

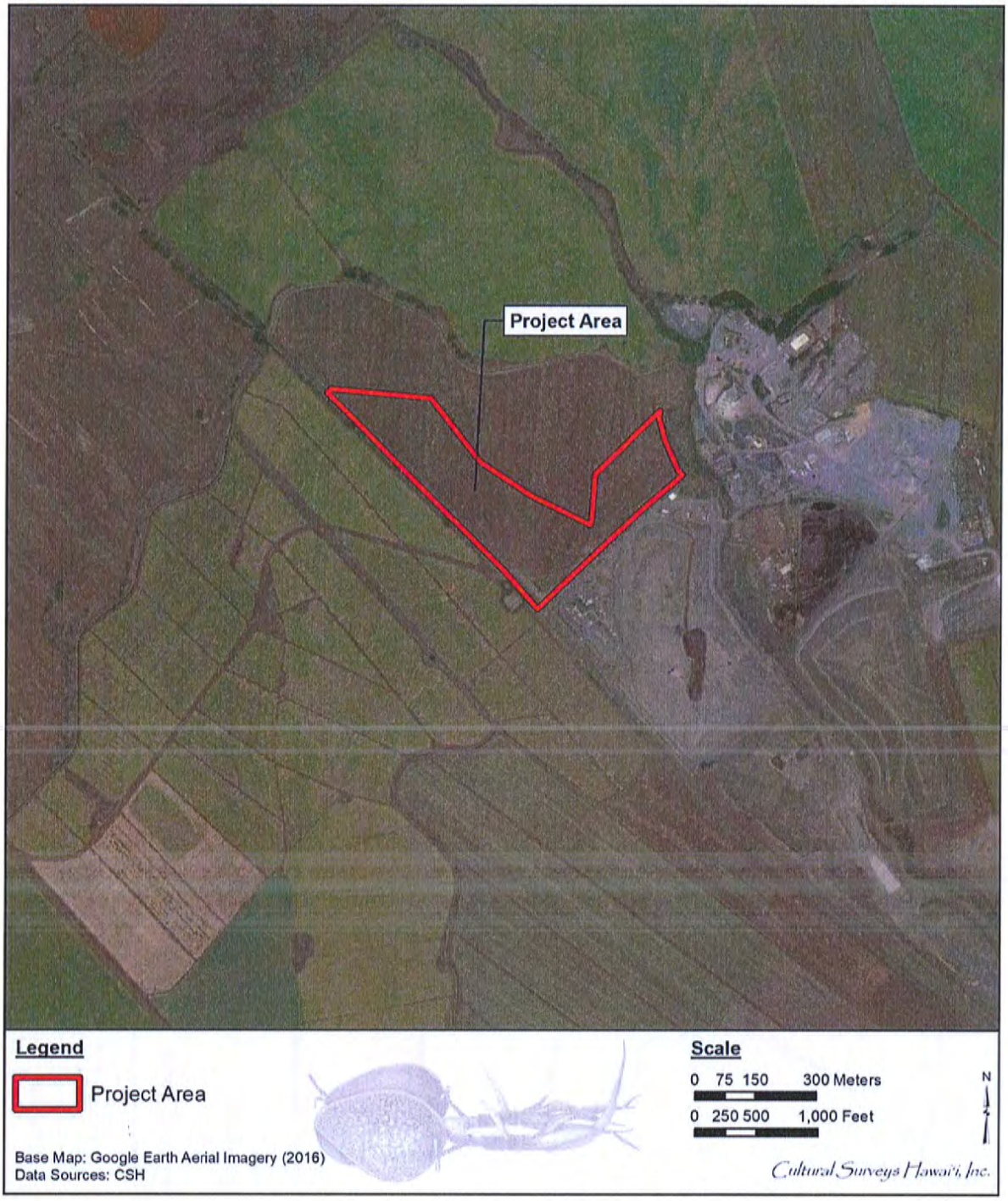

Figure 3. Aerial photograph of the project area (Google Earth 2016)

- Access Roads: paved internal access roads connecting the Project facilities with site Entrances 1 and 2 off Pulehu Road, and connecting the Project site to the CML;
- Stormwater Infiltration Basin "A" with a net storage capacity (i.e., after deducting a 1 foot freeboard) of approximately 12,000 cubic yards, or about 7.2 acre-foot; and
- Stormwater Infiltration Basin "B": with a net storage capacity (i.e., after deducting a 1 foot freeboard) of nearly 15,000 cubic yards, or about 9.4 acre-foot.

1.2 Document Purpose

The purpose of this CIA is to comply with the State of Hawai'i's environmental review process under Hawai'i Revised Statutes (HRS) §343, which requires consideration of the project's potential effect on cultural beliefs, practices, and resources. Through document research and cultural consultation efforts, this report provides information compiled to date pertinent to the assessment of the proposed project's potential impacts on cultural beliefs, practices, and resources (pursuant to the Office of Environmental Quality Control's *Guidelines for Assessing Cultural Impacts*), which may include Traditional Cultural Properties (TCPs). These TCPs may be significant historic properties under State of Hawai'i significance criterion "e," pursuant to Hawai'i Administrative Rules (HAR) §13-275-6 and §13-284-6. Significance criterion "e" refers to historic properties that "have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with 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 group's history and cultural identity" (HAR §13-275-6 and §13-284-6). The document will likely also support the project's historic preservation review under HRS §6E and HAR §13-275 and §13-284. The document is intended to support the project's environmental review and may also serve to support the project's historic preservation review under HRS §6E-8 and HAR §13-284.

1.3 Scope of Work

The scope of work for this cultural impact assessment includes the following:

1. Examination of cultural and historical resources including Land Commission documents, historic maps, and previous research reports for the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal, and other resources or agricultural pursuits as may be indicated in the historic record.
2. Review of previous archaeological work within and near the subject parcel that may be relevant to reconstructing traditional land use activities; and to the identification and description of cultural resources, practices, and beliefs associated with the parcel.
3. Identify present and past uses of the cultural resources, practices, and beliefs associated with the parcel through interviews with person knowledgeable about the project area and its surroundings.
4. Preparation of a report that summarizes the results of these research activities and provides recommendations based on findings.

1.4 Environmental Setting

1.4.1 Natural Environment

The project area is situated in the *ahupua'a* (traditional land division) of Wailuku which is located in the larger *moku* (district) of Wailuku on central isthmus of the island of Maui. James (2001) provides the following description of Wailuku District:

> The present-day land division of Wailuku includes all of the Central Valley between east and west Maui, as well as 'Īao Valley and the northern portion of Kīhei. It is the only land area in the Hawaiian Islands bordered by mountains on two opposite sides and the sea on the other two sides. [James 2001:56]

The notably large and sprawling *ahupua'a* of Wailuku is home to the urban centers of Kahului and Wailuku as well as the sacred 'Īao Valley.

1.4.2 Soils

According to the U.S. Department of Agriculture (USDA) Soil Survey Geographic (SSURGO) database (2001) and soil survey data gathered by Foote et al. (1972), the project area's soils consist of Waiakoa silty clay loam, 3 to 7 percent slopes and 7 to 15 percent slopes (WeB, WeC), and Molokai silty clay loam, 3 to 7 percent slopes (MuB) (Figure 4).

Soils of the Waiakoa Series are described as:

> This series consists of well-drained soils on uplands on the island of Maui. These soils developed in material weathered from basic igneous rock. The upper part of the profile is influenced by volcanic ash. These soils are gently sloping to moderately steep. Elevations range from 100 to 1,000 feet. The annual rainfall amounts to 12 to 20 inches; most of it occurs in winter. The mean annual soil temperature is 74° F. Waiakoa soils are geographically associated with Keahua and Keawakapu soils.
>
> These soils are used for sugarcane, pasture, homesites, and wildlife habitat. The natural vegetation consists of buffelgrass, feather fingergrass, ilima, kiawe, uhaloa, and zinnia. [Foote et al. 1972:126]

Soils of the Molokai Series are described as:

> This series consists of well-drained soils on uplands on the islands of Maui, Lanai, Molokai, and Oahu. These soils formed in material weathered from basic igneous rock. They are nearly level to moderately steep. Elevations range mainly from nearly sea level to 1,000 feet but are as much as 1,500 feet on Lanai. The annual rainfall amounts to 20 to 25 inches, most of which occurs between November and April. The summers are hot and dry. The mean annual soil temperature is 73° F. Molokai soils are geographically associated with Holomua, Keahua, Lahaina, and Uwala soils.
>
> In this survey area a shallow variant of the Molokai series was mapped. This soil, Molokai silty clay loam, shallow variant, 15 to 25 percent slopes, severely

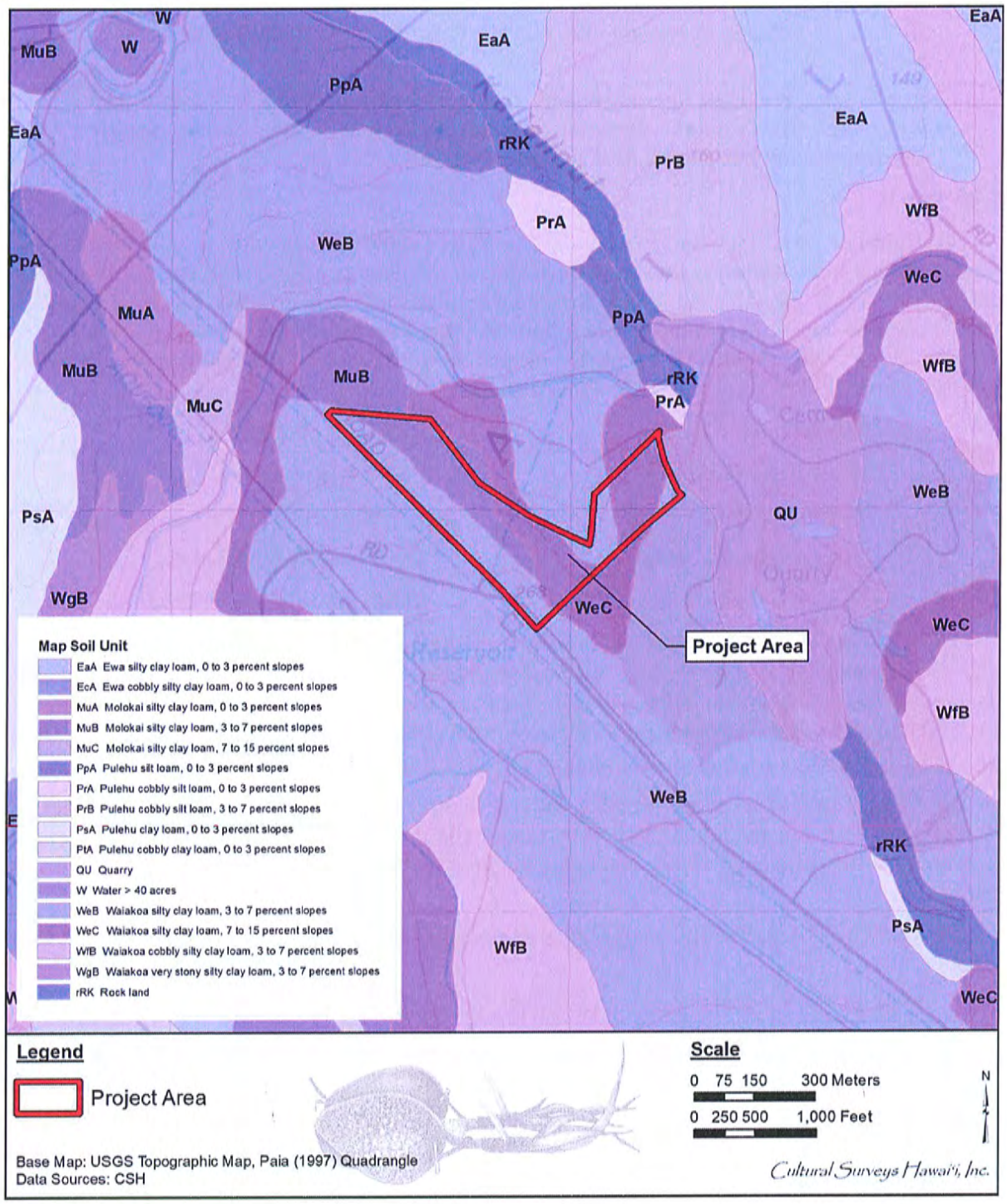

Figure 4. Overlay of Soil Survey of the State of Hawaii (Foote et al. 1972) on a 1997 USGS Topographic map, indicating soil types within and surrounding the project area (U.S. Department of Agriculture Soils Survey Geographic Database [SSURGO] 2001)

> eroded, is described in alphabetical order, along with other mapping units of this series.
>
> These soils are used for sugarcane, pineapple, pasture, wildlife habitat, and homesites. The natural vegetation consists of kiawe, ilima, uhaloa, feather fingergrass, and buffelgrass. [Foote et al. 1972:96]

1.4.3 Winds

The Hawaiian word for wind is *makani*. *The Wind Gourd of La'amaomao* tells the story of Pāka'a and his son Kuāpāka'a who are descendants of the wind goddess La'amaomao. With their possession of this special wind gourd, they could control and call forth the winds of Hawai'i. Pāka'a's chant traces the winds of Maui and Moloka'i, including the winds of the *moku* of Wailuku. Four distinct winds are identified in relation to the project area and nearby *ahupua'a*: *Kololio, I'a-iki, 'O'opu*, and *Kaua'ula*. Pāka'a's chant is listed below:

Kololio mai o Waikapu,	Kololio is of Waikapū,
He i'a iki ko Wailuku,	I'a-iki is of Wailuku,
He oopu ko Waihee,	'O'opu is of Waihe'e,
Pa ka makani Kauaula,	The Kaua'ula wind blows,
	[Nakuina 1902:68;1992:63]

Pāka'a's wind chant recognizes an upwardly circulating wind pattern in the following lines: "*He pelu ka makani no kai, He kupa he okea ka makani*" which translates to "The wind that doubles up is of the lowlands, Kupa and Okea are the winds" (Nakuina 1902:69; Nakuina 1992:63). In the iteration of the chant found in Sterling (1998:7), *okea* is written as *okee*, meaning, "To veer, as the wind, to change, as direction; to eddy" (Pukui and Elbert 1986:281).

The Maui Vortex is a diurnal weather pattern, dissipating in the evening when the slopes of Haleakalā cool. It was modelled in 1949 by Luna Leopold, Chief Meteorologist at the Pineapple Research Institute (Leopold 1949), and again in 1966 by the National Weather Service (Peterson 1966).

The four winds of the Wailuku *moku* are also recounted in Sterling (1998) by an informant who relates:

> Wailuku's wind is the Makani-lawe-malie, the wind that takes it easy.
>
> Waiehu's wind is the Makani-hoo'eha-ili, the wind that hurts the skin.*
>
> Waikapu's wind is the Makani-ko-kololio, the gusty wind.
>
> Waihee's wind is the Makani-kili-'o'opu. [Sterling 1998:62]

1.4.4 Rain

Precipitation is a major component of the water cycle and is responsible for depositing *wai* (water) on local flora. Pre-Contact *kānaka maoli* (Native Hawaiians) recognized two distinct annual seasons. The first, known as *kau* (period of time, especially summer) lasts typically from May to October and is a season marked by a high-sun period corresponding to warmer

temperatures and steady trade winds. The second season, *ho 'oilo* (winter, rainy season) continues through the end of the year from November to April and is a much cooler period when trade winds are less frequent, and widespread storms and rainfall become more common (Giambelluca et al. 1986:17). Typically, the maximum rainfall occurs in January and the minimum in June (Giambelluca et al. 1986:17). Handy and Pukui describe this seasonal change as follows:

> The season of storm and rain was termed Ho'oilo, including roughly the period of November through March, It commenced with 'Ikuwa (October-November) whose name means 'Loud-voice,' when Lono's thunder resounds over uplands and plains. Now the long drought of summer, when the intense heat of radiation of sun on black lava combined with the steady tradewinds made the kula kai seared and dry as a black tropical desert and the kula uka brown and arid, gives way to moisture-laden southern warm fronts pressing inshore, as tradewinds lapse. November is a noisy month with variable strong winds; and with the winds come the roaring and pounding surf . . . Commencing now and continuing through the rainy months until March, there was and is little deep-sea fishing, and inshore fishing depending on those occasions when the sea was not too rough. [Handy and Pukui 1977:23]

Rainfall accumulation near the project area averages around 15 inches per year with the heaviest rainfall occurring during the winter months (December through February) and little to no rainfall during the summer months (June through August) (Giambelluca et al. 1986). This pattern of rainfall and low annual precipitation rate may have once sustained a lowland, dry shrub land, and grassland native ecosystem (Pratt and Gon 1998).

Rains were named to show their action toward plants or the supposed effects on people or their possessions (Pukui and Elbert 1986:361). Each small geographic area on Maui had a Hawaiian name for its own rains. Akana and Gonzalez (2015) elaborate saying,

> Rain names are a precious legacy from our kūpuna who were keen observers of the world around them and who had a nuanced understanding of the forces of nature. They knew that one place could have several types of rain, each distinct from the other. They knew when a particular rain would fall, its color, its duration, its intensity, its path, its sound, its scent, and its effect on the land and their lives . . . Rain names are a treasure of cultural, historical, and environmental information. [Akana and Gonzalez 2015:n.p.]

Wailuku was no exception in this naming practice. Names of rain referencing the *ahupua'a* and *moku* of Wailuku include *Hō'eha'ili*, the skin-hurting rain of Waiehu (Akana and Gonzalez 2015:36); *Kili*, a delicate gentle rain associated with Waihe'e (Akana and Gonzalez 2015:81); and *Kili'o'opu* found at Waihe'e, Waiehu, Wailuku, and Waikapū (Akana and Gonzalez 2015:83).

1.4.5 Streams

Wailuku Ahupua'a was included in the traditional *'okana* (subdistrict) of Na Wai Eha, or "The Four Streams". This area is home to the four largest streams found on the windward coast of Maui. The streams of Wailuku Ahupua'a include the perennial 'Īao Stream also known as Wailuku River. Handy and Handy (1972) describe Wailuku River saying, "Wailuku is partly landbound, but its stream flows into Kahului Bay, which has been eroded by the ocean out of what was formerly the

stream mouth" (Handy and Handy 1972:496). Wailuku River drains from the heights of the western Maui uplands through the deep gorges of 'Īao Valley (Figure 5). Tributaries that flow into Wailuku River include Nakalaloa, Poonahoahoa, Kinihapai, and Ae streams.

1.4.6 Built Environment

The project area was formerly utilized for sugar cane cultivation and is currently vacant. The majority of land in the general vicinity of the project area is undeveloped and has been impacted by a significant amount of modification and alteration of the landscape by the cultivation of commercial hybrid sugar cane.



Figure 5. ʻĪao Valley, taken between 1883 and 1905 (Brother Bertram Photo Collection)

Section 2 Methods

2.1 Archival Research

Research centers on Hawaiian activities including *ka'ao* (legends), *wahi pana* (storied places), *'ōlelo no'eau* (proverbs), *oli* (chants), *mele* (songs), traditional *mo'olelo* (stories), traditional subsistence and gathering methods, ritual and ceremonial practices, and more. Background research focuses on land transformation, development, and population changes beginning with the early post-Contact era to the present day.

Cultural documents, primary and secondary cultural and historical sources, historic maps, and photographs were reviewed for information pertaining to the study area. Research was primarily conducted at the CSH library. Other archives and libraries including the Hawai'i State Archives, the Bishop Museum Archives, the University of Hawai'i at Mānoa's Hamilton Library, Ulukau, The Hawaiian Electronic Library (Ulukau 2014), the State Historic Preservation Division (SHPD) Library, the State of Hawai'i Land Survey Division, the Hawaiian Historical Society, and the Hawaiian Mission Houses Historic Site and Archives are also repositories where CSH cultural researchers gather information. Information on Land Commission Awards (LCAs) were accessed via Waihona 'Aina Corporation's Māhele database (Waihona 'Aina 2000), the Office of Hawaiian Affairs (OHA) Papakilo Database (Office of Hawaiian Affairs 2015), and the Ava Konohiki Ancestral Visions of 'Āina website (Ava Konohiki 2015).

2.2 Community Consultation

2.2.1 Scoping for Participants

The cultural department commences our consultation efforts by utilizing our previous community contact list to facilitate the interview process. This is then followed with a review of CSH's in-house database of *kūpuna* (elders), *kama'āina*, cultural practitioners, lineal and cultural descendants, Native Hawaiian Organizations (NHOs; includes Hawaiian Civic Clubs and those listed on the Department of Interior's NHO list), and community groups. CSH also contacts agencies such as SHPD, OHA, and the appropriate Island Burial Council where the proposed project is located for their response to the project and to identify lineal and cultural descendants, individuals and/or NHO with cultural expertise and/or knowledge of the study area. CSH is also open to referrals and new contacts.

2.2.2 "Talk Story" Sessions

Prior to the interview, CSH cultural researchers explain the role of a CIA, how the consent process works, the project purpose, the intent of the study, and how their *'ike* (knowledge) and *mana'o* (thought, opinion) will be used in the report. The interviewee is given an Authorization and Release Form to read and sign.

"Talk Story" sessions range from the formal (e.g., sit down and *kūkā* [consultation, discussion] in participant's choice of place over set interview questions) to the informal (e.g., hiking to cultural sites near the study area and asking questions based on findings during the field outing). In some cases, interviews are recorded and transcribed later.

CSH also conducts group interviews, which range in size. Group interviews usually begin with set, formal questions. As the group interview progresses, questions are based on interviewees' answers. Group interviews are always transcribed and notes are taken. Recorded interviews assist the cultural researcher in 1) conveying accurate information for interview summaries, 2) reducing misinterpretation, and 3) missing details to *mo'olelo*.

CSH seeks *kōkua* (assistance) and guidance in identifying past and current traditional cultural practices of the study area. Those aspects include general history of the *ahupua'a*; past and present land use of the study area; knowledge of cultural sites (for example, *wahi pana*, archaeological sites, and burials); knowledge of traditional gathering practices (past and present) within the study area; cultural associations (*ka'ao* and *mo'olelo*); referrals; and any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the study area.

2.2.3 Completion of Interview

After an interview, CSH cultural researchers create an interview summary based on information provided by the interviewee. Cultural researchers give a copy of the interview summary to the interviewee for review and ask that they make any necessary edits. Once the interviewee has made those edits, CSH incorporates their *'ike* and *mana'o* into the report. When the draft report is submitted to the client, cultural researchers then prepare a finalized packet of the participant's interview summary, and any photos taken during the interview. We also include a thank you card and honoraria.

It is important that CSH cultural researchers cultivate and maintain community relationships. The CIA report may be completed, but CSH researchers continuously keep in touch with the community and interviewees throughout the year—such as checking in to say hello via email or by phone, volunteering with past interviewees on community service projects, and sending holiday cards to them and their *'ohana* (family). CSH researchers feel this is an important component to building relationships and being part of an *'ohana* and community.

"*I ulu no ka lālā i ke kumu*—the branches grow because of the trunk," is an *'ōlelo no'eau* (#1261) shared by Mary Kawena Pukui with the simple explanation: "Without our ancestors we would not be here" (Pukui 1983:137). As cultural researchers, we often lose our *kūpuna* but we do not lose their wisdom and words. We routinely check obituaries and gather information from other community contacts if we have lost our *kūpuna*. CSH makes it a point to reach out to the *'ohana* (family) of our *kūpuna* who have passed on and pay our respects including sending all past transcriptions, interview summaries, and photos for families to have on file for genealogical and historical reference. All field activities are performed in a manner so as to minimize impact to the natural and cultural environment in the project area. Where appropriate, Hawaiian protocol may be used before going on to the study area and may include the *ho'okupu* (offering) of *pule* (blessing), and *oli*. All participants on field visits are asked to respect the integrity of natural and cultural features of the landscape and not remove any cultural artifacts or other resources from the area.

Section 3 *Ka'ao* and *Mo'olelo* (Legends and Stories)

Hawaiian storytellers of old were greatly honored; they were a major source of entertainment and their stories contained lessons while interweaving elements of Hawaiian lifestyles, genealogy, history, relationships, arts, and the natural environment (Pukui and Green 1995:IX). According to Pukui and Green (1995), storytelling is better heard than read for much becomes lost in the transfer from the spoken to the written word and *ka'ao* are often full of *kaona* or double meanings.

Ka'ao are defined by Pukui and Elbert (1986:108) as a "legend, tale [...], romance, [and/or], fiction." *Ka'ao* may be thought of as oral literature or legends, often fictional or mythic in origin, and have been "consciously composed to tickle the fancy rather than to inform the mind as to supposed events" (Beckwith 1970:1). Conversely, Pukui and Elbert (1986:254) define *mo'olelo* as a "story, tale, myth, history, [and/or] tradition." The *mo'olelo* are generally traditional stories about the gods, historic figures or stories which cover historic events and locate the events with known places. *Mo'olelo* are often intimately connected to a tangible place or space (*wahi pana*).

In differentiating *ka'ao* and *mo'olelo* it may be useful to think of *ka'ao* as expressly delving into the *wao akua* (realm of the gods), discussing the exploits of *akua* (gods) in a primordial time. However, it is also important to note that not all *ka'ao* explicitly deal with the exploits of either gods, goddesses, or the supernatural. *Mo'olelo* on the other hand, reference a host of characters from *ali'i* (royalty; chief) to *akua; kupua* (supernatural beings) to *maka'āinana* (commoners); and discuss their varied and complex interactions within the *wao kānaka* (realm of man). Beckwith elaborates, "In reality, the distinction between *ka'ao* as fiction and *mo'olelo* as fact cannot be pressed too closely. It is rather in the intention than in the fact" (Beckwith 1970:1). Thus a so-called *mo'olelo*, which may be enlivened by fantastic adventures of *kupua*, "nevertheless corresponds with the Hawaiian view of the relation between nature and man" (Beckwith 1970:1).

Both *ka'ao* and *mo'olelo* provide important insight into a specific geographical area, adding to a rich fabric of traditional knowledge. The preservation and passing on of these stories through oration remains a highly valued tradition. Additionally, oral traditions associated with the study area communicate the intrinsic value and meaning of a place, specifically its meaning to both *kama'āina* as well as others who also value that place.

The following section presents traditional accounts of ancient Hawaiians living in the vicinity of the project area. Many relate an age of mythical characters whose epic adventures inadvertently led to the Hawaiian race of *ali'i* and *maka'āinana*. The *ka'ao* in and around the project area shared below are some of the oldest Hawaiian stories that have survived; they still speak to the characteristics and environment of the area and its people.

3.1.1 The Battle of the Owls

In Pukui and Curtis's *The Water of Kāne* (1994) the naming of Wailuku is recounted in the *mo'olelo* of the battle of the owls. Mistaking owl eggs for duck eggs, a woman of Maui brings home eight owl eggs to her husband. The husband in disgust, proclaims that the eggs are of an owl and no good to eat. At this moment the mother owl, to whom the eggs belonged, appears and appeals to the husband that the eggs be returned to her nest. The husband who was a cruel man smashed the eight owl eggs leaving the mother owl with only bits of shell.

> The mother owl wept. . . She gathered up the bits of shell and flew back to her empty nest. There her mate met her.
>
> "Why do you weep?" he asked,
>
> "For our eggs," she told him. "Only these bits of shell are left". . .
>
> "We shall punish him!"
>
> "What can two owls do against a man?"
>
> "Two owls? Four hundred owls! Four thousand owls! Fly to the west and tell all owls of this cruel deed. I shall fly to Hawai'i. Let us gather the owls of every island to our aid."
>
> The owls of every island came. Those of Ni'ihau and Kaua'i met the owls of O'ahu. Flying together in a great flock they joined the owls of Moloka'i, Lāna'i and Kaho'olawe. When they were united with flocks from Hawai'i and from Maui their numbers filled the sky and shut out the sun's light. A fierce battle followed. The cruel man was punished and the battle place still bears the name Wailuku, Water-of-killing. [Pukui and Curtis 1994:188-189]

3.1.2 Luahinepi'i

The *wahi pana* of 'Īao Valley is the subject of a number of *ka'ao* and *mo'olelo*. One legend tells of a woman named Luahinepi'i who came to her end after jumping from Kūkaemoku, the 2,250 foot peak also known as the 'Īao Needle (Figure 6). The story of Luahinepi'i is recounted in Sterling (1998):

> At the base of this noble perpetual sentinel to Iao Canyons [*Kukaemoku - 'Iao Needle*] lived, a few centuries ago, a most beautiful maiden. Her figure and form was so near perfection that a Raphael or a Michael Angelo might have selected her for a model representing a Hawaiian Venus. Her name was Luahinepii (climbing old woman), a name most unsuitable to a maiden so beautifully fair. She possessed, however, a voice so unpleasant and hideous that other maidens, jealous of her unsurpassed natural beauty, made fun of her.
>
> Luahinepii had a lover who lived at the beach near Paukukalo. Other maidens looked upon him as a possible suitor, but like all true lovers he turned a deaf ear to their entreaties.
>
> The rival belles met and agreed to circulate a report to this wise: "Ua lohe- ia ko leo kapu e ko ipo i Moealoha" (Your sacred voice has been heard by your lover at Lover's-dream). This soon reached the ear of Luahinepii. She felt deeply these to her, most humiliating words. In her frantic moments she sought to end her life and to free herself from the cares and woes of this deceptive world. . . Luahinepii scaled to the top of Kukaemoku, called Nanahoa, and from its dizzy height dashed

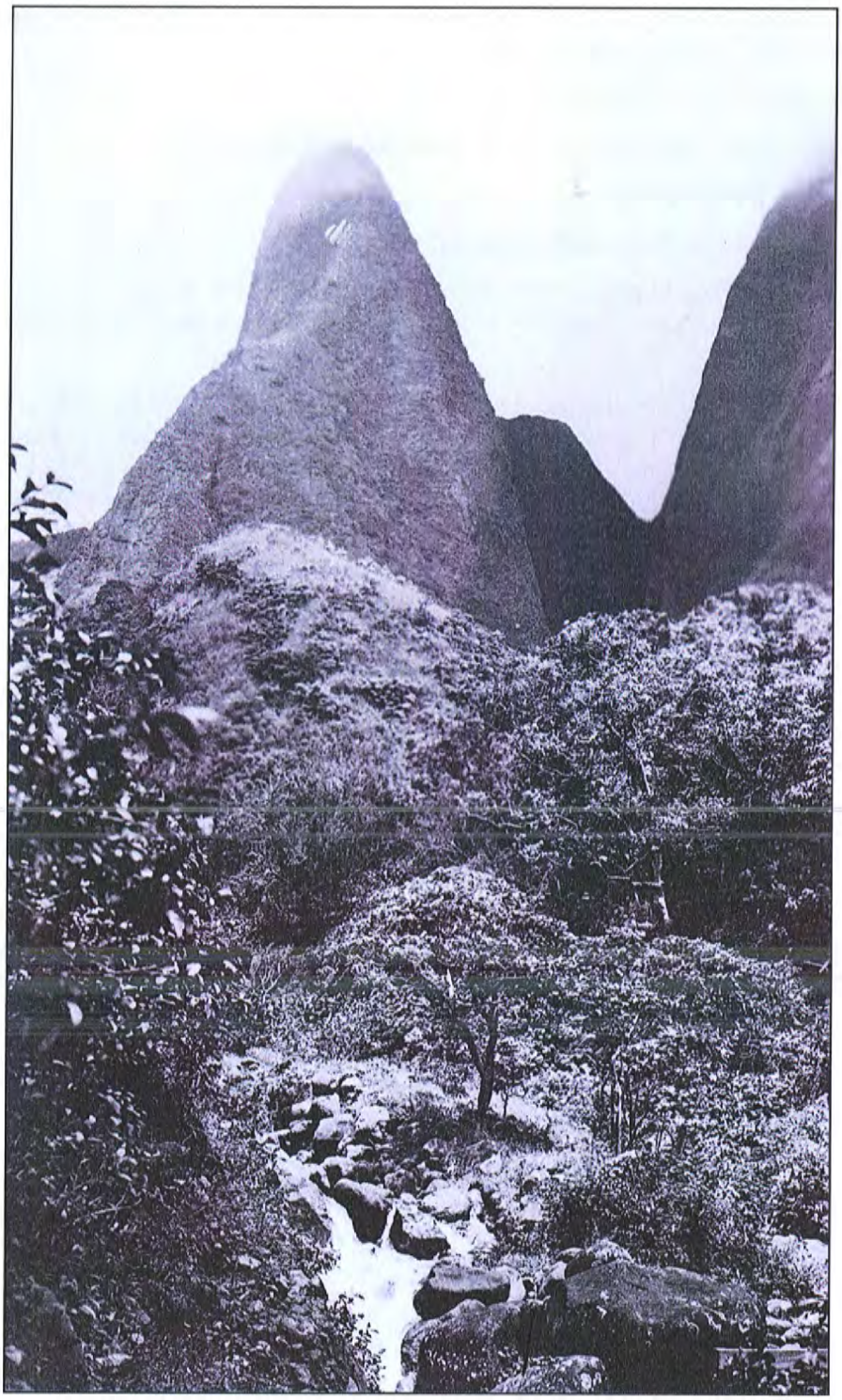

Figure 6. Kūkaemoku, the 2,250-foot peak also known as the 'Īao Needle (USC Pierce Collection).

herself headlong to the valley beneath, and the waters of Iao were made incarnadine with her blood. [Sterling 1998:83]

3.1.3 The Owls of Kama'oma'o

The Ke Kula o Kama'oma'o, or the Plains of Kama'oma'o, is cited as a home to owl deities, considered one of the oldest *'aumakua* (personal family gods) in Hawaiian mythology. The endemic *pueo* (Hawaiian short-eared owl; *Asio flammeus sandwichensis*), most likely named from one of its calls, was once worshiped by early Hawaiians as a god (Titcomb and Gagne 1976). Pueo-nui-akea was the name of an owl who traversed the Plains of Kama'oma'o and restored life to wandering souls (Beckwith 1970:124).

Fornander (1919) recalls the story of Pumaia who was a heroic young man that fell to the hands of a spirit. This spirit, Puukolea, had a dual body, capable of shape-shifting in ways the mere human, Pumaia, could not. After falling to Puukolea, Pumaia's spirit returned home but continued to be chased by Puukolea. Pumaia fled till he reached the plains of Kama'oma'o. There an owl by the name of Pueonuiokona began battling Puukolea and ultimately killed him, his entrails were scattered about the plains.

3.2 *Wahi Pana* (Storied Places)

Wahi pana are legendary or storied places of an area. These legendary or storied places may include a variety of natural or human-made structures. Oftentimes dating to the pre-Contact period, most *wahi pana* are in some way connected to a particular *mo'olelo*, however, a *wahi pana* may exist without a connection to any particular story. Davianna McGregor outlines the types of natural and human-made structures that may constitute *wahi pana*:

> Natural places have mana, and are sacred because of the presence of the gods, the akua, and the ancestral guardian spirits, the 'aumakua. Human-made structures for the Hawaiian religion and family religious practices are also sacred. These structures and places include temples, and shrines, or heiau, for war, peace, agriculture, fishing, healing, and the like; pu'uhonua, places of refuge and sanctuaries for healing and rebirth; agricultural sites and sites of food production such as the lo'i pond fields and terraces slopes, 'auwai irrigation ditches, and the fishponds; and special function sites such as trails, salt pans, holua slides, quarries, petroglyphs, gaming sites, and canoe landings. [McGregor 1996:22]

As McGregor makes clear, *wahi pana* can refer to natural geographic locations such as streams, peaks, rock formations, ridges, offshore islands, and reefs, or they can refer to Hawaiian land divisions such as *ahupua'a* or *'ili* (land division smaller than an *ahupua'a*), and man-made structures such as fishponds. In this way, the *wahi pana* of Wailuku tangibly link the *kama'āina* of Wailuku to their past. It is common for places and landscape features to have multiple names, some of which may only be known to certain *'ohana* or even certain individuals within an *'ohana*, and many have been lost, forgotten or kept secret through time. Place names also convey *kaona* and *huna* (secret) information that may even have political or subversive undertones. Before the introduction of writing to the Hawaiian Islands, cultural information was exclusively preserved and perpetuated orally. Hawaiians gave names to literally everything in their environment, including individual garden plots and *'auwai* (ditch, canal), house sites, intangible phenomena

such as meteorological and atmospheric effects, *pōhaku* (rock, stone), *pūnāwai* (freshwater springs), and many others. According to Landgraf (1994), Hawaiian *wahi pana* "physically and poetically describes an area while revealing its historical or legendary significance" (Landgraf 1994:v).

3.2.1 Pu'u Nēnē

Pu'u Nēnē, is literally translated as "goose hill" according to Pukui et al. (1974:49). The site of the Hawaiian Commercial & Sugar (HC&S) sugar mill at Pu'u Nēnē, the avenue of Pu'u Nēnē and the school named Pu'unēnē are not located where the actual "goose hill" once stood. The hill, named for the Hawaiian goose or *nēnē* (*Nesochen sandvicensis*), was a cinder cone built by lava of the Kula series (Stearns and MacDonald 1942:83), elevation 187 feet (56 meters), that was located some 4 miles northeast of the Pu'u Nēnē Mill. Most all of the cinder from Pu'u Nēnē was removed to pave the runways of the Pu'u Nēnē Naval Air Station Kahului during WWII (Saito 2008).

3.2.1 Kama'oma'o: A Wandering Place of Spirits

Ke Kula o Kama'oma'o, or the Plains of Kama'oma'o, is the name given to a region of sandy plains between Kahului and Wailuku, Maui (Emerson 1915). This area was known by Hawaiians in traditional times as a wandering place of the souls (Beckwith 1970), a place where dead spirits waited for a friendly escort, perhaps a family *'aumakua*, to show them the way to eternity:

> The worst fate that can befall a soul is to be abandoned by its aumakua and left to stray, a wandering spirit (*kuewa*) in 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 places which they haunt on each island are feared and avoided. Such are the plains of Kama'oma'o on the island of Maui, the rough country of Kaupea at Pu'uloa on Oahu, Uhana on Lanai, Maohelaia on Molokai, Mana on Kauai, Halali'i on Ni'ihau. In these desolate places lost spirits wander until some friendly *aumakua* takes pity upon them (Beckwith 1970:154).

According to Helen P. Hoyt (1976), Kama'oma'o is also a region where the "Marchers of the Night," or *Ka huaka'i o ka Po*, are sometimes heard and seen. When these spiritual "Night Marchers" appear, according to Beckwith (1932), "It is said that such a sight is fatal unless one has a relative among the dead to intercede for him."

> The marchers carried candlenut torches which burned brightly even on a rainy night. They might even be seen in broad daylight and were followed by whirlwinds such as come one after another in columns. They cried "Kapu o moe!" as a warning to stragglers to get out of the way or to prostrate themselves with closed eyes until the marchers passed (Beckwith 1932:199).

The eternity that the souls of the dead seek is a place known as Pō. Beckwith (1970) elaborates on the significance of Pō, "Each human being is formed in the spring of water within the uterus of the mother and emerges from it into human life. At death he returns to the Pō again" (Beckwith 1970:163).

3.2.2 Mau'oni and Kanahā Loko I'a

On the north shore of the central isthmus in Wailuku Ahupua'a lie the *loko i'a* (fishpond) of Mau'oni and Kanahā. A traditional story concerning their construction appears in Sterling (1998:87-88), based on an interview with Mrs. Rosalie Blaisdell in 1923 by J.F.G. Stokes (BPBM Anthropology Department archives, Grp 7, 10.10.C9). According to tradition, construction of the pond walls was begun by an O'ahu chief, but finished by Kamehamehanui, king of Maui in the mid-1700's. The story established that Kapiiohookalani, the original architect of the two ponds and one-time king of O'ahu and half of Moloka'i, was killed in battle before he could complete the construction of the pond walls. His daughter, Kahamaluihiikeaoihilani, sought her brother, Kanahaokalani, and searched Moloka'i and Maui for him. The pond walls were finished by Kamehamehanui, who placed a *kapu* (taboo) on the bank, and built a *kuapā* (fishpond wall), dividing the two ponds. The chiefess Kahamaluihii was born of such high rank that she was able to break the *kapu* by walking on the center *kuapā* of the ponds. Following this act, Kamehamehanui allowed her to name the ponds. She named Kanahā for her brother, and Mau'oni for the identity she travelled by to protect her status as a chiefess of the highest rank.

Sterling (1998) also noted two references by Samuel Kamakau (1992) stating that Kihapi'ilani had built the stonework separating the two ponds at a much earlier time than the work performed by Kamehamehanui. Kanahā is a wetland sanctuary that is home to a large population of the native *ā'eo* (Hawaiian stilt; *Himantopus mexicanus knudseni*). Over fifty species of birds have been observed here, including herons, geese, ducks, owls, plovers, sandpipers, *'ūlili* (tattlers; *Heteroscelus incanus*), *'alae ke'oke'o* (Coot; *Fulica alai*), pheasants (*Lophura leucomelanos*) and doves (Pukui et al. 1974).

3.2.3 Place Names of Wailuku

An analysis of the place name meanings (Table 1) for the region surrounding the project area may yield some insight into the patterns of life in an area. Literal translations of several of the place names for land areas and divisions near to the project area are listed below. Unless otherwise noted, the translations are taken from Pukui et al. (1974).

Table 1. Place Name Meanings of Wailuku Moku in the Vicinity of the Project Area

Name	Translation
Haleki'i (Heiau)	Lit., "image house." A *heiau* (Walker Site 44) located in Wailuku at the site of Pihana Heiau (see below), along the meander of 'Īao Stream.
'Īao (Stream)	Lit., "cloud supreme." The 'Īao Stream brings the water of the 'Īao Valley to the ocean at Paukūkalo, a point just northwest of Kahului Harbor.
Ka'a (Point)	Lit., "rolling." A shoreline promontory just east of Kahului Bay.
Kahului	Lit., "the winning". According to Sterling (1998), the native name for the Kahului region is "Kaihuwa'a".

Name	Translation
Kalialinui (Gulch)	Possible literal translation: "Large tree or plant used for medicine" (Pukui and Elbert 1986). Kalialinui Gulch measures some 11 miles long, beginning on the upper slopes of Haleakalā, through the project area, and on across the Wailuku Ahupua'a, terminating on the flat plains of Kahului just south of Kanahā Pond.
Kanahā (Pond)	Star name (Pukui and Elbert 1986). Sterling (1998) notes that salt was gathered at Kanahā: "When the sea rose the hollows in the rocks were filled." The story of the building of the ponds is further noted by Sterling (1998:87) in this report.
Ka'ōpala	Lit., "the rubbish"; a dividing line between Pūlehu Nui (*ahupua'a*) and Waikapū (*ahupua'a*).
Kapukaulua	Lit., "the fish hole"; located in the coastal region of Pā'ia, at the most seaward portion of Spreckelsville. Close to the reported location of Papanene Heiau (Walker Site 56). The reference to the fishing area concerns the *ulua* (crevalle, jack, pompano) fish.
Kaunoa	Lit., "place without taboo." A legendary woman of great beauty (Fornander 1916:548).
Mau'oni (Pond)	One of the two fishponds located at the shore of Kanahā.
Papa'ula	Lit., "red flats"; the region just inland of this promontory is presently a portion of the modern Maui Country Club golf course.
Paukūkalo	Lit., "taro piece." This present-day shoreline community is located at the northernmost region adjacent to the Kahului Harbor. The 'Īao Stream reaches the ocean at Paukūkalo, a region formerly heavily planted in *kalo* (taro; *Colocasia esculenta*).
Pihana (Heiau)	Lit., "fullness." According to Pukui et al. (1974), stories of this Wailuku Heiau include it being built in a single night by the legendary race of Menehune, who brought the stones from Paukūkalo beach. Pukui also states that the construction of this heiau has been attributed to the Maui chief, Kahekili. It is listed as Walker Site 43.
Pūlehu Nui (Ahupua'a)	Large *pūlehu* where *pūlehu* is literally translated as "broiled". This *ahupua'a* abuts the *ahupua'a* of Wailuku and Waikapū, and constitutes much of the land area of the central isthmus.
Pu'unēnē	Lit., "goose hill." A cinder cone, once located just inland of Papa'ula, mined for its gravel during WWII to construct the runways at NAS Kahului.

Name	Translation
Wai'ale (reservoir)	Lit., "rippling water"; reservoir located in Wailuku, fed by waters of the Spreckels Ditch.
Waikapū (Ahupua'a)	Lit., "water of the conch", a meaning with reference to the conch shell formerly found in a cave at Waikapū, until it was stolen by a supernatural dog, named Puapualenalena. Also, the scene of a great battle, fought between Kahekili, king of Maui, and Kalani'opu'u, king of Hawai'i Island, at Waikapū Commons.
Wailuku (Ahupua'a)	Lit., "water of destruction", possibly a reference to the battle which took place at 'Īao between the forces of Kamehameha I and the Maui chiefs. Sterling (1998) states that Pukui (1974) believes the name is older than the famous battle. Westervelt (1910) makes special reference to the waters of Wailuku in 'Īao (Lit., "asking for clouds") emptying into the Kahului Harbor. Fornander (1916:304) recorded that Wailuku was known as the place of flying clouds.

3.3 *'Ōlelo No'eau* (Proverbs)

Hawaiian knowledge was shared by way of oral histories. Indeed, one's *leo* (voice) is oftentimes presented as *ho'okupu* ("to cause growth," a gift given to convey appreciation, to strengthen bonds); the high valuation of the spoken word underscores the importance of the oral tradition (in this case, Hawaiian sayings or expressions), and its ability to impart traditional Hawaiian "aesthetic, historic, and educational values" (Pukui 1983:vii). Thus, in many ways these expressions may be understood as inspiring growth within reader or between speaker and listener:

> They reveal with each new reading ever deeper layers of meaning, giving understanding not only of Hawai'i and its people but of all humanity. Since the sayings carry the immediacy of the spoken word, considered to be the highest form of cultural expression in old Hawai'i, they bring us closer to the everyday thoughts and lives of the Hawaiians who created them. Taken together, the sayings offer a basis for an understanding of the essence and origins of traditional Hawaiian values. The sayings may be categorized, in Western terms, as proverbs, aphorisms, didactic adages, jokes, riddles, epithets, lines from chants, etc., and they present a variety of literary techniques such as metaphor, analogy, allegory, personification, irony, pun, and repetition. It is worth noting, however, that the sayings were spoken, and that their meanings and purposes should not be assessed by the Western concepts of literary types and techniques. [Pukui 1983:vii]

Simply, *'ōlelo no'eau* may be understood as proverbs. The Webster dictionary notes it as "a phrase which is often repeated; especially, a sentence which briefly and forcibly expresses some practical truth, or the result of experience and observation." It is a pithy or short form of folk wisdom. Pukui equates proverbs as a treasury of Hawaiian expressions (Pukui and Green 1995:xii). Oftentimes within these Hawaiian expressions or proverbs are references to places. This section

draws from the collection of author and historian Mary Kawena Pukui and her knowledge of Hawaiian proverbs describing *'āina* (land), chiefs, plants, and places. The following proverbs concerning the larger area of Wailuku come from Mary Kawena Pukui's *'Ōlelo No'eau* (Pukui 1983).

3.3.1 'Ōlelo No'eau #2300

The following *'ōlelo no'eau* describes the four main water sources on Maui.

Na wai 'ehā.

The four waters.

A poetic term for these places on Maui: Wailuku, Waiehu, Waihe'e, Waikapū, each of which has a flowing water (*wai*). [Pukui 1983:251]

3.3.2 *'Ōlelo No'eau* #1711

This proverb references Wailuku in relation to battles that took place between warring chiefs on Maui.

Ke inu aku la paha a'u 'Ālapa i ka wai o Wailuku.

My 'Ālapa warriors must now be drinking the water of Wailuku.

Said when an expected success has turned into a failure. This was a remark made by Kalaniōpu'u to his wife Kalola and son Kiwala'ō, in the belief that his selected warriors, the 'Ālapa, were winning in their battle against Kahekili. Instead they were utterly destroyed. [Pukui 1983:184]

3.3.3 *'Ōlelo No'eau* #2647

The following *'ōlelo no'eau* plays on the word *luku* (massacre, slaughter) in Wailuku.

Pili ka hanu o Wailuku.

Wailuku holds its breath.

Said of one who is speechless or petrified with either fear or extreme cold. There is a play on *luku* (destruction). Refers to Wailuku, Maui. [Pukui 1983:290]

3.3.4 *'Ōlelo No'eau* #2578

The following *'ōlelo no'eau* describes two ponds in Kahului, Maui: Mau'oni and Kanahā.

Pākāhi ka nehu a Kapi'ioho.

The *nehu* of Kapi'ioho are divided, one to a person.

Kapi'ioho, ruler of Moloka'i, had two ponds, Mau'oni and Kanahā, built on his land at Kahului, Maui. The men who were brought from Moloka'i and O'ahu to build the ponds were fed on food brought over from Moloka'i. The drain on that island was often so great that the men were reduced to eating nehu fish, freshwater 'ōpae and poi. The saying is used when poi is plentiful but fish is scarce and has to be carefully rationed. [Pukui 1983:284]

3.3.5 *'Ōlelo No'eau* #2912

Wailuku is spoke of as a place of shelter and refuge in the succeeding proverb.

Wailuku i ka malu he kuawa.

Wailuku in the shelter of the valleys.

Wailuku, Maui, reposes in the shelter of the clouds and the valley. [Pukui 1983:319]

3.3.6 *'Ōlelo No'eau* #1481

The subsequent *'ōlelo no'eau* all pertain to the Wailuku plains area known as Kama'oma'o. This place was famous for it's connection to wandering spirits.

Kama'oma'o, ka 'āina huli hana.

At Kama'oma'o, land of activities.

Ghosts who do not go to the pō of their ancestors often wander about in certain areas. Kama'oma'o, Maui is such a place. The activities of such ghosts usually annoy the living. [Pukui 1983:160]

3.3.7 *'Ōlelo No'eau* #1514

Ka 'ōlohe puka awakea o Kama'oma'o.

The bare one of Kama'oma'o that appears at noonday.

The plain of Kama'oma'o, Maui, is said to be the haunt of ghosts ('ōlohe) who appear at night or at noon. Also a play on 'ōlohe (nude), applied to one who appears unclothed. [Pukui 1983:164]

3.3.8 *'Ōlelo No'eau* #1761

Ke kula o Kama'oma'o ka 'āina huli hana.

The plain of Kama'oma'o – that is the place where plenty of work is to be found.

A taunt to one who talks of looking for work but does not do it. The plain of Kama'oma'o, Maui was said to be the haunt of ghosts whose activities were often terrifying. [Pukui 1983:189]

3.4 *Oli* (Chants)

Oli, according to Mary Kawena Pukui (Pukui 1995:xvi–xvii) are often grouped according to content. Chants often were imbued with *mana* (spiritual power); such *mana* was manifested through the use of themes and *kaona*. According to Pukui, chants for the gods (prayers) came first, and chants for the *ali'i* (chiefs), "the descendants of the gods," came second in significance. Chants "concerning the activities of the earth peopled by common humans," were last in this hierarchy (Pukui 1995:xvi–xvii). Emerson conversely states:

> In its most familiar form the Hawaiians–many of whom [were lyrical masters]–used the oli not only for the songful expression of joy and affection, but as the vehicle of humorous or sarcastic narrative in the entertainment of their comrades.

> The dividing line, then, between the oli and those other weightier forms of the mele, the *inoa*, the *kanikau* (threnody), the *pule*, and that unnamed variety of mele in which the poet dealt with historic or mythologic subjects, is to be found almost wholly in the mood of the singer. [Emerson 1965:254]

While *oli* may vary thematically, subject to the perspective of the *ho'opa'a* (chanter), it was undoubtedly a valued art form used to preserve oral histories, genealogies, and traditions, to recall special places and events, and to offer prayers to *akua* and *'aumākua* (family gods) alike. Perhaps most importantly, as Alameida (1993:26) writes, "chants . . . created a mystic beauty . . . confirming the special feeling for the environment among Hawaiians: their one *hānau* (birthplace), their *kula iwi* (land of their ancestors)."

3.4.1 A Travel Chant

The chant below mentions rains closely associated with the Wailuku Ahupua'a. The chant below gives passing references to Kama'oma'o (the plains near Pu'u Nēnē) and other areas near Wailuku.

Pau 'ole ko'u mahalo i ka laulā o Kama'oma'o	My admiration is endless for the expanse of Kama'oma'o
Ka hālana maika'i a Keālia	The fine rising of the waters of Keālia
Ka hemolele o ka ua 'Ulalena	The perfection of the 'Ulalena rain
Lena ka pua o ka māmane pala luhiehu i ka lā	Yellow are the blossoms of the māmane, soft and lovely in the sun

[Akana and Gonzalez 2015:267]

3.4.2 Hi'iaka and Wailuku

The goddess Hi'iaka, the sister of volcano goddess Pele, passes through Wailuku, Maui during her epic journey throughout the Hawaiian Islands. When Hi'iaka's *aikāne* (friend) Wahine'ōma'o complains of hunger during their travels along a *kaha* (hot dry shore) portion of northern Maui, Hi'iaka offers the following chant:

Ke kahulihuli a ka papa o Wailuku;	As trembles the plank at Wailuku (So trembles the fate of the king):
He ole ke kaha kuai ai, e:	There's no market where to buy meat;
Ho-mai he ai;	Give the stranger, then, something to eat:
Ho-mai ana ua ai, e!	Give us, I pray, of your meat.

[Emerson 1915:74]

Hi'iaka and Wahine'ōma'o were met with little hospitality after their appeal for food was largely ignored by the areas residents. Hi'iaka then offered the following chant making, "known her wish, concluding her appeal with ominous threats against the life of the king, in case her demands were not met" (Emerson 1915:75):

E Wai-hinano, wahine a ka po'ipo'i, e,	O Waihinano, thou soul-grabber,
Ua make ke alii, ka mea nona nei moku.	Dead is the king of this island;
He pua'a kau ka uku no Moloka'i;	Moloka'i shall offer a boar;
He ilio lohelohe Lana'i;	Lana'i's a half-baked dog;
A pale ka A-a ka Kanaloa;	Kanaloa fends off the A-a;
He puo'a kai Molokini:	Molokini buffets the waves.
Huli ka ele o na Hono;	The ship of state turns turtle:
Haki kepakepa na moku;	What wailing and beating of breast!
Pa'iauma ka aina;	Wild anguish of child and of ghost
Uwē kamali'i, uwē ka hanehane —	O'er the sandy plain of Kama'o.
Ke uwē la i ka pili,	The districts are frenzied with grief
I ke kula o Ka-ma'o-ma'o;	Tearing of hair and breaking of teeth
Ka'a kumakena o Maui, e!	One wail that lifts to heaven.
Ia wai Maui?	Who shall be heir to this Maui land?

[Emerson 1915:75-76]

The mention of Ka-ma'o-ma'o is in reference to the area known as Ke Kula o Kama'oma'o, or the Plains of Kama'oma'o, a region of sandy plains between Kahului and Wailuku, Maui.

3.5 *Mele* (Song)

There exist a number of *mele* that concern or mention Wailuku. These particular *mele* may also be classified as *mele wahi pana* (songs for legendary or historic places). *Mele wahi pana* such as those presented here may or may not be accompanied by *hula* (dance) or *hula wahi pana* (dance for legendary or historic places).

3.5.1 Na Wai 'Ehā O Maui

This *mele* was composed by Alice Namakelua in 1940 for the Kamehameha Day Celebration in Honolulu. The four waters of Maui, including that of Wailuku, are mentioned in this *mele*.

E Maui nui o Kama	Great Maui of Kama
'Āina ua kaulana	Famous land
O ka heke i'o no 'oe	You are truly superior
Ua lohe 'ia 'a puni ka honua	Heard around the earth
'Āina 'oe ua wehi	You are the land adorned

Ua 'ohu e ka roselani	Adorned by the rose
He pua ho'i nāu e lei	A flower for you to wear as an adornment
A e ha'aheo mau ai 'oe	And continue to wear in pride
Kaulana nā wai 'ehā	Famous are the four waters
He puana he inoa he ha'ina	A refrain, a name, an answer
Waikapū, Wailuku, Waiehu	Waikapū, Wailuku, Waiehu
A'o Waihe'e iho ia wai	Water descends in Waihe'e
He inoa nēia nou	This is a name chant for you
E Maui nui o Kama	Great Maui of Kama
Ha'aheo 'oe i ka roselani	You are cherished with pride because of the rose
E ō mai i kou inoa	Reply to your name

[Huapala n.d.]

3.5.2 No Na Wai 'Ehā

This 20th century *mele* composed by Scott Hai references Wailuku and other locations on Hai's beloved island home of Maui.

I Waikapū ke aloha	My love is at Waikapū
Ka makani Kokololio	The gusty wind named Kokololio
Pili i ka poli nahenahe	Held close to the soft bosom
He 'īnikiniki mālie	Gently pinching
I Wailuku iho 'oe	You went down to Wailuku
I ka piko a'o 'Īao	To the summit of 'Īao
Lihilihi o ka pua rose	Petals of the roses
He 'īnikiniki mālie	Gently pinching
I Waiehu iho 'oe	You went down to Waiehu
Ka makani Hō'ehaili	Hō'ehaili, the wind that pierces the skin
Me ka uhi wai a'o uka	With the thick fog of the upland
He 'īnikiniki mālie	Gently pinching
I Waihe'e kāua	We were at Waihe'e
Ka makani Kili'o'opu	The wind named Kili'o'opu
Me ka wai a'o Eleile	And the water of Eleile
He 'īnikiniki mālie	Gently pinching

I Lahaina iho 'oe	You went down to Lahaina
Ka makani Kaua'ula	Kaua'ula, the strong mountain wind
Me ka malu ulu a'o Lele	Amid the shade of the breadfruit trees of Lele
He 'īnikiniki mālie	Gently pinching
Ha'ina mai ka puana	Tell the refrain
No na wai 'ehā	Of the four water
E ho'i no e pili	Return and let us be together
He 'īnikiniki mālie	Gently pinching

[Huapala n.d.]

3.5.3 Waikapū/'Iniki Mālie

This song describes the winds of the four water-lands in Maui: Waikapū, Wailuku, Waiehu, and Waihe'e. The meaning of each name is described below by Pukui et al. (1974). Waikapū, water of the conch. A conch found in a cave in this area could be heard anywhere througout the Hawaiian Islands. It was stolen by a supernatural dog named Puapualenalena whose name meant yelow tail feathers. Wailuku, water of destruction. Wailuku was the battle site where Kalani'ōpu'u's army was nearly annihilated by Kahekili. Waiehu, meaning water spray and Waihe'e, meaning slipping water.

Waikapō makani kokolo lio,	Waikapū has a swift blowing wind,
He makani houhou 'ili	Wind that pierces the skin
'Ini'iniki malie.	Gently pinching it
Wailuku makani lawe mālie,	Wailuku has a gently blowing wind
He makani houhou 'ili	Wind that pierces the skin
'inikiniki mālie.	Gently pinching it
Waiehu makani ho 'eha'ili	Waiehu has a wind that pricks the skin
Makani houhou 'ili	Wind that pierces the skin
'Inikiniki mālie.	Gently pinching it
Waihe'e makani kili'o'opu	Waihe'e has a cool wind

Makani houhou 'ili
'Inikiniki mālie.

Ha'ina mai ana ka puana,
He makani houhou 'ili
'Inikiniki mālie.

Wind that pierces the skin
Gently pinching

This ends my song,
Wind that pierces the skin
Gently pinching
[Huapala n.d.]

Section 4 Traditional and Historical Accounts of Wailuku

4.1 Pre- Contact to Early Historic Period

Various legends and early accounts of Wailuku Ahupua'a indicate that a notable population of long-settled, pre-Contact Hawaiians inhabited the Wailuku area. In ancient times Wailuku, specifically the area around Kahului Bay, was known as a chosen gathering and residential site for Maui *ali'i* and chiefs (James 2001). James (2001) provides the following description of seventeenth century Wailuku:

> From the seventeenth century it was densely populated, by Hawaiian standards, with the Pihanakalani Heiau complex serving as a spiritual center. The beaches were lined with coconut groves, and along the shores were the thatched *hale* of fishermen and those concerned with the high chief's war canoes. Wailuku, Paukūkalo, and Waiehu were popular surfing spots amongst the chiefs of Maui, and from Waihe'e to Wailuku lay the largest continuous area of wetland taro cultivation in the Islands. [James 2001:56]

Handy and Handy (1972) reiterate the prolific cultivation of taro in Wailuku District saying that, "in ancient times [Wailuku District] was the largest continuous area of wet-taro cultivation in the islands" (Handy and Handy 1972:496). Taro, or *kalo*, was perhaps the most distinguished plant within traditional Hawaiian horticultural and society. This is echoed in pre-Contact descriptions of agricultural cultivation in Wailuku which are dominated by passages illustrating the prominence of taro. Handy and Handy (1972) describe the multifaceted role taro played in the pre-Contact era and its significance in the socio-cultural order:

> The function and nature of the taro plant, its cultivation and use, were responsible not only for its primal place in mythology but for the fact that the cult associated with it, namely that of the male god Kane (= Wakea) as first procreator, and of *Ka-wai-'ola-a-Kane* or "The-life-giving-water-of Kane," although less elaborated than that of the rain-father Lono, was more fundamental, not only in Hawaii but throughout Polynesia. It was, in fact, the basic cult of the primal procreator of nature and man, out of the union of Sky and Earth.
>
> Actually the course of fresh-water streams and ditches patterned the entire subsistence economy, and through this, the whole round and cycle of individual and social activity. The streams and ditches were the regulators, the law givers, in communal relationship; not directly, but because upon their water depended the taro, and upon the taro depended man.
>
> The requirements of labor, in connection with building and maintenance of dams, ditches, terraces, and embankments, and the planting, tending, and harvesting of the taro, determined the ordering of cooperative work and relationships between individuals and families within the community. This cooperation in turn was responsible for the obligations in the matter of work required of individuals and the right of individuals and families to a share in the products.

> Finally, taro in its habit of growth established a biological prototype of the form in which heredity and relationship were conceived. The taro growth supplied one of the terms in which the family system of the civilization was framed: *'ohana*, meaning the dispersed biological family group as a whole. *'Oha* means a shoot or sucker from the base of a plant, but essentially and primarily was applied to the buds from the corm of the taro that were broken off and replanted by the gardener. With the substantive suffix added, *'oha-na* literally means "offshoots," or "that which is composed of offshoots." The family stock, then, budding and branching from parent stocks, was conceived of in terms of the habit of reproduction of the taro. [Handy and Handy 1972:76]

The well-watered 'Īao Valley also provided ample shrimp, taro, and fish but was only accessible to commoners during the season of Makahiki (James 2001). Makahiki is the ancient festival beginning about the middle of October and lasting for about four months incorporating sports, religious festivities, and taboo on war.

4.1.1 Battle of Kakanilua

In 1776, the army of Kalani'ōpu'u, King of Hawai'i Island, landed at Keone'ō'io with their war canoes, a force so vast that the area between Makena and Honua'ula was said to have been completely filled by these canoes. There, the invading army proceeded to ravage the countryside. Kalani'ōpu'u then landed with additional forces at Kīheipuko'a at Keālia to Kapa'ahu (Kamakau 1992:85). Here his elite army of *Alapa* and *Pi'ipi'i* warriors, 800 men strong, landed ready for war. It was alleged that these men were of equal stature and all carried spears of identical length. Their appearance is related as a being a "magnificent spectacle" marching across the plains of Kama'oma'o wearing their feather cloaks and helmets. They were ready to battle Kahekili, chief of Maui, at his stronghold across the isthmus at Wailuku. Their army was said to be eager to drink the waters of the Wailuku Stream (Fornander 1880:152-153).

Samuel Kamakau recounts the invasion of Kalani'ōpu'u:

> Across the plains of Pu'u'ainako (Cane-trash-hill) and Kama'oma'o shone the feather cloaks of the soldiers, woven in ancient pattern and colored 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. Kahekili was at Kalanihale just below Kihahale and above the plateau of Ka'ilipoe at Pohakuaokahi. Said Kaleopu'upu'u to Ka-hekili, "The fish have entered the sluice; draw in the net". [Kamakau 1992:85]

The battle occurred between Waikapu and Wailuku. Kalani'ōpu'u planned to enter Wailuku via Kakanilua, however Kahekili's men occupied Kama'oma'o and the Waikapu area. Instead Kalani'ōpu'u's men were ambushed by Kahekili's army where scores of "spears, javelins, and other missiles poured like water" (Kamakau 1992:87) Kalani'ōpu'u's army was annihilated in what was called *Ahulau Ka Pi'ipi'i i Kakanilua* or Slaughter-of-the-Pi'ipi'i-at-Kakanilua (Kamakau 1992:86), one of the most legendary battles of pre-Contact Hawai'i.

The ruling chief of the Big Island, Kalani'ōpu'u, landed his army along the coastline of Maui, at Kiheipuko'a in the Keālia area, with his war canoes visible from Kapa'ahu (in Puna, on the

island of Hawai'i), and maneuvered his army inland across the central isthmus. In this way, the army of Kalani'opu'u crossed over the areas of Kama'oma'o and Pu'u 'Ainako to engage Kahekili's forces on the sand hills of Kalua, ending in a slaughter of the Big Island army known as "Ahulau ka Pi'ipi'i i Kakanilua" (Hokulani Holt Padilla, in Hill et al. 2006).

According to Ms. Holt-Padilla, the outcome of the battle for Kakanilua was not decided on the first day. The day following the "Slaughter of the Pi'ipi'i at Kakanilua," the remaining forces of Kalani'ōpu'u were again sent to battle Kahekili's forces, which were expected to be in Wailuku. The Big Island army was ambushed at an area close to Waikapū and was destroyed by the army of Kahekili on the plains of Kama'oma'o.

Ms. Holt-Padilla explained that the central isthmus was a dry, hot place with trails leading west toward Waikapū, and east along the Kīhei coastline. She stated that the guardian spirits of men, the *'aumakua* spirits, were known to wander on the lower, sandy plains of Waikapū. She explained that this place was a special place for the souls of the soldiers killed at Kakanilua.

4.1.2 The Battle of 'Īao

The 1790 invasion of Maui by Kamehameha the Great of Hawai'i Island, is memorialized in many place names within Wailuku. The Battle of 'Īao is also known as the Battle of Kepaniwai, meaning the "Dammed Stream". Prior to the Battle of 'Īao, Kahekili, the ruling chief of Maui, had gained control of O'ahu, Lanai and Moloka'i. However, in 1790, the defining battle establishing Kamehameha's supremacy over the army defending Maui began at Pu'unēnē. Crossing the channel from the island of Hawai'i with his war fleet, Kamehameha I overwhelmed the Maui forces in Hāna en-route to engaging the main island defense force gathered along Maui's northern coastline. Kamehameha I assembled his invasion forces at Kahului. With Kahekili on O'ahu, the defense of Maui fell to his son, Kalanikupule. The Maui forces were swept across the isthmus and destroyed at 'Īao Valley, above Wailuku. The high chiefs and royalty of Maui fled to other islands, and Kamehameha I went on to defeat the combined forces of Kahekili and Kalanikupule at Nu'uanu, on O'ahu in 1795.

The Battle of 'Īao is said to have been one of the most bitter battles fought by Kamehameha I in his bid to control the Hawaiian Islands. The following passage recounts the Battle of 'Īao and Kamehameha's triumph in detail, citing his arrival to Maui and route through parts of the *ahupua'a* and *moku* of Wailuku.

> One tradition indicates that Kamehameha's war canoes landed at Kalepolepo near Keālia Pond from where he proceeded inland toward Wailuku. The four streams of this region tell the story of the unfolding battle. Kamehameha placed a *kapu* on the first stream he came to, reserving it for *ali'i*. Waikapū ("water of the conch") was where the sacred conch shell was blown sounding the call to war. At Wailuku ("water of destruction") Stream, the battle became fierce and many warriors were killed. The Maui armies were routed and took flight by way of the third stream, Waiehu ("water spray"), kicking up the water in a frenzied dash to get away. By Waihe'e ("squid liquid") Stream the Maui army was utterly defeated and simply melted away like the ink of a fleeing octopus.

> However, another description of this decisive battles speaks of a landing at the Kawela area of Kahului Bay, perhaps a second wave, where two days of fighting into 'Īao Valley took place. Here, with the help of a cannon, a terrible slaughter of commoners took place and in such great numbers that the dead bodies dammed up the water of Wailuku Stream. It has since been referred to as Kepaniwai, or "the water dam." From here people fled to Kauwa'upali ("precipice climbers" or "clawed of the cliff") and 'Īao Needle, scrambling up the steep cliffs to escape. Women, children, and the elderly fled up the gulch called A'i, now known as Black Gorge. Chief Kalanikūpule and other Maui *ali'i* are said to have escaped over the *pali* (cliff) to Lahaina, where they secured canoes and fled to O'ahu.
>
> Facing the valley entrance, Mauna Kane is the peak on the right, named after one of the major Hawaiian gods. On the left is Mauna Leo, meaning "voice mountain," which, according to one source was changed to Lī'ō ("terror") after the invasion by Kamehameha. This fight between the armies of Hawai'i and those of Maui is now known as the Battle of 'Īao. [James 2001:62-63]

4.2 Early Historic Period

Estimates of the early historic period population of Wailuku are difficult to find. In regions where Protestant missionaries had been stationed, statistical records are plentiful, but the missionary out-station region of Kahului appeared to have received scant attention during the 1820's. In 1829, Protestant missionaries recorded school attendance figures for the out-stations of Wailuku as: 612 students in Waihu [Waihe'e], 329 students in Waikepu [Waikapū], and 103 students in Waiehu, with no mention of Kahului (Richards 1829). The use of the northern coastline landing at Kahului by early Europeans proved difficult, for far more records exist of early explorers and merchant ships at anchor off the southern, more protected coastline of Maui than along the exposed, northern coast. An account by the American missionary Rufus Anderson (1864) portrays the obstacle of landing in Wailuku District:

> We were bound to Wailuku, situated near the western side of the isthmus connecting West and east Maui. After crossing the channel the wind increased, and so rough was the sea that our landing seemed not quite safe. Mr. Alexander met us on the shore, but in such a sand-storm that we were obliged to veil our faces. We breasted the gale for a dozen miles, and near Wailuku were wet to the skin by a storm of rain. [Anderson 1864:176]

James Jarves (1844), the first editor of *The Polynesian*, the third English-language newspaper in the Hawaiian Islands, included news about events in Kahului. He noted a "remarkable oscillation of the ocean" that occurred at Kahului on November 7, 1837:

> At Maui, the sea retired about 20 fathoms, and returned with great speed, in one immense wave, which swept before it houses, trees, canoes, and all else exposed to its fury. At the village of Kahului, the inhabitants, as at Honolulu, followed with rapturous delight the retreating wave, when suddenly it turned upon them, rising like a steep wall, rushed forward to the shore, burying the natives in its foam, and destroying the whole hamlet. [Jarves 1844:19-20]

During the early and middle 1800s, the Hawaiian demography was affected by two dramatic factors: radical depopulation resulting from Western disease and nucleation around the developing port towns. Traditional Hawaiian populations lived in a largely dispersed settlement pattern. Although there were royal centers and areas of more concentrated population, these areas never came close to rivaling the populations of the historic port towns that developed on Hawai'i's shorelines during the 1800s. Kuykendall (1938) notes that from 1830 to 1854:

> The commercial development during this period, by magnifying the importance of a few ports, gave momentum and direction to a townward drift of population; the population of the kingdom as a whole was steadily going down, but the population of Honolulu, Lahaina and Hilo was growing. [Kuykendall 1938:313]

4.3 The Māhele and the Kuleana Act

The Organic Acts of 1845 and 1846 initiated the process of the Māhele—the division of Hawaiian lands—that introduced private property into Hawaiian society. On 27 January 1848, the Crown and the *ali'i* began to receive their land titles as *konohiki* (land manager) awards. For *konohiki* lands, a claim first had to be approved by the Land Commissioners. Upon confirmation of the claim, a certificate was awarded to the claimant. This certificate was called a Land Commission Award (LCA), which confirmed the claim of an individual for a parcel. The awardee could then obtain from the Minister of the Interior a Royal Patent (RP), which indicated the government's interest in the land had been settled by the payment of a commutation fee. Commutation means "an exchange, or replacement." The commutation fee was usually set at a maximum of one-third of the value of the unimproved land. The fee could be settled by the exchange of cash but was usually settled by the return of one-third of the lands (or cumulative value of the lands) originally awarded to the claimant (Chinen 1958:13).

On 19 October 1849, the Hawaiian Privy Council adopted resolutions to protect the rights of native tenants, the *maka'āinana*, or the "common" people. The Kuleana Act of 1850 confirmed these rights. Under this act, the claimant was required to produce two witnesses who knew the claimant and the boundaries of the land, knew that the claimant had lived on the land for a minimum of two years, and knew that no one had challenged the claim. The land also had to be surveyed. Native tenants or naturalized foreigners who could prove occupancy on the parcels before 1845 could be awarded lands they occupied or that they cultivated as *kuleana* (land holding of a tenant or *hoa'āina* residing in the *ahupua'a*) awards. No commutation fee was necessary to apply for a Royal Patent for a *kuleana* award, as the commutation fee had presumably already been paid by the *ali'i / konohiki* who had been awarded the entire *ahupua'a*, or *'ili* in which the native tenant claimed his own small parcels (Chinen 1958:29–30).

It is through records for Land Commission Awards generated during the Māhele that the first specific documentation of life in Hawai'i as it had evolved up to the mid-nineteenth century comes to light. Although many Hawaiians did not submit or follow through on claims, or simply were not granted the claims for their lands, the distribution of LCAs can provide insight into patterns of residence and agriculture; many of these patterns probably had existed for centuries past. Land Grant 3342 was awarded to sugar industrialist Claus Spreckels for the beginnings of HC&S (Figure 7). The parcel consisted of 24,000 acres (Zambucka 1977:48).

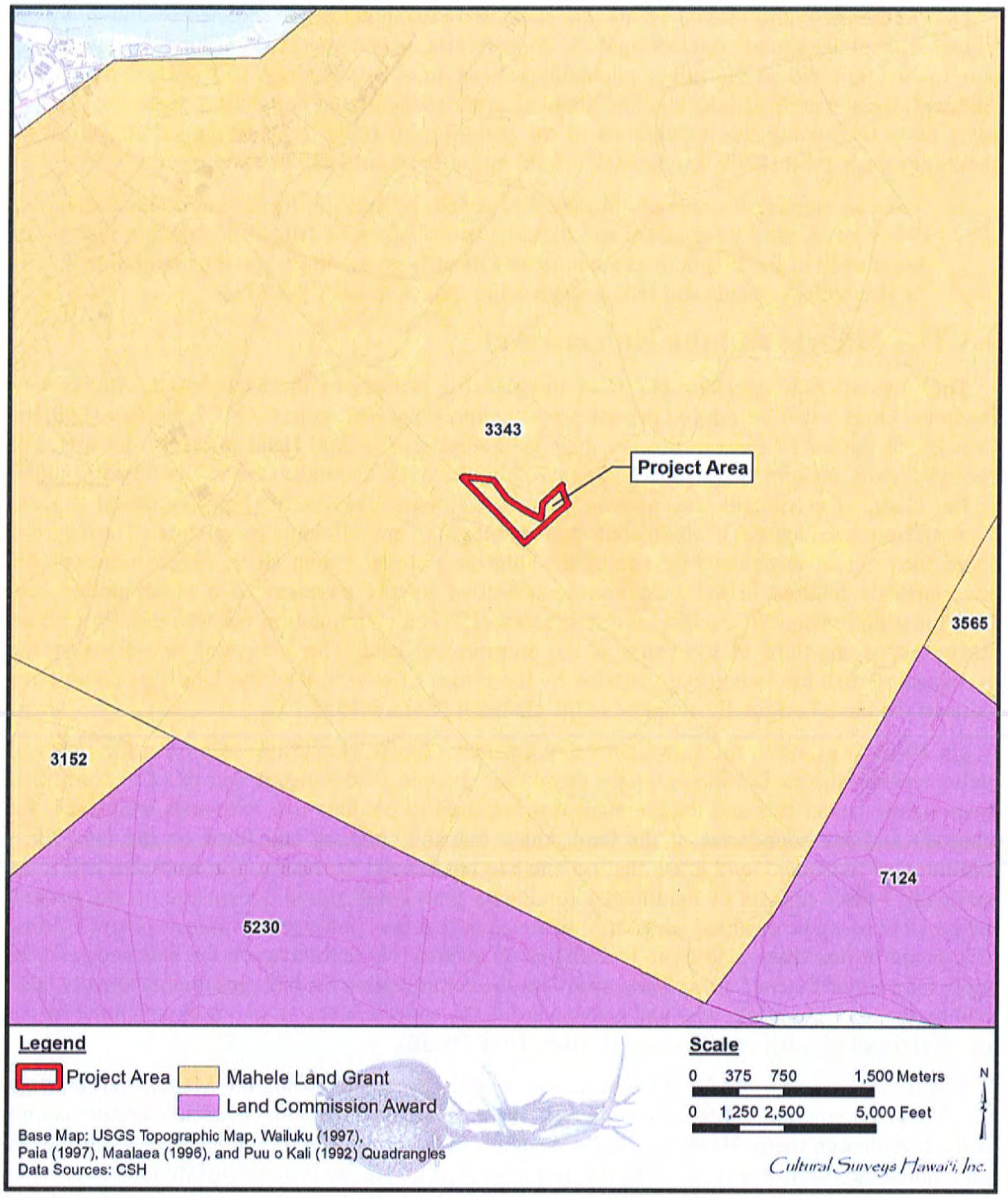

Figure 7. USGS Topographic Map (Puu o Kali Quadrangle [1992], Maalaea [1996], Paia [1997], and Wailuku [1997]) with Land Commission Award and Māhele Land Grant overlay

Although almost 300 individual parcels were awarded by the Land Commission for Kuleana Lands within the *ahupua'a* of Wailuku, these claims represented lands which were located in the upland portion of the *ahupua'a*. Testimony gathered during a water controversy hearing in 1895 (Lonoaea vs. Wailuku Sugar Co. Hawaiian Reports, 9:654-657, 660-665, May 20, 1895) and reprinted by Sterling (1998:86) reports information regarding the density of pre-Contact settlements of the upper reaches of the Wailuku Ahupua'a:

> The Valley of Iao where the Wailuku river has its source is surrounded by precipitous mountains, a narrow defile affording an outlet for the river which flows down a gulch in a north easterly direction to the sea. A short distance below the defile the river is tapped, on the north bank, by an artificial ditch called Kalaniauwai, and a little further down, but on the opposite side, by a similar ditch called Kamaauwai. These two auwai have existed immemorially and were evidently constructed for the purpose of irrigating kalo on the plains which stretch away to the northward and southward of the river. . .
>
> The district of Wailuku was once thickly settled, kuleanas to the number of over 400 were granted to natives and others. A large proportion of these cultivated kalo with the aid of water from the river as described by the commissioner in his decision above set forth. The cultivation of sugar cane on a small scale was begun by Kamehameha III in the early fifties. [Sterling 1998:86]

4.4 Mid- to Late 1800s

Activities associated with missionary endeavors and the cultivation of sugar cane in the mid to late nineteenth century offer detailed accounts of Wailuku during this time.

An excerpt from an 1823 letter from Reverend William Richards included within the 1824 edition of the Missionary Herald describes the excursion of Hiram Bingham and Reverend Richards from their station in Lāhainā to the plantation of Waikapū and the observation of *iwi kūpuna* exposed on the surface of the sand:

> The plain in this part appears to be made of sand, which, to some extent, is continually changing its position by the action of the wind, throwing it into hillocks and banks resembling drifts of snow, and thus disclosing many fragments of human skeletons of former generations, wasted tenements, once the habitations of immortal souls, that knew nothing of Jesus and his *resurrection*. Over these we walked, as we proceeded to the king's temporary dwelling or lodging place at Wyrookoo [Wailuku] [Richards 1824:112]

In 1863 Samuel Thomas Alexander started a theological seminary in Wailuku where he taught for nine years before partnering with Henry Perrine Baldwin to create the sugar company known as Alexander and Baldwin, Inc (Alexander 1953). An account of the geography, agriculture, and irrigation engineering of mid-nineteenth century Wailuku is given by Missionary Rufus Anderson who states:

> The soil of Wailuku is rich and deep, and the sugar cane is extensity cultivated. The rains, though copious, are not sufficient, and channels are therefore cut along the foot of the hills, for conveying the waters of the mountain streams where they may

> be diffused over the entire plantations. Good cane lands have here been sold for eighty dollars the acre. Along the streams are numerous *taro* patches, of course covered with water. This district is one of the chief producing regions for that indispensable article of native food, out of which the *poi* is manufactured. Upland taro is cultivated on Hawaii but the taro is grown in water. This vegetable seemed to me equal to the Irish potato, and better than the large sweet potato of the Islands. [Anderson 1864:177]

In a publication by Polk (1880) titled "The Hawaiian Kingdom Statistical and Commercial Directory and Tourists' Guide," it is said that three roads connected Wailuku to Lahaina. One treacherous road that connected Lahaina to Wailuku via 'Īao Valley is said to have been traversed by "adventurous residents" and "visitors" alike. Bower describes this passage saying,

> The tract leads right over the mountain, the ascent being made through a great gulch that lies close to Lahaina up to what is known as the Wailuku Pass, and thence down the Iao Valley, of which I have already spoken. . . it is perhaps the very best way of all by which to approach the wonder and beauties of the great gorge of the Iao. [Polk 1880:525-526]

4.4.1 The Sugar Industry

A common crop on nearly all major Hawaiian Islands was sugar cane. Among the early government grants in the upland area of Wailuku Ahupua'a were lands set aside for the Wailuku Sugar Company, a plantation first organized in 1862 by James Robinson & Company, Thomas Cummins, J. Fuller, and agent C. Brewer & Company. The success of sugar grown in the region resulted in a second large plantation, in Waihe'e, producing over 757 tons of sugar and 45,000 gallons of molasses in 1865. The Waihe'e mill manager was Samuel T. Alexander, and the mill's head foreman was Henry P. Baldwin, both of whom would resign in the late 1860's to establish a small sugar enterprise of their own in upper Pā'ia (Gilmore 1936).

In 1869, on land located just west of Pā'ia, a small *kuleana* of 11.94 acres was purchased by S.T. Alexander and his business partner, H.P. Baldwin, both descended from Lāhainā missionary families, who were eager to apply their agricultural experience to their own plantation. This initial land purchase was the beginning of the development of the entire central isthmus for sugar cultivation. In rapid succession, Alexander & Baldwin expanded its operations by purchasing other small *kuleana*, setting up a mill, and attracting more investment capital (Dean 1950).

In 1876, a treaty was signed between the Kingdom of Hawai'i and the United States, which opened larger and more lucrative markets for Hawaiian sugar. Plans were immediately drawn up by Alexander & Baldwin to finance a ditch to bring water from the Hāna region of East Maui to the arid plains of Pā'ia. The Kingdom of Hawai'i issued a lease for the construction right-of-way, and in 1879, the successful venture delivered millions of gallons of water to the Pā'ia region via the Hamakua Ditch (Wilcox 1996).

Competition was supplied by Claus Spreckels who engineered a similar irrigation ditch from Honomanū in East Maui to lands located just inland of Kahului, where the Spreckelsville mill and plantation camp were built (Figure 8). Spreckels invested three million dollars in the Hawaiian

Commercial & Sugar Company, and competed for sugar lands, wharf and warehouse space, railway lines, and shipping schedules with Alexander & Baldwin (Dorrance and Morgan 2000).

In 1882, Spreckels, following his success in building the Honomanu Ditch linking East Maui water sources with his sugar fields in the central isthmus, further capitalized on that success to engineer the Waihe'e Ditch [also named the Spreckels Ditch] in West Maui. The 15-mile-long ditch started at the 435 foot elevation of Waihe'e Stream, and carried 60 million gallons of water (per 24-hour day) to the Wai'ale Reservoir at the 214 foot elevation of Wailuku. Spreckels became the first plantation owner to irrigate his fields by water from both Haleakalā and the West Maui mountains (Wilcox 1996). By 1888, the Spreckels plantation covered 28,000 acres, making it the largest sugar plantation in the world. Financial pressures forced Spreckels to give up control of Hawaiian Commercial & Sugar Company (HC&S) to Alexander & Baldwin in 1898 after a long and fierce battle (Dean 1950). An 1885 Dodge Map of Maui and an 1893 CTW map show the extent of HC&S sugar lands and the associated sugar plantation infrastructure, such as irrigation ditches and labor camps, in the vicinity of the project area (Figure 9 and Figure 10).

In 1899 HC&S determined that cultivating the Pu'unēnē plains required far more water than the original Hamakua Ditch could provide. The Lowrie Ditch project, completed in 1900, was undertaken to provide an additional source of water to the central Maui plains (Thrum 1900). The ditch began at the Pāpa'a'ea Reservoir, at 1,000 ft. elevation, and maintained a four-foot drop per mile following the ditch's initial plunge from the Kailua reservoir. Steep mountain gulches were traversed using the force of the constant weight of water flowing in a series of siphons. The Halehaku Gulch, at 250 feet deep, and the Māliko Gulch, at over 350 feet deep, were both crossed by giant siphons fabricated of three-eighths-inch iron, and set in place by Japanese laborers. At a weir located above Pā'ia, the allocation of water began. The first tenth of the water flow in the Lowrie Ditch was divided out to the Pā'ia Plantation (an 11/20ths share) and the Haikū Plantation (a 9/20ths share) (Thrum 1900).

4.5 1900s

In 1899, HC&S was planning its new mill at Pu'u Nēnē which processed its first cane in 1902 (Bartholomew 1994:121). From the time it opened and for a several years after, Pu'u Nēnē was home to the largest sugar mill in the world (Figure 11). At the height of its production, Pu'u Nēnē mill covered a vast 33,000 acres. A total of 16,000 was used for sugar cane and the remaining acreage saw residential camps, a hospital, a grade school, a church, and recreational facilities for the employees (Bartholomew 1994:121).

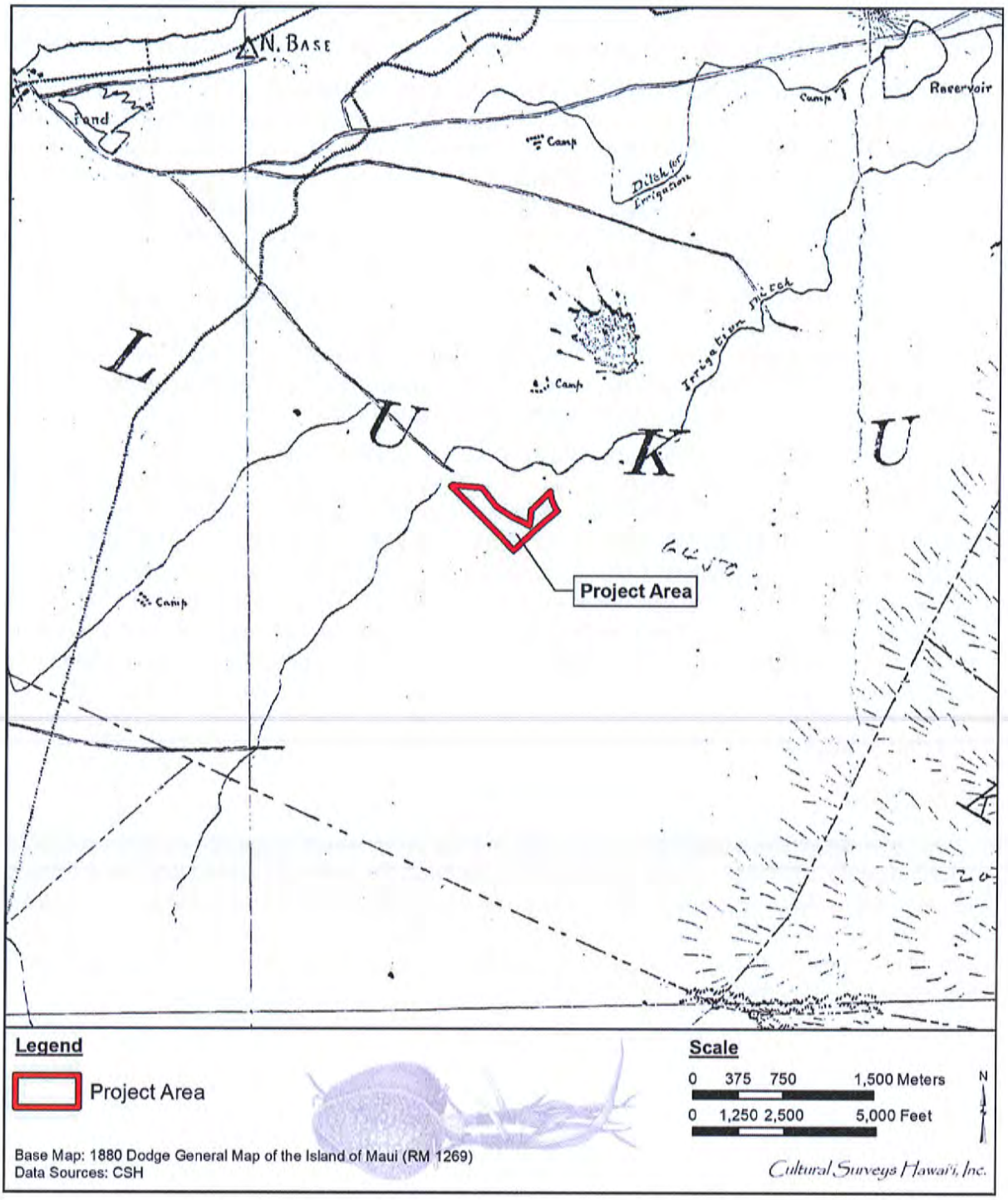

Figure 8. Portion of the 1880 Dodge General Map of the Island of Maui showing the development of irrigation ditches near the project area

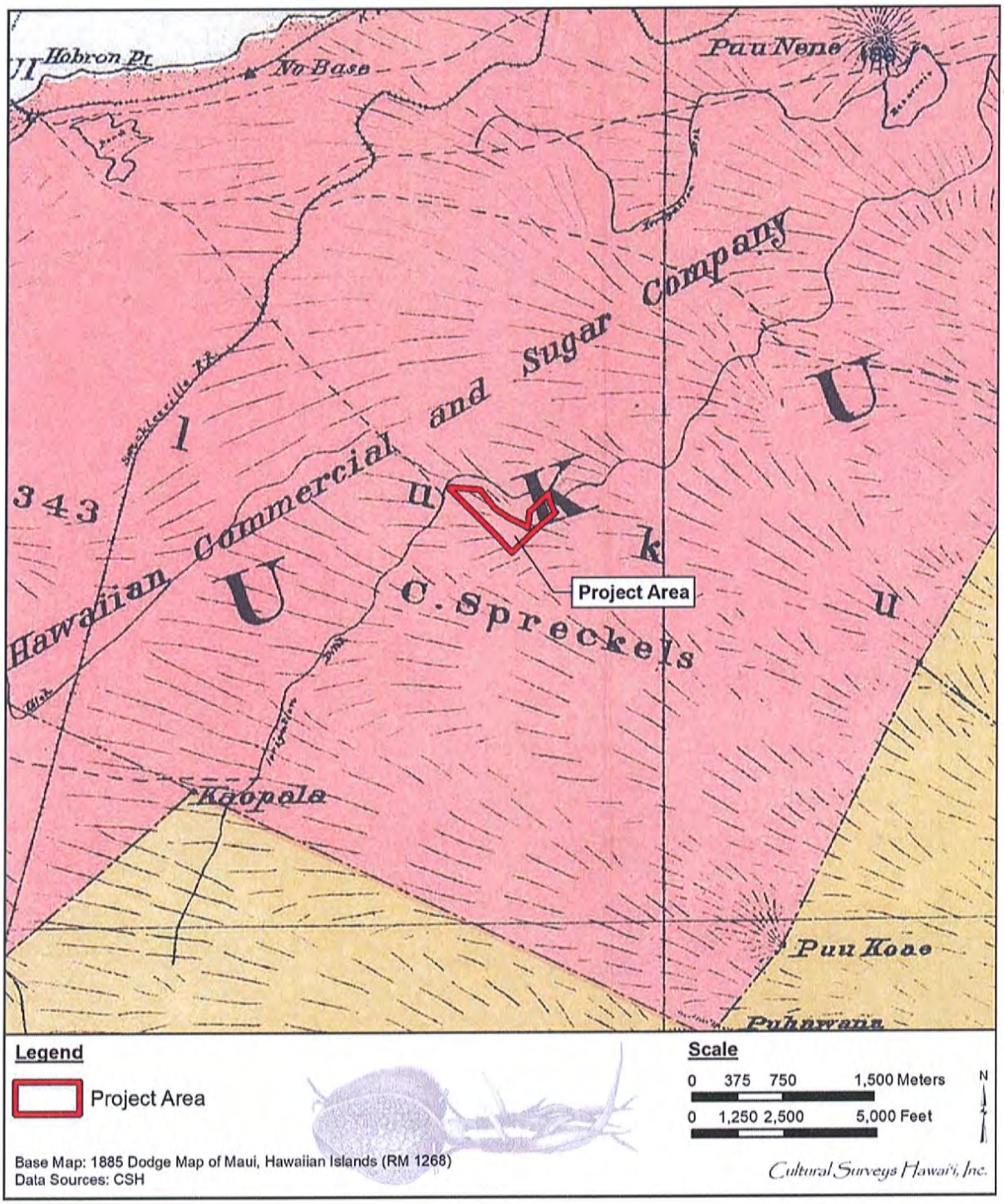

Figure 9. Portion of the 1885 Dodge Map of Maui showing the expanse of HC&S lands and the location of the project area

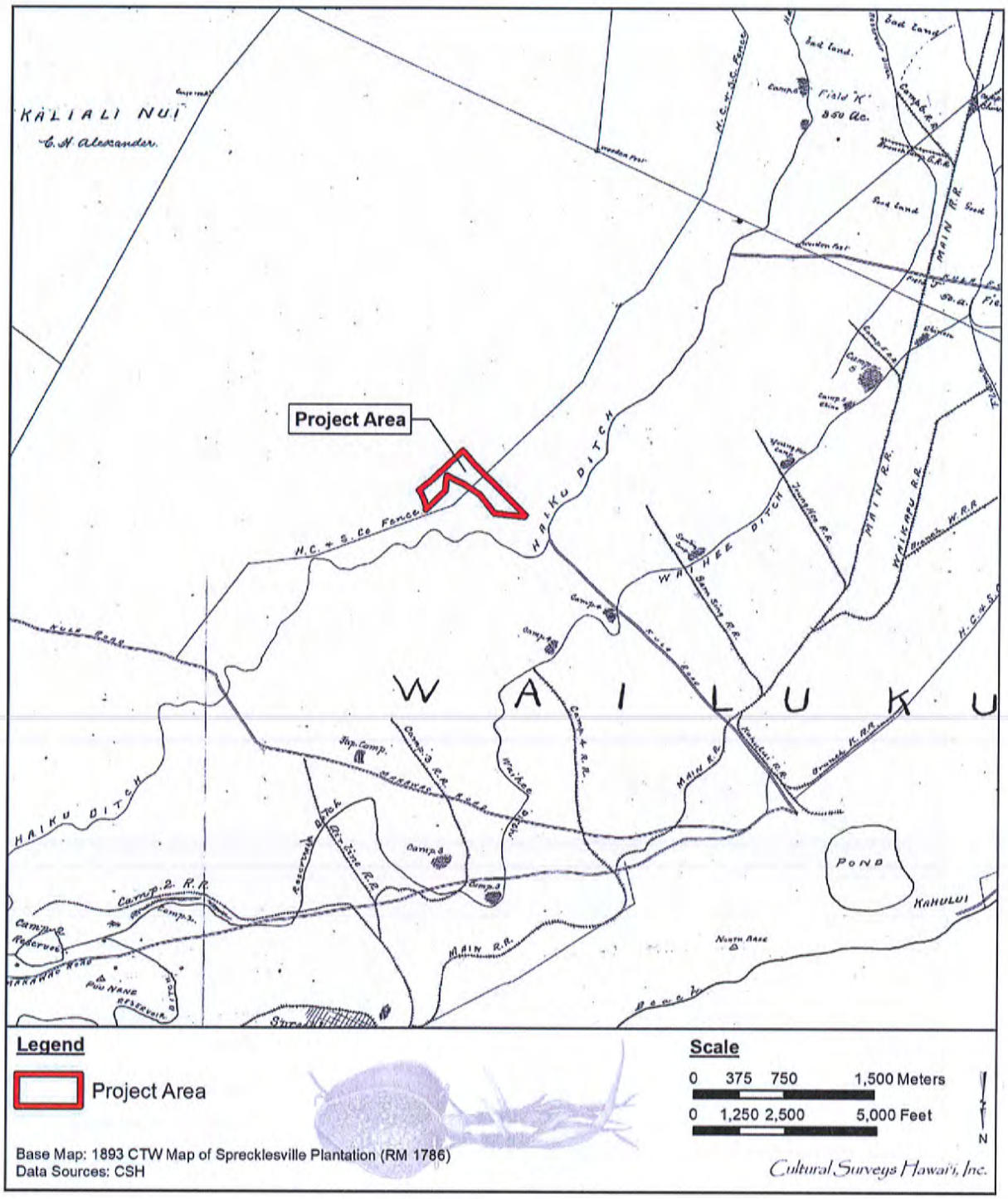

Figure 10. Portion of the 1983 CTW Map of Specklesville Planation showing the project area



Figure 11. Hawaiian Commercial & Sugar Company mill (Bartholomew and Bailey 1994).

The Kihei Plantation Company planned to construct a railway to move their cane. The sugar agency of William Diamond & Company placed an order for a locomotive from the Baldwin Locomotive Works in Philadelphia. The order was placed April 1899, and the plantation locomotive "Haleakala" was built and sent on to Maui (Conde and Best 1973).

The laying of the railroad and the cultivation of the sugar cane in Kīhei was performed primarily by Japanese field labor; the new Maui plantation employing a small part of some 19,908 immigrants from Japan who arrived in Hawai'i in 1899. Kīhei's plantation Camp #1 was set up inland of the Kīhei wharf and mooring pier. Two stables and a plantation store were located at Camp #1. Hospital services were provided by HC&S in Pu'unēnē. Kihei Camp #3 was located 2 ½ miles north of Kihei Camp 1 at Kolaloa Gulch, along the North Kīhei line of the HC&S railroad.

The 3-foot gauge track for the Kihei Plantation Company railroad was built to the same specifications as the railway linking the HC&S mill at Spreckelsville to its fields; and to the sugar warehouses at the Kahului wharf.

In 1900, most of the port town of Kahului was burned to prevent the spread of bubonic plague and to destroy the infected rats harboring the disease. The fire jumped a canebreak and destroyed 575 acres of immature cane. The rebuilding of Kahului following the 1900 fire saw the first large scale development turning the area into a commercial harbor town. An account of Wailuku in 1901 states that the newly constructed railroad linking the Kahului wharf to Wailuku, Specklesville, and Pā'ia allowed new opportunities in the marketing of fish from Kahului to inland locations (Maly and Maly 2003:452). The fish market of Wailuku sold fish caught in Kahului and was described as, "a small affair with only 5 stalls, which are run by 2 Chinese and 5 natives, and is owned by a private individual" (Maly and Maly 2003:433) (Figure 12).

In 1906, an east breakwater to protect the anchorage at Kahului Harbor was constructed by the territorial government of Hawai'i. The first wharf was constructed in 1910, followed by additional dredging and the construction of the west breakwater by the United States government. The reinforcement of both breakwaters, and the completion of Piers 1 and 2 in 1927, replaced older wharfs damaged during a tidal wave in 1923 and accelerated the harbor towns development (Porteus 1945:217).

By 1902, with the new Pu'unēnē mill completed, a new milling contract with HC&S provided that all cane loaded by the Kihei Plantation Company was to be ground and manufactured into sugar by HC&S. Pu'unēnē Mill and Pā'ia Mill, as well as the network of railroad lines connecting the company's fields and villages, experienced continued growth in the early twentieth century. Between 1900 and 1905, acreage harvested doubled, from 2,484 to 4,827 acres. Tons of sugar produced more than doubled, from 17,857 to 39,411 (Gilmore 1936), and the adoption of heavier rails and a wider rail gauge caused HC&S to completely renovate the plantation railroad (Conde and Best 1973). A 1910 map produced by HC&S shows the extent of sugar cane fields, labor camps, rail tracks, irrigation ditches, and reservoirs associated with the projection of sugar in the Wailuku area (Figure 13).

The plantation villages of the Pu'unēnē area grew quickly to surround the new mill. Between a huge influx of immigrant workers in 1909, and the burning of village areas of Pā'ia and Kahului to control smallpox in 1910, changes to the camp system were in full swing. The



Figure 12. Wailuku Fish Market circa 1886 (Hawaii State Archives Digital Collections)

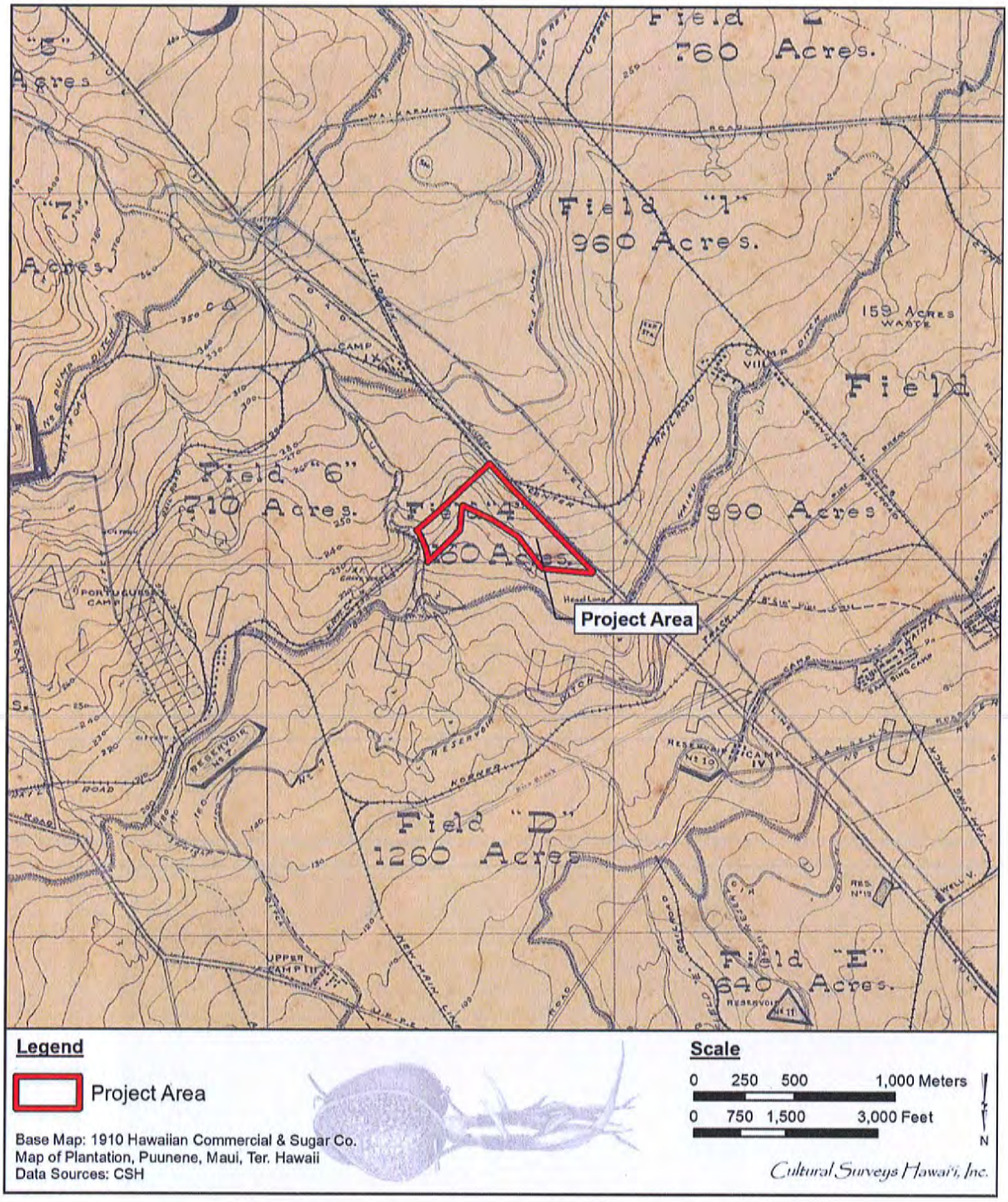

Figure 13. Portion of the 1910 Hawaiian Commercial & Sugar Co. Map of Plantation, Puunene, Maui, Ter. Hawaii showing infrastructure associated with the sugar industry and the location of the project area

plantation workforce continued to expand until 1917, when the United States declared war on Germany, and the accompanying draft seriously depleted the labor pool. By 1919, postwar requirements for sugar had driven the price to $471.40 per ton: an all-time high (Burns 1991) (Figure 14).

In the early 1940's, the harbor town of Kahului was transformed from a sleepy plantation mercantile area to an important military defense depot. Following the entry of the United States in World War II, the rapid construction of military defensive structures demanded the immediate use of plantation wharf space, heavy equipment, and operators. Plantation employees from Wailuku and Kahului were pressed into emergency service until military construction personnel arrived in the Hawaiian Islands.

On January 1, 1942 Kahului Harbor was shelled by Japanese submarines which prompted return fire from U.S. shoreline artillery forces (Clark 1989). By early 1942, the Navy's 39th Construction Battalion had reinforced the pre-war construction gangs composed of Pacific Naval Air Bases (PNAB) personnel and plantation labor. Completion of Naval Air Station Puunene in 1940 andNaval Air Station Kahului in 1943 accelerated and heightened coastal defenses on Maui in the World War II era (Woodbury 1946) (Figure 15).

4.5.1 Post-War Wailuku

Immediately following the end of World War II, Naval Air Station Puunene was completely dismantled. Over one thousand acres of fertile growing land in north Kīhei were returned to sugar cultivation by HC&S. HC&S became the largest sugar producer in the U.S. when it acquired Maui Agricultural Company in 1948 (Hawaiian Commercial & Sugar Company 2018). On the development side, more improvements were made to the lands of NAS Kahului, to create a modern civilian airport where the U.S. Navy's second Carrier Air Service Unit (CASU) had once been based.

Early in the morning, April 1, 1946, coastal residents of Kahului, NAS Kahului, Spreckelsville, Kaunoa, and Pā'ia found themselves floundering in a quickly rising tide of ocean where their houses had once been. A tidal wave flattened the Officer's Club at NAS Kahului, uprooted trees, and destroyed residences. Including losses on the Ke'anae Peninsula, along the Hāna coastline, 14 people were killed, 77 homes and buildings demolished, and 156 buildings partially damaged (Shepard et al. 1950).

Postwar Maui saw the wholesale development of Kahului as a master-planned community providing fee-simple ownership of single-family homes. The majority of the homes, located between Baldwin High School and Pu'unēnē Avenue, were purchased by plantation employees and servicemen returning from duty overseas. This trend continued throughout the 1950's, with plantation camp populations falling in the outlying communities, including Pu'unēnē, and rising in the central town site of Kahului's new "Dream City" (Dean 1950).

The early postwar years (1946-1950) saw the increased construction of urban infrastructure in Wailuku, including projects such as the Maui Memorial Hospital in Wailuku. Areas once occupied by the military returned to cattle ranching, and pineapple and sugar cultivation. The pace of social change began to accelerate. The political power base of the County of Maui began to include Nisei, second-generation Japanese Americans, who had returned from service in



Figure 14. Harvesting of sugar cane in Pu'unēnē, 1915 (Hawaii State Archives)

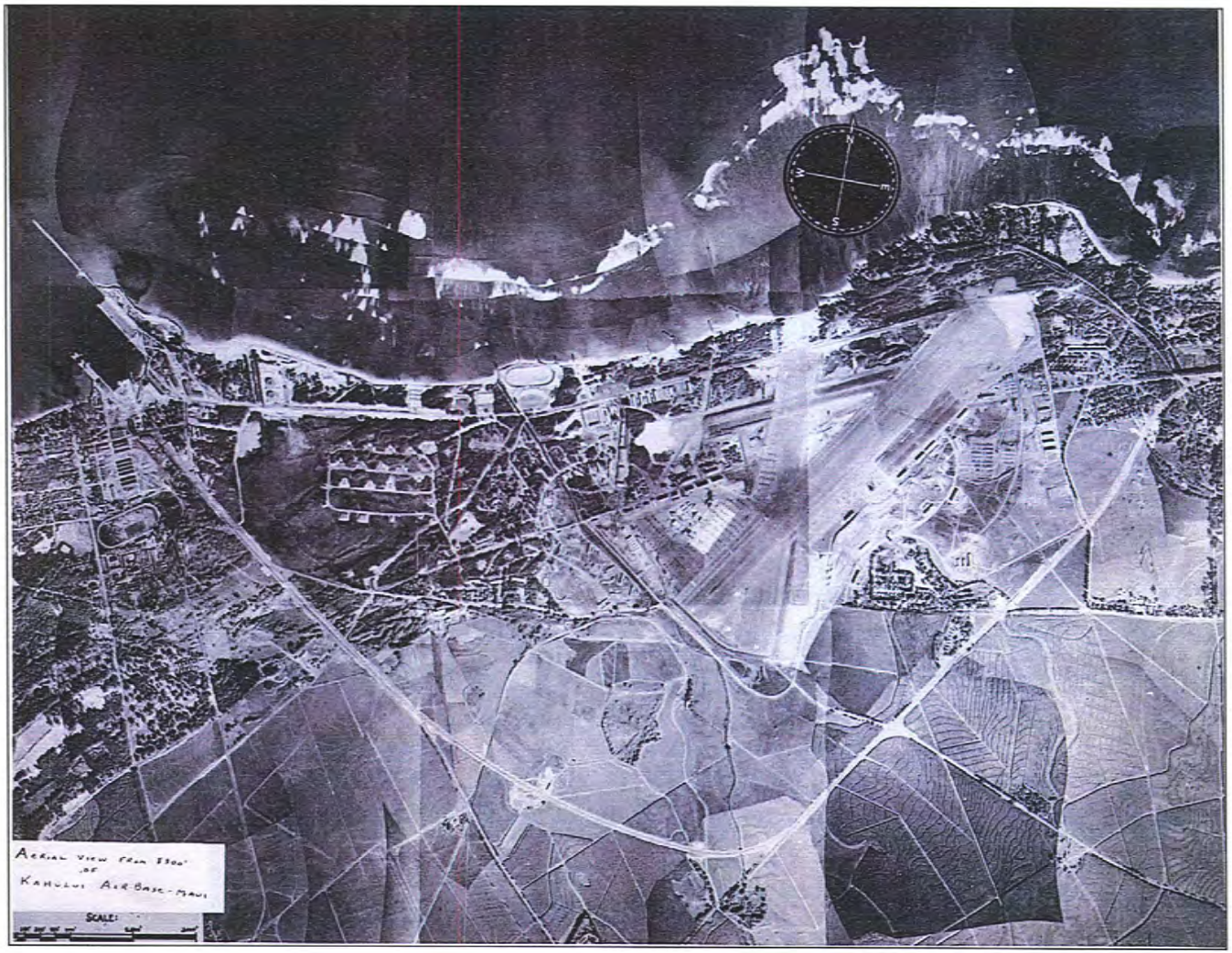

Figure 15. Aerial photograph showing Naval Air Station Kahului, 1945 (Hawai'i Aviation)

Europe during WWII. Their involvement in county politics began to swing political power from the large agribusiness owners to the union leaders representing plantation workers eager for a change (Speakman 1978:148-149).

In the years during the Korean War (1950-1953), the modernization of the workforce and stronger unions brought a host of changes to the central region of Maui. Gone were the railroads of the prewar age, replaced by trucks and mechanized sugar and pineapple harvesters. The modernization of the Kahului Harbor meant that canned pineapple, bulk sugar and molasses could be loaded onto ships faster.

4.6 Contemporary Land Use

Following statehood for Hawai'i in 1959, mainland retail giants S.H. Kress & Co. and the National Dollar Stores Ltd. expanded their existing locations in Wailuku, and a Ben Franklin Store anchored the new Kahului Shopping Center. Manpower for the construction of new tourist resorts in the outlying leeward areas of Maui would come almost exclusively from Maui's central district (Bartholomew 1994:132).

Statehood also saw the establishment of the Kanahā Pond Wildlife Sanctuary (SIHP 50-50-05-1783). This project was accomplished by the State of Hawai'i to protect the cultural remains of the original fish pond wall structure, and three endangered wetland bird species: the Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), and Hawaiian duck (*Anas wyvilliana*).

The sugar industry saw further consolidation in 1962 when HC&S became a division of Alexander & Baldwin Inc (Hawaiian Commercial & Sugar Company 2018). In 1966, what was once the quarry department of the Kahului Railroad and the ready-mix concrete and concrete products department of A&B Commercial Company combined to form Concrete Industries Inc., a wholly-owned subsidiary of Honolulu Concrete and Draying, Ltd. Today Kahului is home to Maui's largest population due in part to its status as the main port and industrial center for the Island of Maui (Figure 16).

By 1988, after 125 years of sugar operations, and varied attempts at diversified agriculture, the Wailuku Sugar Company mill was closed, scrapped, and the site redeveloped as an industrial park. The current land-use of the corridor connecting Kahului with Wailuku includes a mix of residential, warehousing, light industrial and commercial, with retail sales centered primarily in Kahului. Until December 2016 when HC&S announced its closure, most of the land area of Wailuku Ahupua'a was in sugar cultivation. HC&S was the last sugar plantation still in operation in the State of Hawai'i.

A series of maps illustrate the changes that have taken place in Wailuku Ahupua'a within the last century (Figure 17 through Figure 20).

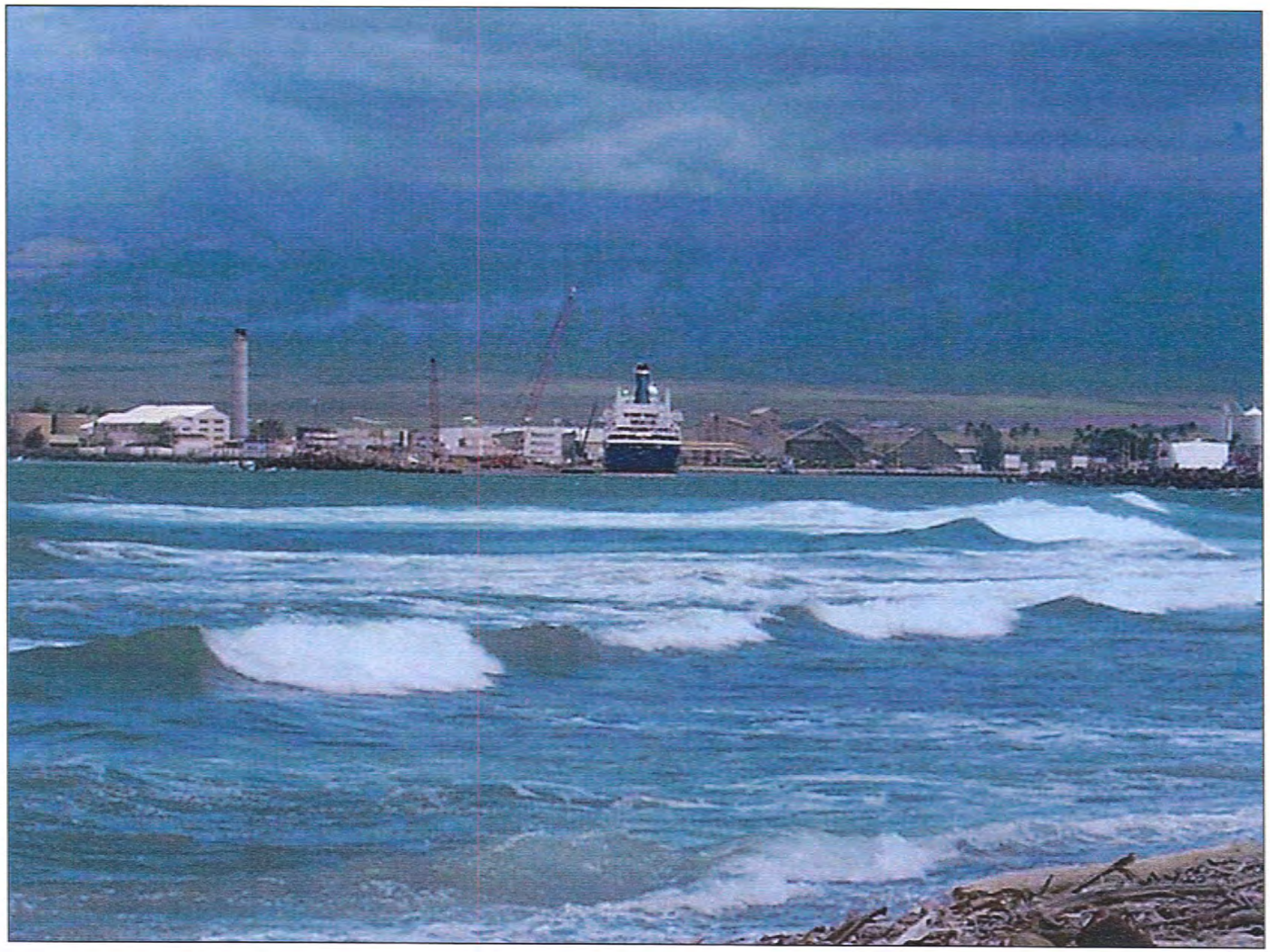

Figure 16. Kahului Bay, Wailuku District, Maui (Wikipedia)

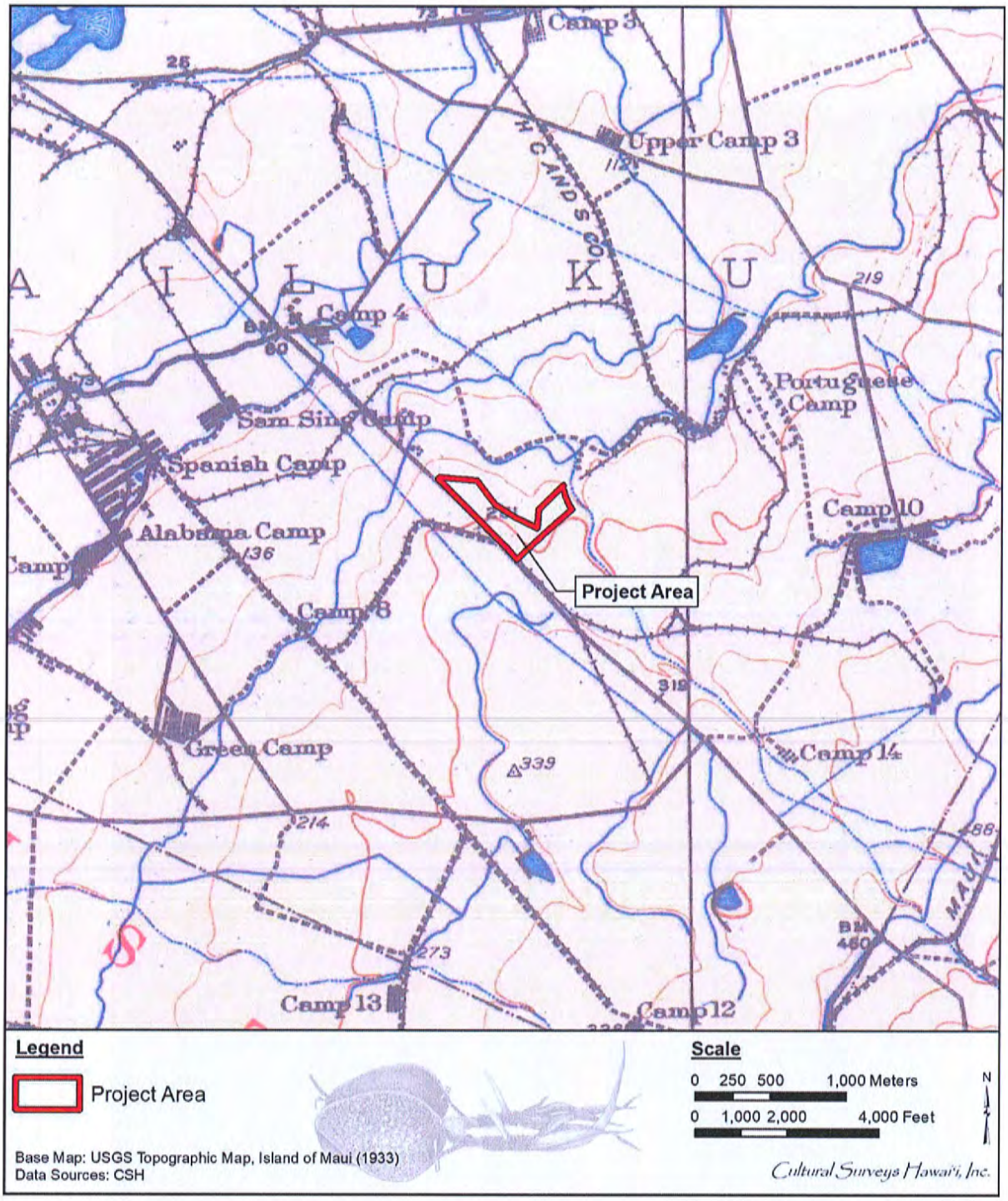

Figure 17. Portion of the 1933 USGS Topographic Map, Island of Maui showing the project area

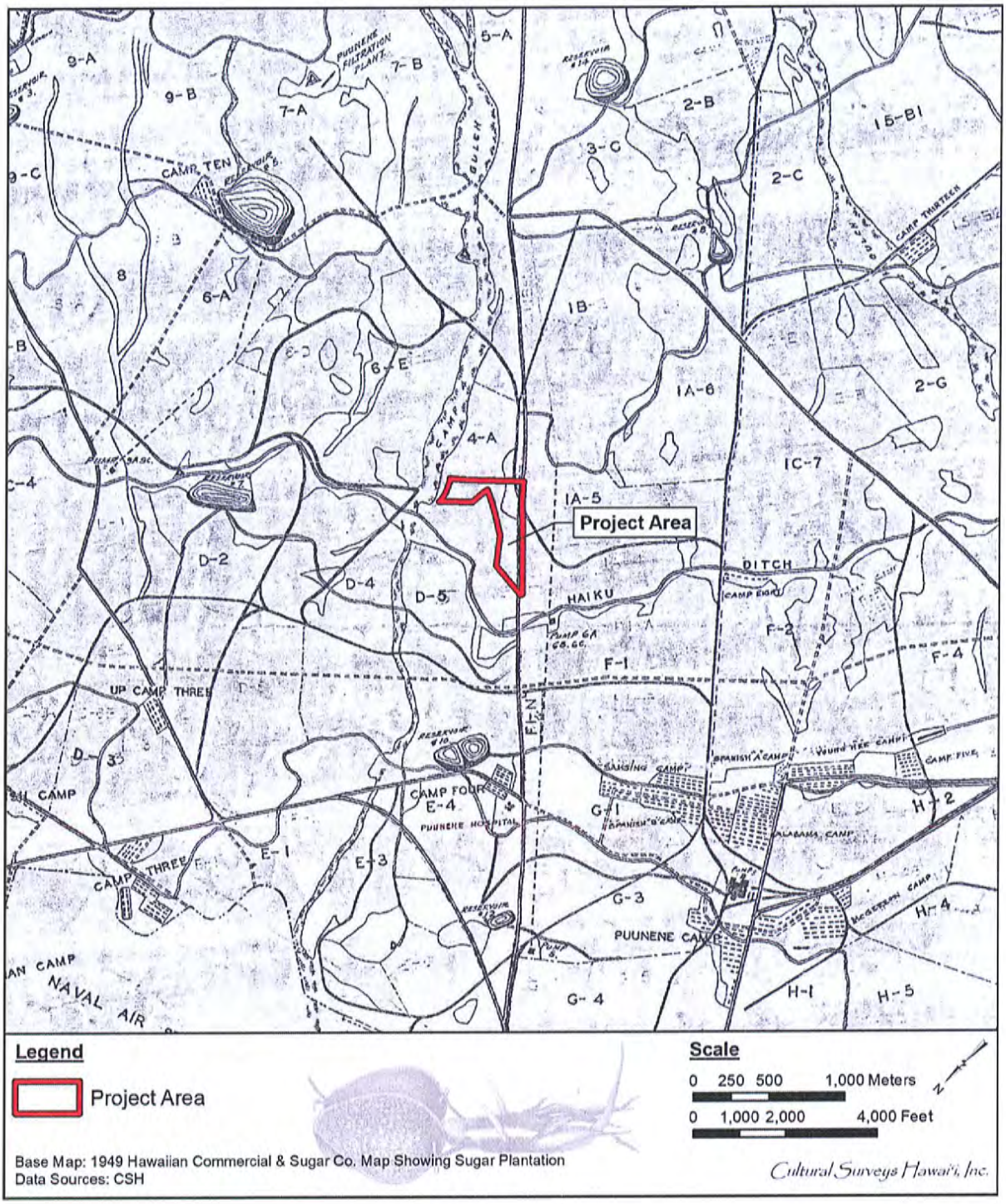

Figure 18. Portion of the 1949 Hawaiian Commercial & Sugar Co. Map showing the HC&S plantation and the project area

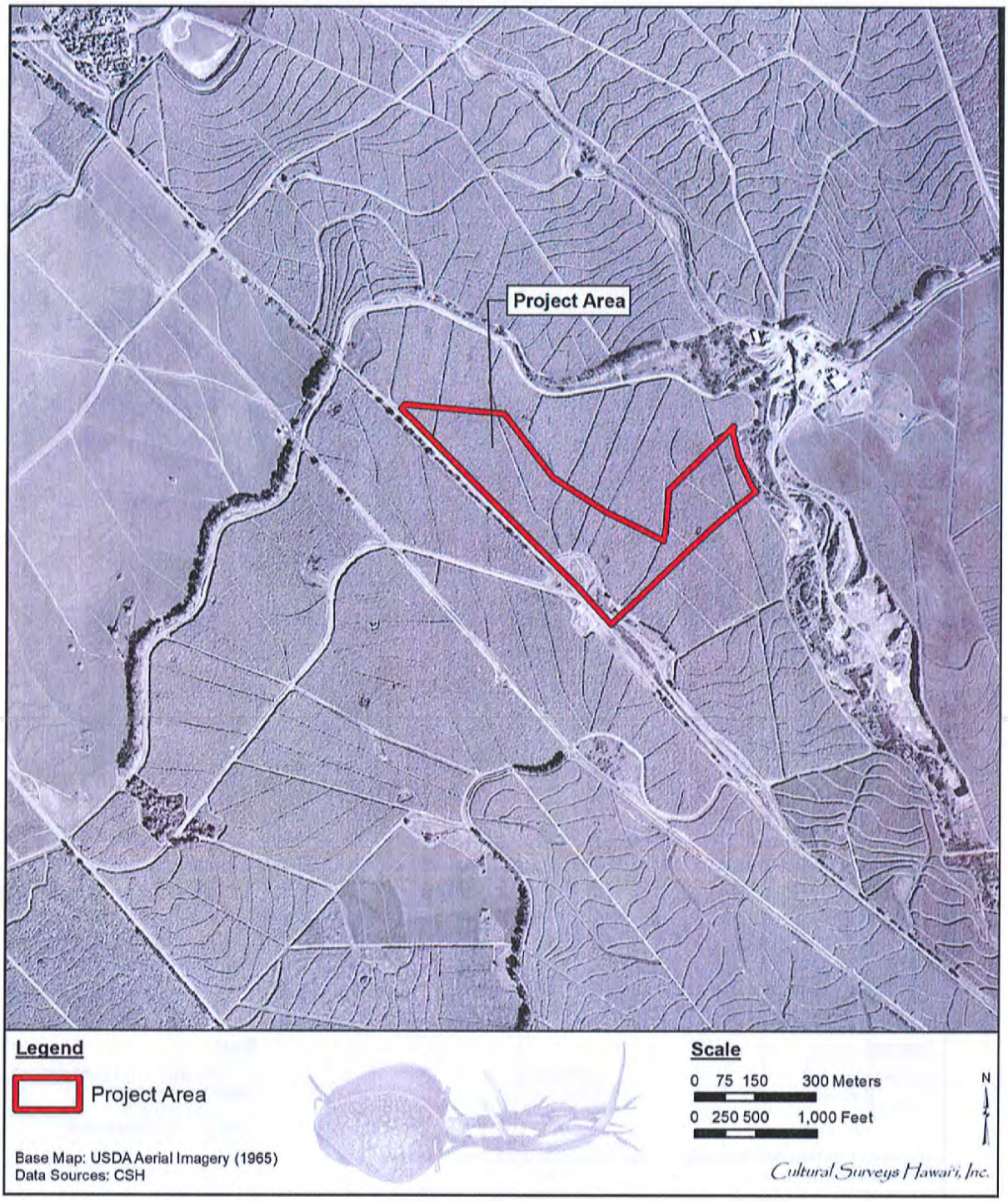

Figure 19. 1965 USDA aerial imagery showing the project area

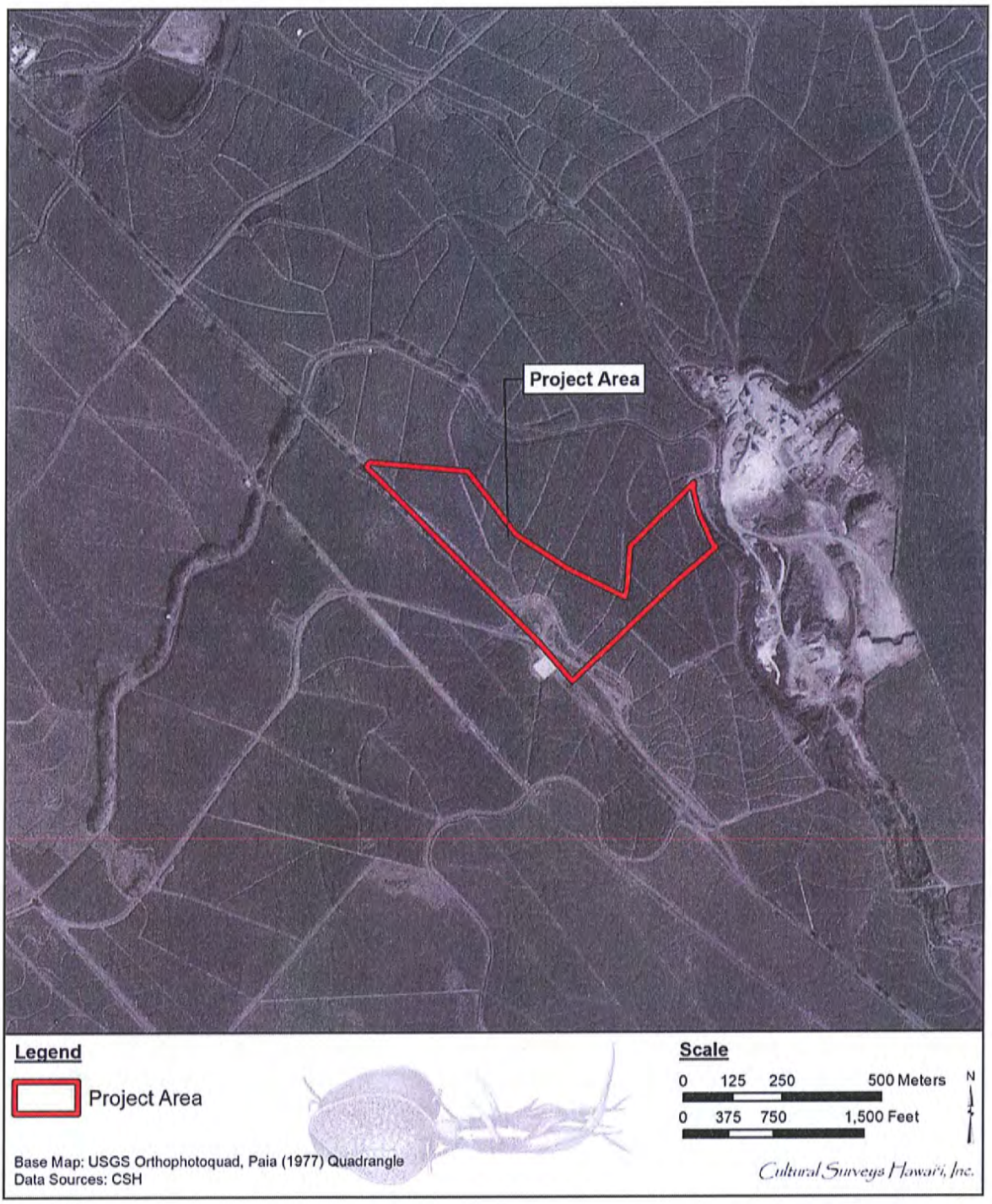

Figure 20. 1977 USGS Orthophotoquad, Paia Quadrangle showing the project area

Section 5 Previous Archaeological Research

The earliest archaeological studies on the island of Maui were a part of island-wide surveys conducted in the early 1900s (Stokes 1917; Walker 1931). These studies focused on the generation of descriptive lists of large scale architecture or traditional ceremonial *heiau* sites. Since these seminal studies a number of archeologic studies have been carried out in Wailuku Ahupua'a. Table 2 summarizes, and Figure 21 illustrates, the previous archaeological studies near or within the current project area.

Table 2. Previous Archaeological Studies in the Vicinity of the Project Area

Reference	Type of Study	Location	Results
Sinoto and Pantaleo 1992	Archaeological inventory survey	East Maui Waterline Project route, including a section northwest of the project area	No significant cultural materials identified
Hammatt 1995	Archaeological assessment	Three 50-acre parcels, including a section that encompasses the majority of the current project area	No significant cultural materials identified
Burgett and Spear 1997	Archaeological inventory survey	67 acres power plant site and 10 miles of transmission line routes a section of which located adjacent to the southwest side of the project area	No significant cultural materials identified
Madeus and Fredericksen E. 2008	Archaeological Inventory Survey	12.778 acres, located northwest of the project area	Documented one historic property: SIHP # 50-50-05-6360, former Pu'unene Hospital
McCurdy, Hill, and Hammatt 2009	Archaeological field inspection and literature review	Approximately 13 acres, located adjacent to the southeast portion of the project area	No significant cultural materials identified

Reference	Type of Study	Location	Results
Andricci and Dega 2017	Archaeological Assessment	Current project area	Full pedestrian survey and excavation of 30 trenches in a portion of the current project area; no significant cultural materials identified

5.1.1 Sinoto and Pantaleo (1992)

Intermittently between 17 June and 3 September 1992, Aki Sinoto Consulting conducted an archaeological inventory survey of the East Maui Waterline Project, which included surveys of gulches and pedestrian surveys, mostly along existing paved roads and cane roads (Sinoto and Pantaleo 1992). The westernmost parcel (TMK: [2] 3-8:001:999) surveyed in this study is located approximately 1500 northwest of the current project area. No cultural materials were observed during this study.

5.1.2 Hammatt (1995)

On 30 January 1995, Cultural Surveys Hawaii conducted a preliminary investigation aimed at identifying known archaeological sites and areas of potential archaeological concern within three approximately 50-acre parcels (TMKs: [2] 3-8-003:004por., 001por, and 002por) of proposed sites under consideration for a Power Plant by Maui Electric Co., Ltd (MECo) (Hammatt 1995). The area investigated, which was historically used for sugar cane cultivation, included the entire project area of the present study. No significant cultural materials were observed during this investigation. Therefore, the study was termed an archaeological assessment.

5.1.3 Burgett and Spear (1997)

On 13 March 1997 an archaeological inventory survey was conducted by Scientific Consultant Services, Inc. on a prosed 67-acre power plant site (TMK: 2-5, 3-8) and along 10 miles of proposed and alternative transmission lines routes (Burgett and Spear 1997). The power plant site was located at the junction of Waikapu and Pulelu Roads and the transmission line routes investigated were located northwest toward Pulehu and North Firebreak road junction, and southwest toward Pu'unēnē. No significant cultural materials were observed during this archaeological inventory survey.

5.1.4 Madeus and Fredericksen (2008)

From 3 October 2007 to 4 October 2007, Xamanek Researches, LLC conducted an archaeological inventory survey of a 12.778-acre parcel (TMK: [1] 3-8-01:002por.), consisting of 100% pedestrian survey and 15 mechanically excavated test trenches (Madeus and Fredericksen 2008). This survey occurred on lands located approximately 1750 meters northwest of the present project area. Only one historic property, remnants of the former Pu'unene Hospital (SIHP # 50-50-05-6360), was encountered. No other significant cultural materials were observed during this survey.

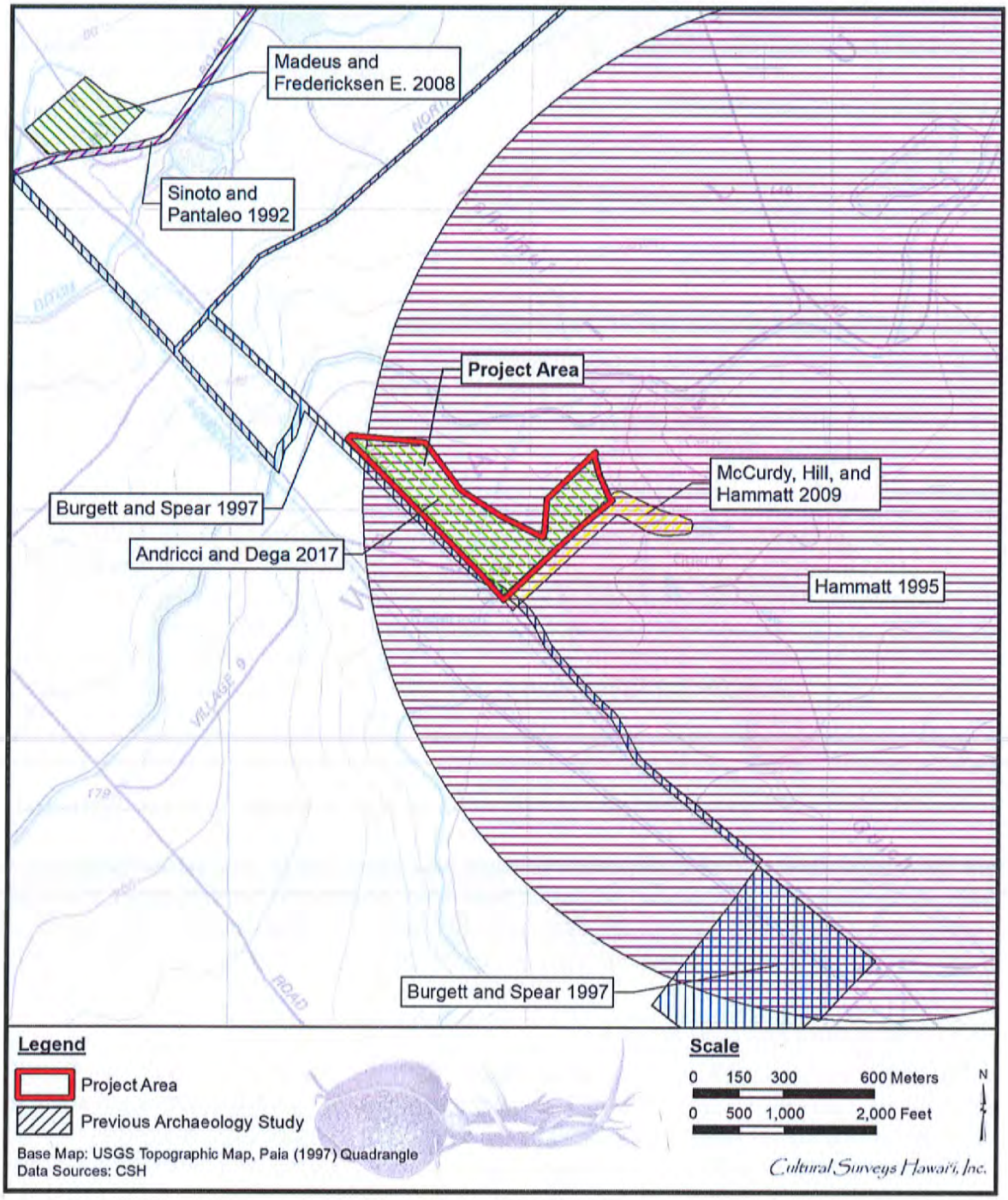

Figure 21. Portion of a 1997 Paia USGS topographic quadrangle showing previous archaeological studies conducted within the vicinity current project area

5.1.5 McCurdy, Hill, and Hammatt (2009)

On 11 November 2008, Cultural Surveys Hawai'i, Inc. conducted an archaeological field inspection and literature review for the Central Maui Landfill Expansion Project (McCurdy et al. 2009). The inspected parcel was approximately 13 acres (TMK: [2] 3-8-003:004), which included a northwestern portion of the current project area. The study noted the historic use of the project area for agriculture (sugar cane) and modern developments likely caused destruction of any potential above-ground historic properties. No significant cultural materials were encountered during this field inspection.

5.1.6 Andricci and Dega 2017

Scientific Consultant Services, Inc. (SCS) conducted an archaeological assessment to the current project area (Andricci and Dega 2017). A full pedestrian survey and excavation of 30 trenches in a portion of the project area was conducted. Due to sugar cane cultivation over the past 100 years, pre-Contact activities were most likely disturbed or destroyed. No significant cultural materials were encountered. A SHPD acceptance letter can be found in Appendix A

Section 6 Community Consultation

6.1 Introduction

Throughout the course of this assessment, an effort was made to contact and consult with Native Hawaiian Organizations (NHO), agencies, and community members including descendants of the area, in order to identify individuals with cultural expertise/and or knowledge of the *ahupua'a* where the project areas are located. CSH initiated its outreach effort in June 2018 through letters, email, telephone calls, and in-person contact. CSH completed the community consultation in January 2019.

6.2 Community Contact Letter

Letters (Figure 22 and Figure 23) along with a map, aerial photograph and site plan of the project area were mailed with the following text:

> Cultural Surveys Hawai'i (CSH) at the request of A-Mehr, Inc., on behalf of the County of Maui, is conducting a Cultural Impact Assessment (CIA) for the Central Maui Landfill Facilities Improvement Project, Wailuku Ahupua'a, Wailuku District, Maui Island, TMK: (2) 3-8-003:019 (por.). The total project area is approximately 40.8 acres.
>
> The County of Maui, Department of Environmental Management (DEM) proposes to enhance their integrated solid waste management and recycling/diversion facilities on the expanded Central Maui Landfill (CML) property, which will serve to increase recycling and diversion of valuable resources and reduce the amount of waste entering the landfill. The project area is located on former sugar cane farmland situated on the north side of Pūlehu Road and northwest of the existing CLM facility, between Kahului and Kula. The project area is bounded by agricultural lands owned by Hawaiian Commercial and Sugar Company (HC&S). Northeast of the project area is HC&D, LLC Quarry operation.
>
> The County of Maui, Department of Environmental Management (DEM) currently operates the CML on a portion of TMK (2) 3-8-003:019 (Parcel 19). The CML has been in operation since 1986 through State Land Use Commission (SLUC) Special Permits encompassing approximately 126 acres of Parcel 19. The proposed expansion of the CML will increase the CML property by approximately 32 percent. The project includes the following proposed facilities and related activities:
>
> - Abandoned Vehicles Area: approximately 2 acres;
> - Office Structure: 8,000 square feet (sf) with a parking lot;
> - Construction and Demolition (C&D) Material Recovery Area: approximately 4 acres, including a 40,000 sf open materials processing area;

Cultural Surveys Hawai'i, Inc.
Archaeological and Cultural Impact Studies
Hallett H. Hammatt, Ph.D., President

P.O. Box 1114 Kailua, Hawai'i 96734 Ph: (808) 262-9972- Fax: (808) 262-4950

Job code: WAILUKU 52 enielsen@culturalsurveys.com www.culturalsurveys.com

June 2018

Aloha,

Cultural Surveys Hawai'i (CSH) at the request of A-Mehr, Inc., on behalf of the County of Maui, is conducting a Cultural Impact Assessment (CIA) for the Central Maui Landfill Facilities Improvement Project, Wailuku Ahupua'a, Wailuku District, Maui Island, TMK: (2) 3-8-003:019 (por.). The total project area is approximately 40.8 acres.

The County of Maui, Department of Environmental Management (DEM) proposes to enhance their integrated solid waste management and recycling/diversion facilities on the expanded Central Maui Landfill (CML) property, which will serve to increase recycling and diversion of valuable resources and reduce the amount of waste entering the landfill. The project area is located on former sugar cane farmland situated on the north side of Pūlehu Road and northwest of the existing CLM facility, between Kahului and Kula. The project area is bounded by agricultural lands owned by Hawaiian Commercial and Sugar Company (HC&S). Northeast of the project area is HC&D, LLC Quarry operation.

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- Abandoned Vehicles Area: approximately 2 acres;
- Office Structure: 8,000 square feet (sf) with a parking lot;
- Construction and Demolition (C&D) Material Recovery Area: approximately 4 acres, including a 40,000 sf open materials processing area;
- Metals Processing Area: approximately 8.2 acres, including a 40,000 sf processing area with canopy cover;
- Household Hazardous Waste (HHW) and Electronic Waste (E-Waste) Collection and Storage Area: approximately 2.4 acres, including a 20,000 sf roofed structure;
- Warehouse and Storage Area: approximately 1.4 acres, with a 20,000 sf warehouse structure;
- Refuse Collection Office, Truck Parking, and Maintenance Area: approximately 3 acres, including a 12,000 sf structure with office and maintenance area, 2 acre refuse collection vehicle parking area, and an adjacent automobile parking lot;
- Water Tank: at the highest site location (south corner of expansion parcel);
- Parking Stalls: for truck-type vehicles located along the Pulehu Road frontage;
- Access Roads: paved internal access roads connecting the Project facilities with site Entrances 1 and 2 off Pulehu Road, and connecting the Project site to the CML;

Figure 22. Community Consultation Letter, page one

- Stormwater Infiltration Basin "A" with a net storage capacity (i.e., after deducting a 1 foot freeboard) of approximately 12,000 cubic yards, or about 7.2 acre-foot; and
- Stormwater Infiltration Basin "B": with a net storage capacity (i.e., after deducting a 1 foot freeboard) of nearly 15,000 cubic yards, or about 9.4 acre-foot.

The purpose of the CIA is to gather information about the project area and its surroundings through research and interviews with individuals that are knowledgeable about this area. The research and interviews assists us when assessing potential impacts to the cultural resources, cultural practices, and beliefs identified as a result of the planned project. We are seeking your *kōkua* and guidance regarding the following aspects of our study:

- **General history and present and past land use of the project area.**
- **Knowledge of cultural sites- for example, historic sites, archaeological sites, and burials.**
- **Knowledge of traditional gathering practices in the project area, both past and ongoing.**
- **Cultural associations of the project area, such as legends and traditional uses.**
- **Referrals of *kūpuna* or elders and *kama'āina* [native born] who might be willing to share their cultural knowledge of the project area and the surrounding *ahupua'a* [land division extending from the mountains to the sea] lands.**
- **Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the project area.**

In advance, we appreciate your assistance in this research effort. If you are interested in participating in this study, please contact Erika Nielsen at enielsen@culturalsurveys.com or by phone at (808) 262-9972. **We kindly ask for your response by 31 July 2018.**

Me ka ha'aha'a,

Erika Nielsen

Cultural Researcher

Cultural Surveys Hawai'i, Inc.
41-1537 Kalanianaole Hwy., Suite 204
Waimanalo, Hawai'i 96795
Office: (808) 262-9972
Fax: (808)262-4950
enielsen@culturalsurveys.com

Figure 23. Community Consultation Letter, page two

- Metals Processing Area: approximately 8.2 acres, including a 40,000 sf processing area with canopy cover;
- Household Hazardous Waste (HHW) and Electronic Waste (E-Waste) Collection and Storage Area: approximately 2.4 acres, including a 20,000 sf roofed structure;
- Warehouse and Storage Area: approximately 1.4 acres, with a 20,000 sf warehouse structure;
- Refuse Collection Office, Truck Parking, and Maintenance Area: approximately 3 acres, including a 12,000 sf structure with office and maintenance area, 2 acre refuse collection vehicle parking area, and an adjacent automobile parking lot;
- Water Tank: at the highest site location (south corner of expansion parcel);
- Parking Stalls: for truck-type vehicles located along the Pulehu Road frontage;
- Access Roads: paved internal access roads connecting the Project facilities with site Entrances 1 and 2 off Pulehu Road, and connecting the Project site to the CML;
- Stormwater Infiltration Basin "A" with a net storage capacity (i.e., after deducting a 1 foot freeboard) of approximately 12,000 cubic yards, or about 7.2 acre-foot; and
- Stormwater Infiltration Basin "B": with a net storage capacity (i.e., after deducting a 1 foot freeboard) of nearly 15,000 cubic yards, or about 9.4 acre-foot.

The purpose of the CIA is to gather information about the project area and its surroundings through research and interviews with individuals that are knowledgeable about this area. The research and interviews assists us when assessing potential impacts to the cultural resources, cultural practices, and beliefs identified as a result of the planned project. We are seeking your *kōkua* and guidance regarding the following aspects of our study:

- **General history and present and past land use of the project area.**
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- **Knowledge of traditional gathering practices in the project area, both past and ongoing.**
- **Cultural associations of the project area, such as legends and traditional uses.**
- **Referrals of *kūpuna* or elders and *kama'āina* [native born] who might be willing to share their cultural knowledge of the project area and the**

surrounding *ahupua'a* [land division extending from the mountains to the sea] lands.

- **Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the project area.**

In most cases, two or three attempts were made to contact individuals, organizations, and agencies.

6.3 Community Contact Table

Below in Table 3 are names, affiliations, dates of contact, and comments from NHOs, individuals, organizations, and agencies contacted for this project. Results are presented below in alphabetical order.

Table 3. Results of Community Consultation

Name	Affiliation	Comments
Adams, Mark	Wai'ehu Kou Phase II	Referred by Mr. Bryan Esmeralda Letter and figures sent via email on 20 June 2018 Letter and figures sent via email on 6 July 2018
Ainsworth, Gail	Author and Historian	Letter and figures sent via United States Postal Service (USPS) on 15 June 2018 Letter returned to sender 19 June 2018
Ampong, Foster	Wailuku Moku Representative	Referred by Mr. Ke'eaumoku Kapu Letter and figures sent via email on 9 July 2018 Mr. Ampong responded via email on 20 July 2018 asking that the community consultation response deadline be extended to 31 August 2018 CSH responded on 23 July 2018 stating that CSH could contact the client regarding extending the community consultation response period

Name	Affiliation	Comments
		CSH called Mr. Ampong on 2 November 2018 to see if he would be interested in interviewing for the project; he felt that others from the area (i.e. kuleana families) would have more *mana'o* and *'ike* than him but is willing to participate; he requested we email the letter and figures again and would get back to us by next week; CSH emailed letter and figures to Mr. Ampong CSH followed up with Mr. Ampong via email 19 November 2018 Mr. Ampong responded to CSH via email 20 November 2018 apologizing for forgetting and requested to follow up after the Thanksgiving holiday; CSH replied the same day stating that we would contact him after the weekend CSH called Mr. Ampong on 28 November 2018 to schedule an interview; tentative interview set for 6 December 2018 CSH emailed Mr. Ampong 3 December 2018 confirming 6 December 2018 for an interview Mr. Ampong replied via email 4 December 2018 confirming interview and gave his personal address CSH interviewed Mr. Ampong 6 December 2018 CSH sent Mr. Ampong his draft interview summary for review 8 January 2019 via email

Name	Affiliation	Comments
		CSH followed up with Mr. Ampong via email on the status of his draft 11 January 2019 Mr. Ampong replied to CSH 14 January 2019 via email stating he would review and get back to us at a later date CSH followed up via email 15 January 2019 Mr. Ampong sent edits to CSH via email 16 January 2019 CSH called Mr. Ampong 24 January 2019 for clarification on his recommendations; no answer, left a message Mr. Ampong returned CSH's call on 25 January 2019; CSH unable to answer, Mr. Ampong left a message CSH returned Mr. Ampong's call on 25 January 2019; no answer, left a message; CSH also texted Mr. Ampong to see if he could clarify the following: *In case we don't get to talk, was calling for clarification on your recommendations. Is it...* 1. *Presence of an archaeological monitor IF remains are discovered?* *Or...* 2. *An archaeological monitor present during ALL construction activities?*

Name	Affiliation	Comments
		Just want to make sure we get it right. Let me know. Mahalos! Mr. Ampong texted CSH shortly after stating: *Numba 2. "An archaeological monitor present during ALL construction activities..."* *Mahalo* See Section 6.4.1 for Mr. Ampong's interview summary
Antonio, Kapulani	Maui Island Burial Council; Teacher at Kamehameha Schools Maui	Letter and figures sent via email on 15 June 2018 Letter and figures sent via email on 6 July 2018
Artates, Perry	Waiohuli Hawaiian Homesteaders Inc.	Referred by Mr. Bryan Esmeralda Letter and figures sent via email on 20 June 2018 Letter and figures sent via email on 6 July 2018
Bisgard, Bill	Former engineer, Hawaiian Commercial and Sugar Company (HC&S)	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via USPS on 6 July 2018
Buland, Holly	Operations Administrator Alexander & Baldwin Sugar Museum	Ms. Buland was forwarded CSH's inquiry and responded via email on 9 July 2018 stating: *. . . thank you for your inquiry. We may have something useful for your search. It is a survey of what may be the same area you are interested in, done by your company in 1993. If you don't have a copy, we can show you ours. We may also have a map showing the area. I will double check our inventory. That is all we have, however.*

Name	Affiliation	Comments
		If you are still interested, please make an appointment to access our archives. I am available Mon-Fri of this week, from 10-12. Please see attached documents on how to access our collection. *Thank you,* *Holly Buland* *Operations Administrator* *Alexander & Baldwin Sugar Museum* CSH responded to Ms. Buland thanking her for providing the above information
Crabbe, Kamana'opono	Ka Pouhana, OHA	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via email on 6 July 2018
Daniels, Ronald	*Kama'āina*	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via USPS on 6 July 2018
Enomoto, Kekoa	Pa'upena Community Development Inc.	Referred by Mr. Bryan Esmeralda Letter and figures sent via email on 20 June 2018 Letter and figures sent via email on 6 July 2018
Esmeralda, Bryan	Planner at Department of Hawaiian Home Lands (DHHL), Maui	Referred by Mr. Kaleo M. Manuel. Mr. Esmeralda contacted CSH via email on 19 June 2018 writing: *Aloha Erika!* *I hope this email finds you well. I was forwarded your message by Kaleo as I am the Department's Planner on Maui island. If it would be helpful, I can provide*

Name	Affiliation	Comments
		you with contact information for our active Maui homestead associations so that you may reach out to them for input. *Mahalo nui,* *Bryan* CSH responded on 19 June 2018 writing: *Aloha Mr. Esmeralda,* *Thank you for your email. It would be greatly appreciated if you would like to refer me to the active Maui homestead associations. I look forward to reaching out to the community members you refer.* *Mahalo* Mr. Esmeralda responded on 20 June 2018 providing a list of referrals for Maui homestead leaders CSH responded on 20 June 2018 thanking Mr. Esmeralda for his referrals
Feteira, Blossom	Maui Mokupuni Council	Referred by Mr. Bryan Esmeralda Letter and figures sent via email on 20 June 2018 Letter and figures sent via email on 6 July 2018 CSH called on 2 November 2018; left a message
Fisher, Scott	Associate Executive Director of Conservation, Hawaiian Islands Land Trust (HILT)	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via email on 6 July 2018

Name	Affiliation	Comments
Hobdy, Robert	Retired Naturalist and Forester	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via email on 6 July 2018 CSH called on 2 November 2018; left a message
Hokoana, Lui	President, Central Maui Hawaiian Civic Club; Chancellor; Chief executive officer of UH Maui College	Letter and figures sent via USPS on 15 June 2018 Letter returned to sender 19 June 2018 Letter and figures sent via email on 6 July 2018
Holt-Padilla, Hokulani	*Kumu Hula*; Pā'ū o Hi'iaka Cultural Specialist	Letter and figures sent via email on 15 June 2018 Ms. Holt-Padilla responded via email on 25 June 2018 writing: *I am incredibly busy this summer at my work and may not be able to give the time needed to answer these questions. I'm sure there are others.* *'O au iho nō,* *Hōkūlani* CSH responded on 27 June 2018 thanking Ms. Holt-Padilla for her response
Kaiaokamalie, Ainoa	Ka 'Ohana O Kahikinui	Referred by Mr. Bryan Esmeralda Letter and figures sent via email on 20 June 2018 Email returned to sender 20 June 2018
Kapahulehua, Leonard Kimokeo	Founder, Kimokeo Foundation	Letter and figures sent via USPS on 15 June 2018 Letter returned to sender 25 June 2018

Name	Affiliation	Comments
		Letter and figures sent via email on 6 July 2018 Mr. Kapahulehua responded via email on 7 July 2018 writing: *aloha* *I will be interested to participate advise when to meet.* *Mahalo* CSH responded on 11 July 2018 writing: *Aloha Mr. Kapahulehua,* *Thank you for your response. I would be happy to schedule an interview time with you to discuss in more detail the ahupua'a of Wailuku and the proposed project. Would you be available sometime during the week of July 30th? My schedule is flexible and I can work around your availability. I look forward to speaking with you soon.* *Mahalo* Mr. Mr. Kapahulehua responded via email on 12 July 2018 writing: *Yes advise time and place.* *Mahalo* CSH called Mr. Kapahulehua on 6 August 2018 attempting to set up an interview; Mr. Kapahulehua requested to send an email with all information; CSH emailed Mr. Kapahulehua details regarding the interview process Mr. Kapahulehua emailed CSH on 7 August 2018 with dates of

Name	Affiliation	Comments
		availability; CSH responded confirming a date of 23 August 2018 for an interview CSH emailed Mr. Kapahulehua on 10 August 2018 letting him know that flight arrangements had been made for the 23 August 2018 CSH called and emailed Mr. Kapahulehua on 22 August 2018 stating that due to Hurricane Lane approaching, we would cancel the interview for the next day and reschedule at a later date Mr. Kapahulehua responded via email on 23 August 2018 stating he understood the reason for the cancellation CSH emailed Mr. Kapahulehua on 28 August 2018 for dates of availability
		Mr. Kapahulehua responded via email on 29 August 2018 stating that he would be in Kona until 3 September; CSH responded the same day via email with a confirmation of 30 August 2018 to interview CSH interviewed Mr. Kapahulehua on 30 August 2018, authorization form signed CSH emailed Mr. Kapahulehua his draft summary on 21 September 2018 CSH followed up with Mr. Kapahulehua via email on 4 October 2018 on his draft summary edits

Name	Affiliation	Comments
		Mr. Kapahulehua emailed his edits to CSH on 5 October 2018 Interview approved on 16 October 2018 See Section 6.4.2 for Mr. Kapahulehua's interview summary
Kamaunu, Johanna	Maui Island Burial Council	Letter and figures sent via email on 15 June 2018 Letter and figures sent via email on 6 July 2018 CSH called on 2 November 2018; number is disconnected
Kamauna, Kaniloa	Aha Moku, Wailuku Representative	Mr. Kamauna reached out to CSH via email on 20 July 2018 asking that he be included in the community consultation. CSH responded on 23 July 2018 providing Mr. Kamauna the community consultation letter and figures.
Kapu, Kekai	Aha Moku o Maui; Cultural Director, Maui Ocean Center	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via USPS on 6 July 2018
Kapu, Ke'eaumoku	CEO, Aha Moku o Maui; Koani Foundation	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via email on 6 July 2018 Mr. Kapu responded via email on 6 July 2018 recommending that CSH contact Mr. Foster Ampong, the Wailuku Moku representative CSH responded on 9 July 2018 thanking Mr. Kapu for his referrals

Name	Affiliation	Comments
Kapu, Uilani	Na Aikane 'O Maui	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via email on 6 July 2018
Kehler, Annalise	County Cultural Resource Planner	Letter and figures sent via email on 15 June 2018 Letter and figures sent via email on 6 July 2018 Ms. Kehler responded via email on 6 July 2018 writing: *Can you tell me more about the process CSH goes through to develop a CIA? Do you research a little about the project area before you send these consultation letters out? Or do you send the letters out first and do research based on the responses you receive? If you have already done preliminary research, which sources did you consult? Which organizations and individuals have you spoken with about this project? It's helpful to provide a bit of background on the work your firm has already done to date on CIAs when you send out consultation letters.* *Does CSH maintain a list of Native Hawaiian Organizations, individuals, and kupuna?* *Thanks,* *Annalise* CSH responded on 11 July 2018 writing: *Aloha Ms Kehler,* *Thank you for your email. The following is a description of*

Name	Affiliation	Comments
		Cultural Survey Hawai'i's (CSH) processes when composing a cultural impact assessment and initiating community consolation. This description is a result of an ongoing dialogue within the Cultural Impact Assessment Department of CSH. *When CSH receives a RFP (request for proposal) our Proposal and Contract Administrator puts together a document for us internally to review (internally we call it a Work Up), which contains pertinent information about the immediate project area. This document includes any previous archaeological reports, historic sites, etc. CSH also looks to see if there are any previous CIAs that were conducted in the area. CSH notes the type of project it is (new development, emergency repair, highway widening, sewage, controversial, etc.) and tries to determine a few of things:* *•What is the general consensus on cultural issues for this community?* *•Does this community give us a lot of feedback or not?* *•Are there a lot of cultural practitioners in this area?* *Once CSH is contracted for a job, we contact the client for a project description and site plan to formulate the consultation letter. Once the consultation letter is approved by the client, we begin the consultation process. CSH*

Name	Affiliation	Comments
		begins constructing a consultation list with agencies and NHOs of the area (i.e. SHPD Burial Specialist, SHPD Cultural Historian, the island Burial Council, NHOs that are listed on the DOI list, Civic Clubs of the area, non-profits that could potentially be stakeholders, etc.). We also include kama'āina, kupuna, and other knowledgeable members of the community. We pull this information from an internal database of organizations and individuals who we have consulted with for over a decade. The database is maintained regularly to update any deceased individuals or dissolved organizations. *The consultation process is time intensive. A CIA usually takes anywhere between 4 months to a year to complete. After CSH sends out consultation letters, the department begins drafting the report. The report includes an introduction of the ahupua'a the proposed project is in (i.e. scope of work, soils, winds, streams); methodology; ka'ao and mo'olelo (traditional background); historical background; consultation/interviews; traditional cultural practices (an abbreviated narrative of ka'ao, mo'olelo, historical background, and interviews); and impacts/recommendations (based on background information and feedback from the interviews).*

Name	Affiliation	Comments
		I hope that this email addresses your questions. Please feel free to peruse our website (http://www.culturalsurveys.com/) or reach out via phone or email if you have further questions. *Mahalo*
Kekahuna, Janice	Paukukalo Hawaiian Homestead Community Association	Referred by Mr. Bryan Esmeralda Letter and figures sent via email on 20 June 2018 Letter and figures sent via email on 6 July 2018
Kubota, Gaylord	Retired Director/Founder Alexander and Baldwin Sugar Museum	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via USPS on 6 July 2018
Kuloloi'a, Leslie	*Kupunakāne,* Kuloloi'a Lineage	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via email on 6 July 2018 CSH emailed on 1 November 2018 to see if he would be interested in participating in an interview CSH called on 2 November 2018 and left a message Mr. Kuloloi'a returned CSH's call on 6 November 2018 giving us permission to use a previous interview summary; CSH asked if he had any concerns about the proposed project; Mr. Kuloloi'a had no comment CSH emailed Mr. Kuloloi'a a draft interview summary with photos on 28 November 2018

Name	Affiliation	Comments
		Mr. Kuloloi'a called CSH on 6 December 2018 stating he had edits and he would send via email CSH followed up with Mr. Kuloloi'a via email on the status of his edits 11 December 2018 Mr. Kuloloi'a sent two photos of his father with captions via email 2 January 2019 CSH emailed Mr. Kuloloi'a thanking him for the photos 3 January 2019 See Section 6.4.3 for Mr. Kuloloi''s interview summary
Lake-Farm, Sissy	Executive Director, Maui Museum; *Kumu Hula*; Nā Hanona Kūlike 'o Pi'ilani	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via email on 6 July 2018
Lightfoot, Roslyn	Director, Alexander and Baldwin Sugar Museum	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via email on 6 July 2018
Manuel, Kaleo M.	Department of Hawaiian Home Lands Planner	Letter and figures sent via email on 15 June 2018 Referred Mr. Bryan Esmeralda
Moore, Cheryl	Waiohuli Undivided Interest Lessees	Referred by Mr. Bryan Esmeralda Letter and figures sent via email on 20 June 2018 Letter and figures sent via email on 6 July 2018
Nakahashi, Ikaika	Cultural Historian, SHPD	Letter and figures sent via email on 15 June 2018 Letter and figures sent via email on 6 July 2018

Name	Affiliation	Comments
		Mr. Nakahashi responded via email on 6 July 2018 stating: *Mahalo for contacting me regarding the CIA for the proposed Central Maui Landfill Facilities Improvement Project in Wailuku, Maui.* *I recommend CSH to utilize the media (e.x. OHA's Ka Wai Ola, Maui News, etc.) to solicit additional information for this CIA.* *I recommend CSH to contact:* *•Ke'eaumoku Kapu – Aha Moku o Maui Inc.,. . .* *•Hōkūao Pellegrino – Hui o Nā Wai 'Ehā. . .* *I recommend CSH to contact and meet with the native tenants and people that currently live or previously lived in the ahupua'a of Wailuku on Maui for information about the cultural resources and practices for this CIA.* *Please let me know if I can assist with anything else.* *Ā hui hou,* *Christopher "Ikaika" Nakahashi, M.S* CSH responded to Mr. Nakahashi on 9 July 2018 thanking him for his referrals and research recommendations.
Nakanelua, Kyle	Aha Moku o Maui	Letter and figures sent via email on 15 June 2018

Name	Affiliation	Comments
		Letter and figures sent via email on 9 July 2018
Nakihei, Sarah	Maui Homestead Farmers and Ranchers Association	Referred by Mr. Bryan Esmeralda Letter and figures sent via email on 20 June 2018 Letter and figures sent via email on 9 July 2018 Ms. Nakihei responded via email on 9 July 2018 inquiring: *What street is this project on and where is the nearest water shed and school. How about traffic.* CSH responded to Ms. Nakihei on 11 July 2018 writing: *Aloha Ms. Nakihei,* *Thank you for your response. The Central Maui Landfill Facilities Improvement Project is located on Pulehu Road and Hansen Rd, Puunene, HI 96784. The project area is situation within the 'Īoa* [sic] *Valley watershed. The closest school to the project area appears to be Ka'ahumanu Hou Christian School which is approximately 1.8 miles northwest of the project area.* *I am not sure what degree of traffic the County of Maui anticipates as a result of this project, but can reach out to the client and get back to you on that if you wish. Mahalo for your questions.* Ms. Nakihei responded to CSH on 11 July 2018 expressing that the farming community near the project area should be contacted.

Name	Affiliation	Comments
		CSH responded on 11 July 2018 asking that Ms. Nakihei refer any parties to CSH whom she believes should be contacted regarding the project
Newbold, Robin	Chair, Maui Nui Resource Council	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via USPS on 6 July 2018
Newhouse, Robin	Keokea Homestead Farm Lots Association	Referred by Mr. Bryan Esmeralda Letter and figures sent via email on 20 June 2018 Letter and figures sent via email on 9 July 2018
Nishiyama, Patty	Nā Kūpuna o Maui	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via USPS on 6 July 2018
Oliveira, Roy Kalani	President, Waiehu Kou Phase 3 Association	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via email on 9 July 2018 Responded via telephone on 9 July 2018. Mr. Oliveira asked CSH questions regarding the CIA processes and said he would forward CSH's email to other community members. He added that the project area is located in the "heart" of the former sugar industry and that the cultural sites of the area had been "kind of erased" due to the legacy of sugar.
Ornellas, Daniel L.	Vice President, Waiehu Kou Phase 3 Association	Letter and figures sent via USPS on 15 June 2018

Name	Affiliation	Comments
		Letter and figures sent via email on 9 July 2018
Pa'ahana, Rodney	Villages of Leialii Association	Referred by Mr. Bryan Esmeralda Letter and figures sent via email on 20 June 2018 Letter and figures sent via email on 9 July 2018
Pellegrino, Hōkūao	*Kama'āina*; President, Maui Historical Society; Manager Noho'ana Farm	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via USPS on 6 July 2018
Pyle, Bill	Former HC&S employee	Letter and figures sent via email on 15 June 2018 Email returned to sender 15 June 2018
Raymond, Ki'ope	Hawaiian Studies Teacher, UH Maui	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via email on 9 July 2018
Roback, William	Royal Order of Kamehameha	Letter and figures sent via email on 15 June 2018 Letter and figures sent via email on 9 July 2018
Schattenburg-Raymond, Lisa	Former Executive Director, Maui Nui Botanical Gardens	Letter and figures sent via email on 15 June 2018 Letter and figures sent via email on 9 July 2018
Six, Janet	Former Chair, Maui County Cultural Resources Commission; Professor University of Hawai'i Maui College	Letter and figures sent via email on 15 June 2018 Letter and figures sent via email on 9 July 2018
Smith, Jade Alohalani	Aha Moku o Maui	Letter and figures sent via USPS on 15 June 2018

Name	Affiliation	Comments
		Letter and figures sent via email on 9 July 2018 Email returned to sender 9 July 2018
Solamillo, Stanley	Former Cultural Resources Expert, County Planning Department Architectural Historian	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via USPS on 6 July 2018
Sterling, Donna D.	Aha Moku o Maui	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via email on 9 July 2018
Tanahy, Dalani	*Kapa* Maker	Letter and figures sent via email on 15 June 2018 Letter and figures sent via email on 9 July 2018
Tavares, William	Chairman, Committee for More Equitable Taxation	Letter and figures sent via USPS on 15 June 2018 Letter and figures sent via USPS on 6 July 2018
Watanabe, Noelani	Maui, Vice-Chair, Native Hawaiian Historic Preservation Council (NHHPC)	Letter and figures sent via email on 15 June 2018 Letter and figures sent via email on 9 July 2018

6.4 *Kama'āina* Interviews

The authors and researchers of this report extend our deep appreciation to everyone who took time to speak and share their *mana'o* and *'ike* with CSH whether in interviews or brief consultations. We request that if these interviews are used in future documents, the words of contributors are reproduced accurately and in no way altered, and that if large excerpts from interviews are used, report preparers obtain the express written consent of the interviewee/s.

Interviews were conducted in accordance with Federal and State laws and guidelines with individuals knowledgeable of the general history, present and past land use, traditional gathering practices (both past and ongoing), and cultural sites of the project area and Wailuku Ahupua'a. The following analysis of *kama'āina* interviews is intended to facilitate the identification of

potential impacts to cultural resources, ongoing cultural practices, and/or cultural sites within the project area or its immediate vicinity.

6.4.1 Foster Ampong

CSH met with Foster Ampong, representing the 'Aha Moku o Wailuku, on 6 December 2018 at his home in Waiehu, Maui. While Mr. Ampong's family genealogy spans the *pae 'āina* (archipelago), he is a lineal descendant of Keka'a (also known as Ka'ānapali). Though he has family in Wailuku, his closer connection to this area is through his son's mother of the Alau Ohana. From the time of the Māhele, the division of Hawaiian lands for private ownership, his son's mother's family acquired a *kuleana* parcel (land award given to Native tenants who occupied or cultivated the land) that they still tend to and *mālama* (take care of) today.

As a young adult, Mr. Ampong spent alot of time *mauka* (upland) and *makai* (on the seaside). He enjoyed surfing and often found himself in the *kuahiwis* (mountain) seeking sanctuary from the stresses of life. Although he grew up in Lāhainā, he had many relatives in Wailuku and would visit them often. The opportunity to learn his family's genealogy and other stories never appealed to him and his interests pointed him in the opposite direction of his family history.

His mother, Emma Ka'iu Kimokeo, was born at Keka'a and was the youngest of four girls. Neither Mr. Ampong's mother or her siblings graduated from high school but took to working instead to help support their family. Their absence from school allowed more time with *kūpuna* and they became accustomed to the "generational knowledge" passed down to them. As with tradition, this knowledge was strictly *ha'i waha* or told verbally without reference to documentation. In this same way, Mr. Ampong learned from his mother and other family elders. His interest in his family genealogy grew when historical documents, from the time of the Māhele and before, was presented to him. This new knowledge pushed him to look into land history as a Hawaiian and representative of the community of Wailuku.

In order to get an idea of the cultural landscape of the *moku* of Wailuku, our *huaka'i* (journey) began at Camp Maluhia (Figure 24) in the Kahakuloa Ahupua'a. This starting point allowed CSH to view the expanse of *Nā Wai 'Ehā* or the Four Waters; this being Waihe'e, Waiehu, Wailuku, and Waikapū (Figure 25). Mr. Ampong then led CSH to the *kuleana* property owned by his wife's family which they still maintain and cultivate (Figure 26 and Figure 27). On the 3.5 acre property they manage *kalo* (taro; *Colocasia esculenta*), banana, papaya, mango, and *liliko'i* (passion fruit; *Passiflora edulis*). According to Mr. Ampong, Maui is known for the sweet tasting Lehua variety *kalo*. His personal favorites include the varieties Mana Loa, Moi, and Pi'i Ali'i and he especially likes eating it sour with dried fish. Mr. Ampong continues to *ku'i kalo* (pound taro) but also enjoys store bought *poi* (mashed kalo).



Figure 24. View from Camp Maluhia looking towards Kahakuloa Shoreline (CSH 2018)



Figure 25. View from Camp Maluhia looking *makai* (CSH 2018)



Figure 26. *Kuleana* lot in Waihe'e with *lo'i* and banana trees (CSH 2018)



Figure 27. *Kuleana* lot in Waihe'e (CSH 2018)

The *huaka'i* continued passing the historic Spreckel's ditch and continued onward to an area called Pu'uohala then to 'Īao Valley at Kepaniwai Park (Figure 28). The Battle of Kepaniwai (4.1.2) took place here. Mr. Ampong confirmed that the *kahawai* (stream) is called Wailuku (Figure 29), though many people mistakenly refer to it as 'Īao Stream. He explained that a friend of his opened and began re-cultivating an ancient *lo'i* (irrigated terrace) found in a nearby *'ili* (smaller land division within an *ahupua'a*) called Lo'iloa. However, a freak storm in 2016 created extensive flood damage when heavy rain caused the streams to swell and sent large boulders and gushing waters downstream. Wailuku Stream looks completely different today; the stream itself is much wider than before (Figure 30 and Figure 31) and portions of access roads were wiped out.

After Kepaniwai we continued on to Wailuku Heights Park (Figure 32). This park overlooks the entire central isthmus including the project area (Figure 33 and Figure 34). Here Mr. Ampong mentioned the Battle of Kakanilua, between the *ali'i nui* (chief) Kahekili of Maui and Kalani'ōpu'u of Hawai'i. This battle was also recounted by famed Hawaiian historian, Samuel Kamakau:

> The great battle took place between Waikapu and Wailuku. Ka-lani-'opu'u expected to enter Wailuku at Kakanilua, but Ka-hekili's men rose at dawn and occupied the sandhills of Kama'oma'o, and a portion of them took their stand on the side toward Waikapu turn, so that the forces of Ka-lani-'opu'u, who had supposed that the battle would be at Kakanilua, found a divided front from which spears, javelins, and other missiles poured like water. Death-dealing weapons poured down like a swift rainstorm beating the sides of the fisherman's canoe and agitating the surface of the sea like a cloudburst over the deep ocean. The terrified soldiers were surrounded and took to flight; they were driven by Ka-hekili's men like leaves before a whirlwind. The plains of Kama'oma'o became like a fishpond through whose sluice gate the sea flooded, Ka-lani-'opu'u's men [became] like the mullet driven by the sound of beating into the sluice gate of 'Uko'a; and the sea rose up to the walls. Like the fiery petals of the lehua blossoms of Pi'iholo were the soldiers of Ka-hekili, red among the leaves of the koa trees of Liliko'i or as one glimpses them through the kukui trees of Ha'iku. Like the creeping branches of the 'ulei, so moved the cloaked warriors, young and middle-aged, over the 'ilima-covered plain of Paholei. A chill seized Ka-lani-'opu'u as he crouched in the canoe, mourning the dead who lay like fish stupefied by the poison spread by the great fisherman, Ka-hekili. Like grasshoppers on the plain, easily to be caught by women, so they lay in the heat of the sun snuggled close to the blossoms of the grasses. [Kamakau 1992:87]

Mr. Ampong mentioned an early missionary survey of this area that made note of thousands of human remains, most likely of the fallen warriors. Years of sugar cane production would make it nearly impossible to recover those remains. However, Mr. Ampong believes that because this central plain was ideal for battles, an expansion of the landfill or any sub-surface work could possibly unearth remains. He recommends the presence of an archaeological monitor during all construction activities occurring at the landfill.



Figure 28. Photo of 'Īao Needle (CSH 2018)

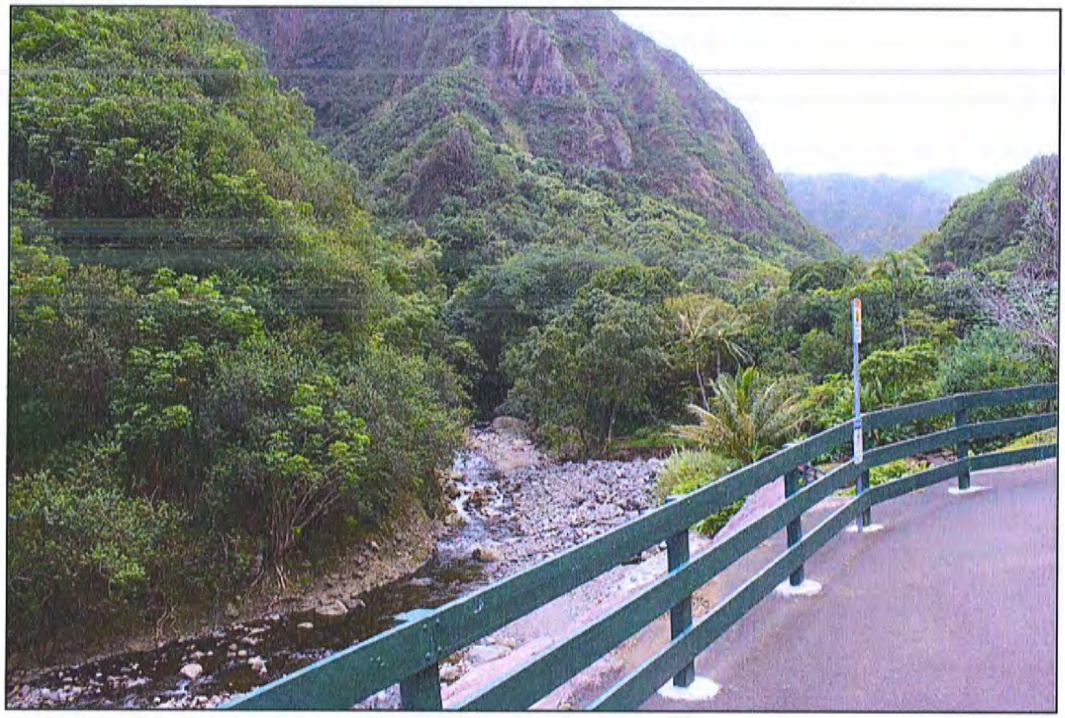

Figure 29. Photo of Wailuku Stream (CSH 2018)



Figure 30. Photo of stream widening looking *makai* (CSH 2018)



Figure 31. Photo of vegetation looking towards Wailuku; evidence of large mango trees, ancient ti (based on height); and *kukui* (CSH 2018)



Figure 32. Photo taken from Wailuku Heights looking towards the isthmus (CSH 2018)



Figure 33. Close up of isthmus; landfill, center of background (CSH 2018)



Figure 34. Zoomed out photo of Wailuku and isthmus; Haleakalā in background (CSH 2018)

6.4.2 Kimokeo Kapahulehua

Cultural Surveys Hawai'i, Inc. interviewed Leonard Kimokeo Kapahulehua in Kona, Hawai'i on 30 August 2018. Mr. Kapahulehua was born to Leonard Kapahulehua, Jr. and Gertrude Kimokeo on 15 December 1947 in Līhu'e, Kaua'i. His father was born in Waiakea, Hilo, Hawai'i and later to moved to Ni'ihau where he worked before moving to Kaua'i. His mother was born and raised on Kaua'i and was a pineapple picker and prep chef. He has two sisters who now reside on Kaua'i and O'ahu.

Mr. Kimokeo moved to Maui in the 1970s and worked in the hospitality industry. Today, he currently resides in Kīhei. An avid canoe paddler and waterman who is dedicated to perpetuating the Hawaiian culture, Mr. Kapahulehua shared his knowledge about the project area. He has always known the area as a landfill. Prior to the area being a landfill, the land was used for sugarcane and pineapple and was owned by Alexander & Baldwin (A&B). There are still remnants of the sugarcane and pineapple industry that remain today. Rock piles (also known as "push piles") that were moved during the plantation era are still evident in the fields today. Rocks were pushed into mounds to clear the fields for cultivation. Mr. Kapahulehua noted that there is no hunting that occurs within or near the project area. When asked if any traditional gathering occurs in the area, he responded that maybe papaya or banana are gathered but there is no traditional Hawaiian growth that occurs within or in the vicinity of the project area. He points out that the project area is heavily disturbed as trucks regularly drive in and out of the landfill. As far as any historic properties in the area, Mr. Kapahulehua knows flumes are present in the area and that one flume crossed the landfill to the Kīhei irrigation ditch. Pu'unene Camp, a plantation camp, was located just below the landfill. Pu'unene Hospital was the first hospital on Maui. Today, the site of the hospital was recently purchased by TJ Gomes Trucking and is used by Maui Towing, a trucking parking lot, and Maui Compost. A mile or two from the landfill is the Pu'unene Sugar Mill, which is still there today. Cane roads still exist in the area as well.

Mr. Kimokeo sees no issues with the proposed landfill expansion project. It is the main landfill on Maui for the last 40+ years and he feels that it is a must for the expanding community on Maui.

6.4.3 Leslie Kuloloi'a

Leslie Kuloloi'a was born in October of 1940 just before the bombing of Pearl Harbor. He can recall growing up in a time of war preparedness where military gas masks were distributed to communities and his father hand-dug a bomb shelter to protect his family. His father worked on a sugar plantation and his mother at a pineapple cannery (Figure 35 through Figure 38. Throughout his childhood, Mr. Kuloloi'a obtained his "Christian-based" religious education at Holy Rosary School in Pā'ia and St. Anthony's Boys High School in Wailuku.

In the year 1959, he enlisted and served three years in the military, specifically the United States Army where he was an honorable discharge veteran. Upon his return in 1962, he began to better understand the meaning of *kuleana* (responsibility) and *ho 'okaulike* (balance) as he witnessed the impact of government statutes limiting his practice of traditional values of survival. This clashed with his childhood memories of subsistence from the land and sea that was passed down from past generations. He began to fish again but was also getting acquainted with the many Western laws that imposed native rights. For example, turtles were considered a food source in Hawai'i.

However, over time turtles became State and Federally protected. As Mr. Kuloloi'a points out, people were being fined for catching and eating turtles.

In his later years, he was introduced to the Kumulipo, the hawaiian cosmogenic chant of creation. After this introduction he "struggled to bridge this Ancient Hawaiian translation with the Christian teachings" he knew all his life. He was forced to rebuild all he was taught to "reconcile all the different beliefs of Akua". His knowledge of the Kumulipo created a shift that turned him from a Christian to a Hawaiian Christian.

Since then and for more than 50 years of his life, he has stood as a force against many issues critical to preserving the identity and ancestral knowledge of his Hawaiian lineage. Mr. Kuloloi'a had no comment on the project.

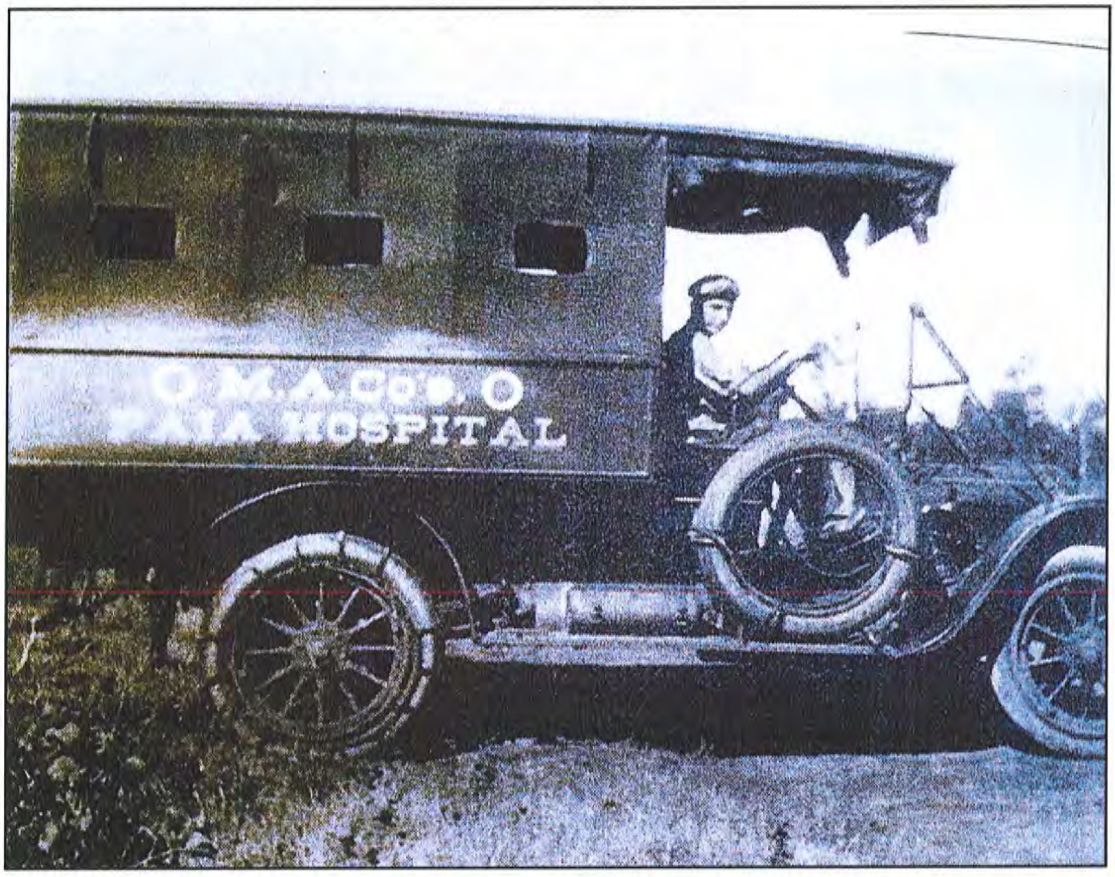

Figure 35. Photo courtesy of Leslie Kuloloi'a



Figure 36. Photo courtesy of Leslie Kuloloi'a



Figure 37. Photo of Mr. Kulololoi'a's father, Wally Aipalena (photo courtesy of Leslie Kulololoi'a)



Figure 38. Photo of Wally Aipalena Kuloloi'a who worked at Maui Agriculture Company/HC&S for 52 years (courtesy of Leslie Kuloloi'a)

Section 7 Traditional Cultural Practices

Timothy R. Pauketat succinctly describes the importance of traditions, especially in regard to the active manifestation of one's culture or aspects thereof. According to Pauketat,

> People have always had traditions, practiced traditions, resisted traditions, or created traditions . . . Power, plurality, and human agency are all a part of how traditions come about. Traditions do not simply exist without people and their struggles involved every step of the way. [Pauketat 2001:1]

It is understood that traditional practices are developed within the group, in this case, within the Hawaiian culture. These traditions are meant to mark or represent aspects of Hawaiian culture that have been practiced since ancient times. As with most human constructs, traditions are evolving and prone to change resulting from multiple influences, including modernization as well as contact with other cultures. It is well known that within Hawai'i, a "broader 'local' multicultural perspective exists" (Kawelu 2015:3) While this "local" culture is deservedly celebrated, it must be noted that it has often come into contact with "traditional Hawaiian culture." This contact between cultures and traditions has undoubtedly resulted in numerous cultural entanglements. These cultural entanglements have prompted questions regarding the legitimacy of newly evolved traditional practices. The influences of "local" culture are well noted throughout this section, and understood to represent survival or "the active sense of presence, the continuance of native stories, not a mere reaction, or a survivable name. Native survivance stories are renunciations of dominance, tragedy and victimry" (Vizenor 1999:vii). Acknowledgement of these "local" influences helps to inform nuanced understandings of entanglement and of a "living [Hawaiian] contemporary culture" (Kawelu 2015:3). This section strives to articulate traditional Hawaiian cultural practices practiced within the *ahupua'a* in ancient times, and the aspects of these traditional practices that continue to be practiced today; however, this section also challenges "tropes of authenticity" (Cipolla 2013) and acknowledges the multicultural influences and entanglements that may "change" or "create" a tradition.

This section integrates information from Sections 1-6 in examining cultural resources and practices identified within or in proximity of the project area in the broader context of the encompassing Wailuku landscape. Excerpts from interviews are incorporated throughout this section where applicable.

7.1 Subsistence and Gathering

In 1862, The Boundary Commission was established to delineate borders of *ahupua'a* awarded during the Māhele (Maly and Maly 2003). H. Kuihelani submitted testimony to the Boundary Commission giving detail descriptions of the Wailuku Ahupua'a. His testimony tells of his family's *kuleana* as overseers of Mau'oni and Kanahā fishponds, which belonged to the *ali'i* Kauikeaouli. The Mau'oni and Kanahā *loko i'a* were said to be stocked with large quantities of *nehu* (Hawaiian anchovy; *Encrasicolina purpurea*) and *'opae* (shrimp; *Halocaridina rubra*) (Sterling 1998). The early Hawaiians of Wailuku supplemented the protein in their diet by raising and breeding fish in fishponds such as Mau'oni and Kanahā. This helped to temper the often-unpredictable results of seasonal deep-sea fishing (Handy and Handy 1972). Additionally, the

wetland taro *lo'i* in Wailuku were utilized as fish rearing ponds (James 2001). Handy and Handy describe the practice of raising fish in taro *lo'i* stating:

> In areas of wet-taro cultivation, young mullet were placed in the liquid mud of taro patches and there thrived. It is not unlikely that this latter custom came about as a result of placing the smaller fish in the *lo'i* when a netful was caught, in order to keep them fresh. It was discovered that they not only kept fresh, but thrived and grew. The mullet (*'ama'ama*) is a grazing fish, and when the fingerlings (*pua 'ama*) were put into *lo'i* their stirring about and grazing helped keep the water fresh. [Handy and Handy 1972:262]

Participant Foster Ampong took CSH on a *huaka'i* to *Nā Wai 'Ehā*, also known as the Four Waters. The four water sources include Waihe'e, Waiehu, Wailuku, and Waikapū. He also led CSH to his wife's family *kuleana* where they still maintain *kalo*, banana, papaya, mango, and *liliko'i*. Mr. Among shared that Maui is known for the Lehua variety of *kalo*. His personal favorites include the varieties of Mana Loa, Moi, and Pi'i Ali'i. He prefers to eat his *poi* sour and with dried fish. He continues to *ku'i kalo* but also enjoys store bought *poi*.

Salt was also gathered at Mau'oni and Kanahā fishponds and given to the *ali'i* according to Kuihelani's Boundary Commission testimony. The gathering of salt from evaporated sea water was an important activity in early Hawai'i. Salt was a stable in the traditional Hawaiian diet of *poi*, or sweet potato, and fish (Handy and Handy 1972). An additional account by Rebecca Nuuhiwa in Sterling (1998) describes the salt pans of Kanahā, Wailuku. "In the olden days salt was gathered at Kanahā. When the sea rose the hollows in the rocks were filled (Sterling 1998:90)".

Kuihelani goes on to mention the practice of *ma'o* (Hawaiian cotton; *Gossypium tomentosum*) gathering at the Kama'oma'o Plain. The *ma'ō* that was collected was given to *ali'i* as it would scent their *kapa* clothing (Maly and Maly 2003). *Ma'o* was also gathered by early Hawaiians as a dye for *kapa* clothing. The leaves of the *ma'ō* were purposed as a light green or red-brown dye while the flower petals of the *ma'ō* plant produced a yellow dye (University of Hawai'i 2009).

Mr. Kimokeo Kapahulehua stated during his interview that papaya or banana might grow in the area, however, no traditional Hawaiian plant growth occurs within or in the vicinity of the project area. He points out that the area is heavily disturbed and that trucks regularly drive in and out of the landfill.

7.2 Agriculture

Traditionally, the production (and consumption) of *kalo* was vitally important to Wailuku Ahupua'a as a whole. The cultivation of taro was noted by early visitors to Wailuku as noted in the following passage. "When the first Westerners arrived in the late 18th Century, the area [Wailuku] was home to a large community of Hawaiians who planted great tracts of taro and fished the waters of the nearby Pacific. (Engebretson 2000:2)" Captain James King (1779) noted that "the natives of these islands are, in general, above the middle size and well made; they walk very gracefully, run nimbly and are capable of bearing great fatigue" (Shintani 1993:10). Accordingly, the high level of physical activity and physical fitness described by Captain King was a normal part of Hawaiian life, and largely attributable to the availability of plant and food resources such as *kalo*, *'uala* (sweet potato; *Ipomoea batatas*), *mai'a* (banana; *Musa acuminata*), *limu* (seaweed),

and *i'a* (fish). Besides the observed contributions to stamina and health, *kalo* was also a revered staple food, believed to have derived from the first-born son of Wakea and Papa.

> . . . the supreme god Kane in the form of Wakea (a form associated with the earth) produced two sequential offspring: the first became kalo (taro) plant, the second became Hāloa, the ancestor of man . . . thus, in kinship terms, the taro is the elder brother and the senior branch of the family tree, mankind belongs to the junior branch, stemming from the younger brother.' [Trask 2012:75]

According to Handy and Handy (1972), Wailuku Valley was included in the largest continuous area of wet taro cultivation in pre-Contact Maui. Old taro terraces often became repurposed in the historic era as cultivation areas for plantations (Handy and Handy 1972). In addition to taro, *'uala*, or sweet potato, was also extensively cultivated by early Hawaiians in Wailuku District.

> On the northeast coast of western Maui it was only the shores and adjacent flatlands below the taro terraces of Waihee and Waiehu that were favorable for the combined enterprises of planting potatoes and fishing. The flat north coasts, eastward from Wailuku, had fishing settlements here and there in ancient times and presumably sweet potato plantations. On the south side of western Maui the flat coastal plain all the way from Kihei and Maalaea to Honokahua, in old Hawaiian times, must have supported many fishing settlements and isolated fishermen's houses, where sweet potatoes were grown in the sandy soil or red *lepo* near the shore. . .
>
> . . . From Waihee to Waikapu there is much good land below and bounding the ancient terrace area on the *kula* and in the lower valleys which would be ideal for sweet potato culture, but it is said that little was grown in this section because there was so much taro. [Sterling 1998:63]

7.3 *Wahi Pana* and Historic Properties

Cultural sites, or Hawaiian *wahi pana* effectively contribute to the ways in which *kama'āina* remember and identify, and thus continue to manifest and perpetuate culture (Basso 1996; Holtorf and Williams 2006). As Cipolla (2008) makes clear,

> . . . people inherit the places that they inhabit (from the past), connections between memory, identity and landscape are usually quite strong. In this sense, space, as configured in the past (which could be the recent past) by either natural or cultural processes, ties reflexively to social relations in the present (see Bourdieu 1977; Lefevbre 1991) and, in turn, to social memories. [Cipolla 2008:199]

These social memories, in turn, work to inform world views and everyday practices. Counted among these practices, and largely subsumed under a "living contemporary culture" (Kawelu 2015:3), is the care or management of natural resources including cultural sites. There exist a myriad of cultural sites or *wahi pana* for Wailuku Ahupua'a of which *heiau*, burial grounds, and natural features were of prominence.

Heiau of Wailuku include the Pihana Heiau complex built in the time of Kakae, *mō'ī* (king) of Maui in the early sixteenth century (Figure 39). Pihana Heiau was located on the west side of 'Īao

Stream crested upon a sand ridge across from the modern-day Wailuku Sugar Co. mill. Features descripted in relation to the Pihana complex include a *luapa'u* (refuse pit), burials, a cave, and adjacent *heiau*. The *wahi pana* of Pihana Heiau is illustrated in Sterling (1998):

> Tradition relates. Kiikewa, the high chief who lived at "the time of Kakae; the king of West Maui, built the Heiau of Pihana-every rebellious high chieftains of Maui were sacrificed at this heiau, but, no alii whose lineage was tainted were sacrificed on its alter; Liliha is the name of the Luapa'u (offal pit). Halekii is the heiau reserved for the females of high rank and is situated on the makai side of the bluff-Kalola is another name. The whole combined in general is Pihana. It is said there is a cave beneath Pihana, and Liliha is the mouth of the cave. Then follows a story of the sacrifice of a chiefess of high rank, Poloahilani- the last at Pihana. [Sterling 1998:75-76]

Pihana Heiau is classified as a *luakini*, or sacrificial heiau, where "human scarifies were performed only on the most important occasions" at this "heiau of the highest class" (Sterling 1998:77). According to Thrum (1908) Pihana Heiau was once used for scarifies by Kamehameha I before defeating Maui forces in the Battle of Kepaniwai, also known as the Battle of 'Īao:

> It is said of Pihana that on Kamehameha's invasion of Maui, in 1790, with an army of warriors which resulted in the defeat of Kalanikupule's forces in the celebrated battle of Pani-wai-o-Iao, the conqueror invoked the blessing of his war god Kukailimoku thereat, and sacrificed upon its altars. [Thrum 1908:46]

The 'Īao Valley, a sacred *wahi pana*, was once a site of royal burials. Pukui et al. (1972) explains that, "infinite caution surrounded the bones of an *ali'i* (member of nobility). High rank brings powerful enemies, and a chief's bones were especially in danger of being profaned" (Pukui et al. 1972:109). Walker (1931) elaborates on the lore and secrecy of royal 'Īao Valley burials saying:

> Iao Valley is reputed by legend as a place of royal sepulturer for many of the ancient kings of Maui and neighboring islands. But the locations of all such burials are kept carefully secret so that even the late King Kalakaua was unable to find any of them in spite of the extensive investigations which were instigated by him. [Walker 1931:296]

Mr. Ampong led CSH to 'Īao Valley where he shared that people mistakenly refer to the stream there as 'Īao Stream whereas the correct name is Wailuku. He explained that a friend had opened and began to re-culitvate a *lo'i* in the *'ili* of Lo'iloa, which is on the opposite side of the stream. However, in 2016 a storm system ripped through the valley. Heavy rain caused the stream to widen, sending boulders and gushing water downstream. A portion of the parking lot was destroyed, and access roads were swept away. Today, the Wailuku Stream looks completely different.

Mr. Ampong also led CSH to Wailuku Heights Park where we could view the entire central isthmus including the project area. Mr. Ampong pointed out that the isthmus is where the Battle of Kakanilua occurred between *ali'i nui* Kahekili of Maui and Kalani'ōpu'u of Hawai'i. Historian Samuel Kamakau places the battle between Waikapū and Wailuku. Thousands of Kalani'ōpu'u's

soldiers were ambushed and killed by Kahekili's men. Mr. Ampong shared that an early missionary survey of this area mentioned thousands of human remains, which were most likely those of Kalani'ōpu'u. Although this area has been under sugar cane production for years and *iwi* (bones) may be destroyed or heavily disturbed, Mr. Ampong believes that any subsurface work could possibly unearth human remains. He recommends an archaeological monitor to be present during construction of the landfill if human remains are found.

Mr. Roy Kalani Oliveira and Mr. Kimokeo both pointed out that the project area is in former sugar planting areas and that any cultural sites (such as *heiau*) were most likely dozed during the plantation era. Mr. Kimokeo has seen push piles in the area and knows of one flume that crosses the landfill to the Kīhei irrigation ditch. The Pu'unene plantation camp was also located just below the landfill. Cane Haul roads are still evident in the area as well.



Figure 39. A lecture at Pihana Heiau in 1957. Photo taken before site restoration (Hawaii State Archives)

Section 8 Summary and Recommendations

CSH undertook this CIA at the request of A-Mehr, Inc., on behalf of the County of Maui. The research broadly covered the entire *ahupua'a* of Wailuku, including the current project area.

8.1 Results of Background Research

Background research for this study yielded the following results, in approximate chronological order:

1. The *ahupua'a* (traditional land division) of Wailuku is located in the larger *moku* (district) of Wailuku on central isthmus of the island of Maui.
2. Names of rain referencing the *ahupua'a* and *moku* of Wailuku include *Hō'eha'ili*, the skin-hurting rain of Waiehu (Akana and Gonzalez 2015:36); *Kili*, a delicate gentle rain associated with Waihe'e (Akana and Gonzalez 2015:81); and *Kili'o'opu* found at Waihe'e, Waiehu, Wailuku, and Waikapū (Akana and Gonzalez 2015:83).
3. Wailuku Ahupua'a was included in the traditional *'okana* (land division) of Na Wai Eha, or "The Four Streams". This area is home to the four largest streams found on the windward coast of Maui.
4. In Pukui and Curtis's *The Water of Kāne* (1994) the naming of Wailuku is recounted in the *mo'olelo* of the battle of the owls. Following a fierce battle between the owls of the Hawaiian Islands and a cruel man, Wailuku earned its name meaning, "Water-of-killing" (Pukui and Curtis 1994:189).
5. The *wahi pana* of 'Īao Valley is the subject of a number of *ka'ao* and *mo'olelo*. One legend tells of a women named Luahinepi'i who came to her end after a false rumor caused her to jump from Kūkaemoku, the 2,250 foot peak also known as the 'Īao Needle.
6. On the north shore of the central isthmus in Wailuku Ahupua'a lie the *loko i'a* (fishponds) named Mau'oni and Kanahā. According to tradition, construction of the pond walls was begun by an O'ahu chief, but finished by Kamehamehanui, king of Maui in the mid-1700's.
7. In ancient times Wailuku, specifically the area around Kahului Bay, was known as a chosen gathering and residential site for Maui *ali'i* (royalty) and chiefs (James 2001). Handy and Handy (1972) add that, "in ancient times [Wailuku District] was the largest continuous area of wet-taro cultivation in the islands" (Handy and Handy 1972:496).
8. The 1790 invasion of Maui by Kamehameha the Great of Hawai'i Island, is referenced by many place names within Wailuku. The Battle of 'Īao is also known as the Battle of Kepaniwai, meaning the "Dammed Stream".
9. An account by the American missionary Rufus Anderson (1864) portrays the obstacle of landing in Wailuku District during the early historic period: "We were bound to Wailuku, situated near the western side of the isthmus connecting West and east Maui. After crossing the channel the wind increased, and so rough was the sea that our landing seemed not quite safe" (Anderson 1864:176).

10. A common crop on nearly all major Hawaiian Islands was sugar cane. Among the early government grants in the upland area of Wailuku Ahupua'a were lands set aside for the Wailuku Sugar Company, a plantation first organized in 1862 by James Robinson & Company, Thomas Cummins, J. Fuller, and agent C. Brewer & Company.
11. Hawaiian Commercial & Sugar Company opened Pu'u Nēnē sugar mill in 1902 (Bartholomew 1994:121). From the time it opened and for a several years after, Pu'u Nēnē was home to the largest sugar mill in the world. At the height of its production, Pu'u Nēnē mill covered a vast 33,000 acres.
12. The early postwar years (1946-1950) saw the increased construction of urban infrastructure in Wailuku, including the Maui Memorial Hospital in Wailuku and the Kahului master-planned community. Areas of Wailuku once occupied by the military returned to cattle ranching, and pineapple and sugar cultivation in post-war years.
13. The current land-use of the corridor connecting Kahului with Wailuku includes a mix of residential, warehousing, light industrial and commercial, with retail sales centered primarily in Kahului. Until December 2016 when HC&S announced its closure, most of the land area of Wailuku Ahupua'a was in sugar cultivation.

8.2 Results of Community Consultation

CSH attempted to contact NHOs, agencies, and community members. Below is a list of individuals who responded about the project area and Wailuku Ahupua'a:

1. Foster Ampong, Wailuku Moku Representative
2. Holly Buland, Operations Administrator, Alexander & Baldwin Sugar Museum
3. Bryan Esmeralda, Planner, DHHL – Maui
4. Hokulani Holt-Padilla, Kumu Hula, Pā'ū of Hi'iaka; Cultural Specialist
5. Leonard Kimokeo Kapahulehua, Founder, Kimokeo Foundation
6. Kea'aumoku Kapu, CEO, Aha Moku o Maui; Koani Foundation
7. Annalise Kehler, Cultural Resource Planner, County of Maui
8. Leslie Kuloloi'a, *Kupunakāne*
9. Ikaika Nakahashi, Cultural Historian, SHPD
10. Sarah Nakihei, Maui Homestead Farmers and Ranchers Association
11. Roy Kalani Oliveira, President, Waiehu Kou Phase 3 Association

8.3 Impacts and Recommendations

Based on information gathered from the cultural and historical background, previous archaeological research, and community consultation, we found there are no potential cultural impacts. However, in the event inadvertent cultural finds, including human remains are found:

1. Community participant, Foster Ampong, pointed out that the Battle of Kakanilua occurred in the isthmus and that an early missionary survey noted thousands of human remains, which were most likely of the fallen warriors. Historian, Samuel Kamakau, specifically places the battle between Waikapu and Wailuku. However, due to years of sugar cane production and development, there is a high probability that *iwi kūpuna* (ancestral bones) have been destroyed or are highly disturbed. Mr. Ampong believes that the central plain was ideal for battles and that an expansion to the landfill or any subsurface work could possibly unearth *iwi kūpuna*. He highly recommends an archaeological monitor during all construction activities occurring at the landfill.
2. CSH notes that in 2016, Scientific Consultant Services conducted an archaeological inventory survey (AIS) for the subject project that included a 100 percent pedestrian inspection and the excavation of 30 test excavations (Andricci and Dega 2017). No historic properties were identified and as such, the study was titled an archaeological assessment. In a 15 March 2018 Chapter 6E-8 historic preservation review letter, the SHPD concurred with a determination of "no historic properties affected" for the project and accepted the archaeological assessment (SHPD Log No. 2018.00184; Doc. No. 1803MBF01; Appendix A). Furthermore, the SHPD indicated it would not review the project's archaeological monitoring plan (Log No. 2017.02461). The SHPD indicates that no archaeological monitoring is required for this project.
3. In an effort to address Mr. Ampong's recommendation, CSH recommends that all personnel involved in project construction be informed of the possibility of inadvertent cultural finds (including funerary objects and *iwi kūpuna*) during a pre-construction meeting. In the event that any potential historic properties are identified during construction activities, all activities will cease and the SHPD will be notified pursuant to HAR §13-280-3. In the event that *iwi kūpuna* are identified, all earth moving activities in the area will stop, the area will be cordoned off, and the SHPD and Police Department will be notified pursuant to HAR §13-300-40. Additionally, project proponents should consult with cultural and lineal descendants of the area to develop a reinterment plan and cultural preservation plan for proper cultural protocol, curation, and long-term maintenance.

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Appendix A SHPD Acceptance Letter

DAVID Y. IGE
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CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

March 15, 2018

IN REPLY REFER TO:
Log No. 2018.00184
Doc. No. 1803MBF01
Archaeology

Stewart Stant
Solid Waste Management & Recycling Division
recycle.maui@mauicounty.gov

Lesli L. Otani, P.E., L.S.
Development Services Administration
Department of Public Works
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Stant and Ms. Otani:

SUBJECT: **Chapter 6E-8 Historic Preservation Review –**
County of Maui Grading & Grubbing Permit G T2018-0006
Archaeological Assessment for the Central Maui Landfill Expansion Project
Wailuku Ahupua'a, Pū'ali Komohana District, Island of Maui
TMK: (2) 3-8-003:019 por.

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject permit application and supporting archaeological survey draft document titled, *Archaeology Assessment for the Central Maui Landfill Expansion Project; Wailuku Ahupua'a, Wailuku District, Maui Island; TMK: (2) 3-8-003:019 por.* (Andricci and Dega, October 2017). The SHPD received the revised report on October 5, 2017 (Log No. 2017.02268), and the permit application on January 30, 2018 (Log No. 2018.00184).

The project area is approximately 40 acres of undeveloped land adjacent to the current existing Central Maui Landfill. The proposed project is expansion of the facility by the County of Maui, Department of Environmental Management, Solid Waste Division. The project area itself has undergone extensive alteration due to sugarcane cultivation. As the results of the archaeological inventory survey (AIS) were negative, the AIS report was submitted to SHPD as an archaeological assessment (AA) report in accordance with HAR §13-275-5(b)(5)(A).

Due to negative findings, the project effect determination is **no historic properties affected**, pursuant to HAR §13-275-7(a)(1). The unsolicited archaeological monitoring plan (AMP) submitted for the subject project (Log No. 2017.02461), it will not be reviewed.

Pursuant to HAR§ 13-275-7(e), when SHPD agrees that the project will not affect any significant historic properties, **this is SHPD's written concurrence and the** historic preservation review process ends. **The historic preservation review process for the subject project has ended**. No archaeological monitoring is required.

The revised draft AA meets the minimum requirements, pursuant to HAR §13-276-5. **It is accepted.** Please send two hardcopies of the document, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office, attention SHPD Library.

Mr. Stant
March 15, 2018
Page 2

You may contact Dr. Matthew Barker Fariss at matthew.b.fariss@hawaii.gov, or by phone at (808) 243-4626, for any questions regarding this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Michael Dega
Scientific Consultant Services
mike@scshawaii.com

APPENDIX G-1

ADDITIONAL CULTURAL INTERVIEWS

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT,
CENTRAL MAUI LANDFILL FACILITIES PROJECT
Cultural Interview Summary

Interview with: *Henry Nakamura*

Interviewed By: *Colleen Suyama, Senior Associate*
Munekiyo Hiraga

Interview Date: *May 9, 2016*

Mr. Henry Nakamura was born on December 30, 1928 at the Puʻunēnē Hospital that was once located between Hansen Road and Pūlehu Road in Hospital Camp. Hospital Camp was near the intersection of Hansen Road and Hāna Highway and was occupied by Japanese families who worked for Hawaiian Commercial & Sugar Company (HC&S). His parents were Taisuke and Yoshiko (maiden name Shimada) Nakamura. His father was born in Haʻiku, Maui and worked for HC&S, while his mother was born in McGerrow Camp, Puʻunēnē, Maui. Mr. Nakamura has a sister Lillian Sodetani and a brother, Paul Nakamura. Mr. Nakamura is married to the former Jeanette Midori Ito and has a daughter.

Mr. Nakamura worked for HC&S from 1949 until he retired in 1993. He started as a grass cutter and was promoted into several jobs with HC&S. When Mr. Nakamura retired, he was working with the HC&S Budget Office. One of the positions that Mr. Nakamura held during his employment was as a water meter reader. Mr. Nakamura's responsibilities included reading the meters, cleaning the meters and replacing the paper used to record the amount of water passing through the meter. The water was supplied by the plantation and part of his job was to read the residential water meters of the plantation workers' homes in the various camps.

Mr. Nakamura remembers Pūlehu Camp was located along Pūlehu Road near the junction of Pūlehu Road and Omaopio Road. Pūlehu Camp was a mixed nationality camp mostly of Filipinos, as well as Japanese and Portuguese who worked in the nearby sugar cane fields. Mr. Nakamura remembers Pūlehu Camp had a manju shop run by the Shishido family and a Filipino store. The Camp remained in existence until the 1980's. Also, the cane haul road above the Central Maui Landfill connected the Paiʻa Mill to the Puʻunēnē Mill.

The Ameron Hawaii quarry adjacent to the Central Maui Landfill started as a cement processing plant by Honolulu Concrete & Dredging Co. (HC&D) who made the concrete flumes for HC&S. Access to the site is from Quarry Road off of Haleakalā Highway.

Mr. Nakamura is familiar with the area around the Central Maui Landfill from his experience living in McGerrow Camp and working for HC&S. Mr. Nakamura noted the A&B Sugar Museum as a good source of information on the area, especially the former

camp sites and former residents. Mr. Nakamura did not voice any concerns with regards to the proposed Central Maui Landfill facilities project, nor was he aware of any cultural activities or sites within or in the immediate vicinity of the project area.

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT,
CENTRAL MAUI LANDFILL FACILITIES PROJECT
Cultural Interview Summary

Interview with: *Lydia Agaran Coloma*

Interviewed By: *Colleen Suyama, Senior Associate*
Munekiyo Hiraga

Interview Date: *June 27, 2016*

Mrs. Lydia Agaran Coloma was born in the Phillipines in Ilocos Norte province. She has lived on Maui for 54 years. She married Manuel C. Coloma, one of the sakadas who came to work in the sugar cane fields in 1946. Mr. Coloma worked in the fields for Hawaiian Commercial and Sugar Company (HC&S) in their irrigation department. They had two (2) children, Gilbert Keith-Agaran and Velma Coloma. Her son is an attorney and State of Hawai'i Senator.

In addition to being a house wife, Mrs. Coloma worked at the Maui Land & Pineapple Company cannery. She also was a night dishwasher working until 11:00 p.m. at the former Maunaolu College, worked on Saturday and Sundays at the Kula Flower Farm owned by Mr. and Mrs. Fukuyama, and worked part time at the airport for the Hawaii Protective Association Ltd.

Mrs. Coloma belongs to several Filipino organizations. She belongs to the United Sons and Daughters Ilocos Region Maui, United Vintarianian of Hawaii, ILWU Local 142 Pensioner Club, Wailuku Filipino Senior Club, Kahului Filipino Senior Club, Kaisahan Club of Hawaii, and Santo Nineo of Hawaii.

Mrs. Coloma lived in Orpheum Camp near the former Paia Mill, which was surrounded by sugar cane fields. Orpheum Camp was mainly home to married Filipino men and their families. The plantation homes were small and did not have any bathrooms in the house. Her family used an outhouse, which was typical of homes in Orpheum Camp. Today there are no remnants of the former camp.

In 1965 the family moved to the Kobayashi Subdivision in Paia Town near the former Kobayashi service station. She remembers Paia Town contained several stores along Baldwin Avenue where the plantation families in the area would shop, such as the former Paia Mercantile Store.

Later on December 27, 1972, the family moved to Kahului. Mrs. Coloma currently lives on Lehua Street in Kahului near Maui High School.

Mrs. Coloma remembers her husband would be picked up each day with other workers and trucked to the various fields to work on the irrigation ditches. Later he was assigned

to fields in Paia and given a truck to get to the fields. Along the reservoirs and ditches workers would grow vegetables to feed their families, such as round and long squashes, eggplant, pumpkin, and bittermelon.

Although Mrs. Coloma rarely got sick or needed medical attention, she remembers the Puunene Hospital and plantation doctors. She remembers Doctors Underwood and Wong who both worked at Puunene Hospital. Although her son was born at Maui Memorial Medical Center (formerly known as Maui Memorial Hospital) she remembers when she was pregnant she would visit her doctor at Puunene Hospital.

Mrs. Coloma remembers life in the plantation camps and is unaware of any cultural sites or customary practices in the area. She has no strong feelings for the area.

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT,
CENTRAL MAUI LANDFILL FACILITIES PROJECT
Cultural Interview Summary

Interview with: Leigh Fukutomi

Interviewed by: Colleen Suyama, Senior Associate
Munekiyo Hiraga

Interview Date: April 11, 2018

Mr. Leigh Fukutomi was born 70 years ago in Wailuku to Nick and Shizuko Fukutomi. He has a brother Roy and sister Susan Mihata. He has a son Darryl and two (2) daughters Courtney and Kara. Except for approximately 10 years living in Los Angeles, he has lived on Maui. He worked for Hawaiian Commercial & Sugar Company (HC&S) for approximately 37 years. He started first as a draftsman mapping the cane fields for HC&S. He held several positions with HC&S including field supervisor for irrigation. He retired as the farm manager for irrigation responsible for the Paia area including the fields near the Central Maui Landfill.

He remembers that the gulch that passes through the landfill area connected to the nearby Haiku Ditch and during heavy rains the usually dry gulch would have a lot of water running through it. At the Haiku Ditch there was a spillway that overflowed the ditch and allowed the water to continue down the gulch and overflow into the HC&S fields. The lands around the landfill were made of grayish sand and gravel, which was good for water to seep into the ground. He was also aware that the gulch eventually emptied into the ocean near the Kahului Airport.

Also, at the Haiku Ditch there was a small pump that used to pump about 1.0 million gallons of water to the quarry site for fire protection. He is unaware whether the pump is still being used to supply water to the quarry.

Mr. Fukutomi remembers that at the quarry they used to blast "blue rocks". They had a cement block storage building with a steel door where they kept the dynamite used for blasting. He is unaware if HC&D continues to blast and if the dynamite storage building is still being used. When he worked for HC&S he would notify the quarry when his workers were in the area. His workers would get off at 3:00 p.m. and he would make sure they were out of the area by 3:30 p.m. so the quarry could blast at 4:00 p.m.

Further, east of the landfill along Pulehu Road near the Maui Electric Company's future Waena site there is a cistern used by HC&S to store water adjacent to the road with a ditch adjacent to the cistern that transported irrigation water from Lowrie Ditch to the fields across Pulehu Road and the landfill.

Mr. Fukutomi was unaware of any cultural practices or traditional access in the area based on his prior knowledge and experience in working previously for the plantation. He did not voice any concerns regarding the landfill or the proposed Central Maui Landfill Facilities Project. He noted though in closing that he was glad that the County recently outlawed the use of plastic bags as the bags used to blow all over the landfill and get caught on the surrounding fencing and in the gulch.

APPENDIX H

BASELINE SOIL SAMPLING REPORT

element environmental llc
environmental · engineering · water resources

Report

Central Maui Landfill TDSR Baseline Soil Sampling

Prepared For:

County of Maui
Solid Waste Division
One Main Plaza
2200 Main St. 225
Wailuku, HI 96793

Prepared By:

Element Environmental, LLC
98-030 Hekaha St., Unit 9
Aiea, HI 96701

Purchase Order Number: 346654
Element Project Number: 160079

November 22, 2016

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APPENDICES

Appendix A Field Notes
Appendix B Analytical Data Summary Table
Appendix C Laboratory Analytical Reports

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1.0 INTRODUCTION

Element Environmental, LLC (E2) conducted a baseline round of surface soil sampling at the temporary debris staging and reduction (TDSR) parcel located adjacent to the north-northwest (downslope) of the Central Maui Landfill. This soil sampling was conducted as directed by the County of Maui in order to comply with the guidelines presented in the County of Maui *Disaster Debris Action Plan*, February 2009 for TDSR site setup and closeout. Sampling effort consisted of collection of Multi-Increment (MI) samples of surface soil from decision units (DUs) established at the TDSR site and analysis for contaminants specified by the *Disaster Debris Action Plan*.

This sampling event was conducted on October 24, 2016.

2.0 PROJECT OBJECTIVE

This soil sampling event was conducted in order to determine baseline conditions at the TDSR site. Upon closure of the TDSR site, another round of soil sampling will be conducted for comparison to the baseline data in order to determine TDSR activities' potential impact at the site.

3.0 COMPLETED SCOPE OF WORK

E2 collected a total of six MI surface soil samples during this sampling event. Samples were collected from areas to be used for TDSR activities and DUs were approved by County of Maui personnel prior to collection. Samples were collected from undisturbed areas in the proposed TDSR site (not from roadways or existing stockpiled cane grass/sod). Figure 1 shows the locations of the DUs.

3.1 Sample Collection Methodology and Laboratory Analyses

Each MI soil sample consisted of 30 randomly located soil aliquots collected with stainless steel trowels from each DU. Each MI sample was placed in a separate sealable plastic bag, labeled and stored in a cooler with ice until delivery to the analytical laboratory, TestAmerica Seattle located in Tacoma Washington via Federal Express (Fedex). Upon receipt the laboratory tested the soil samples on a standard turn-around time for:

- Total petroleum hydrocarbons (TPH) - diesel range organics (DRO) via EPA method 8015B;
- TPH - residual range organics (RRO) via EPA method 8015B; and
- Total Resource Conservation and Recovery Act (RCRA) - 8 metals via EPA method 6010/7471A.

Field notes are included in Appendix A.

Laboratory analysis was completed on a standard turn-around time. E2 received the analytical results on Tuesday, November 12, 2016.

3.3 Laboratory Analytical Results

Analytical results from the laboratory did not indicate any significant concentrations of contaminants in the samples submitted. Please see the analytical data summary table attached

as Appendix B for further detail on the sample results. The full analytical data report, including quality assurance/quality control results is included as Appendix C.

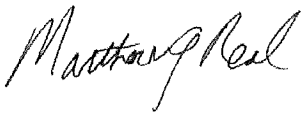
Figure 1: Central Maui Landfill, TDSR Baseline Soil Sampling, October 2016



4.0 SIGNATURES

The data presented in this report reflects the results of a limited sampling event conducted by E2 in accordance with currently acceptable industry standards. This report is based on a specific scope of work requested by the client and only those tasks specifically prescribed in that scope of work, as outlined in this report, were performed.

This report was prepared by Element Environmental, LLC.



Date: November 22, 2016

Matthew Neal
Senior Environmental Scientist

Appendix A
Field Notes

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Central Maui
Landfill
10/16
TDSR

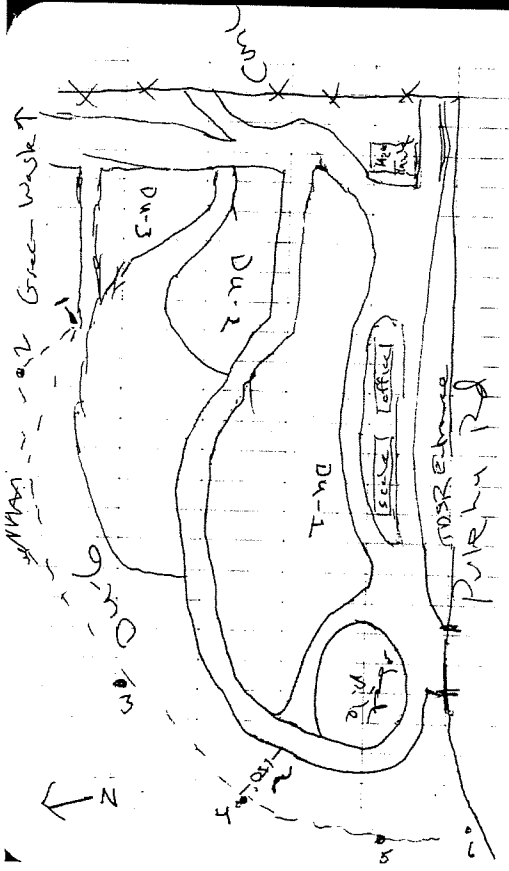
10/24/16

0820 - MN arrives @ CML-
TDSR site - prep
for MI surface
soil sampling.

0900 - Elaine Baker Arrives
on-site - do a site
drive around to
go over DU locations
- Basically - DU's will
be located between
roadways / gravel
areas.

0910 - Begin collection of
MI sample from DU-1
(30 aliquots)

0935 - Complete sample MI-CML1
Elaine Baker leaves site
proceed to continue soil
sampling (see sample log)



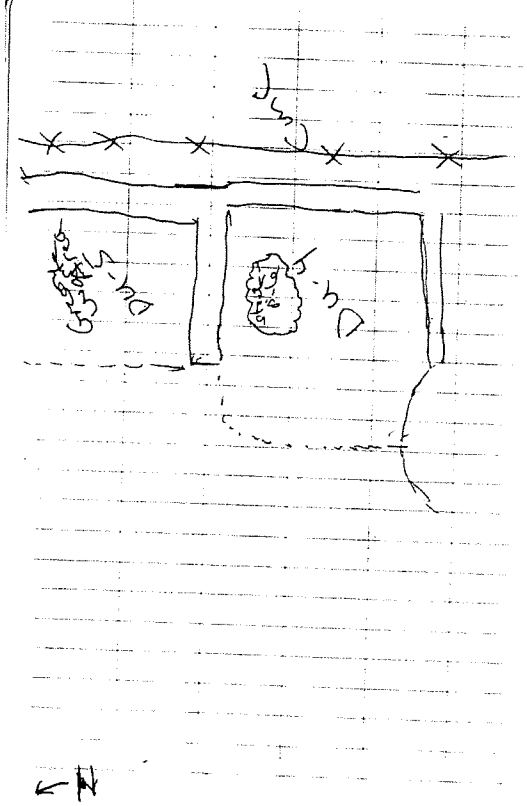
10/24/16

S.I Sample Log

	Time	Amount	DU
CML1	0910	30	DU-1
CML2	0945	30	DU-2
CML3	1000	30	DU-3
CML4	1025	30	DU-4
CML5	1055	30	DU-5
CML6	1115	30	DU-6

GPS Log

Pt #	LAT	LONG
1	20.8611.7°	-156.42383°
2	20.8615.4°	-156.42369°
3	20.861.46°	-156-4246.8°
4	20.861.21°	-156-4254°
5	20.8610.4°	-156-4266°
6	20.8607°	-156-4266.



10/24/16

1125 - GPS Boundary of DU-6 (perimeter boundary)

1155 - Complete GPS readings + soil coupling leave site. Samples stored in cooler w/ice (gel). Samples will be submitted to TAH-[illegible] for
- Total RCRA metals
- TPH-oil
- TPH-diesel

standard TAT

1225 - Leave site

10-24-16

Appendix B
Analytical Data Summary Table

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Analytical Data Results Table - Central Maui Landfill TDSR, October 2016

E2 Project Sample ID:	Regulatory Limits Final Industrial/ Commercial Land Use EAL	MI-CML1		MI-CML2		MI-CML3		MI-CML4		MI-CML5		MI-CML6	
Laboratory ID:		580-63680-1		580-63680-2		580-63680-3		580-63680-4		580-63680-5		580-63680-6	
Date Collected:		10/24/2016		10/24/2016		10/24/2016		10/24/2016		10/24/2016		10/24/2016	
Analyte		Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
Total Petroleum Hydrocarbons (mg/kg)													
TPH-DRO	**500**	8.3	J	6.2	J	10		24		17.9		8.8	J
TPH-RRO	**2,500**	71		45		38		43		59		46	
Total Metals (SW-846 6010B/7470A (mg/kg)													
Arsenic (As)	**2,500**	1.9	J F1	2.9	J	3.6	J	3.3	J	4.4	J	3.3	J
Barium (Ba)	**2,500**	240		220		250		230		190		250	
Cadmium (Cd)	**2,500**	1.6	J	2.4		3		2.6		2.6		2.5	
Chromium, Total (Cr)	**2,500**	30		39		46		37		39		49	
Lead (Pb)	**2,500**	11	B	9.1	B	9.2	B	8.4	B	9.5	B	9.8	B
Selenium (Se)	**2,500**	2.9	J F1	4.3	J	4.1	J	3.1	J	4.2	J	3.9	J
Silver (Ag)	**2,500**	1.2	J	1.8	J	1.7	J	1.3	J	1.8	J	1.9	J
Mercury (Hg)	**1000**	0.025		0.04		0.037		0.04		0.037		0.039	

State of Hawaii Department of Health Environmental Action Levels, 2016 Update

Red font indicates an exceedance of the regulatory limits.

J Result is less than RL but greater than or equal to the MDL and the concentration is an approximate value.

F1 MS and/or MSD recovery is outside acceptance limits

B Compound was found in the blank and the sample

Appendix C
Laboratory Analytical Reports

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TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

TestAmerica Job ID: 580-63680-1
Client Project/Site: Central Maui landfill TDSR Sampling

For:
Element Environmental, LLC
98-030 Hekaha Street, Unit 9
Aiea, Hawaii 96701

Attn: Matt Neal

Authorized for release by:
11/9/2016 12:56:26 PM

David Alltucker, Project Manager I
(916)374-4383
david.alltucker@testamericainc.com

Links

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: Element Environmental, LLC
Project/Site: Central Maui landfill TDSR Sampling

TestAmerica Job ID: 580-63680-1

Job ID: 580-63680-1

Laboratory: TestAmerica Seattle

Narrative

Job Narrative
580-63680-1

Receipt
The samples were received on 10/26/2016 10:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 1.7° C.

Samples were processed for ISM prior to extraction. Methods 7471 and 8015 (DRO only) were processed prior to drying.

GC Semi VOA
Method(s) 8015B: Surrogate o-Terphenyl recovery for the following sample was outside control limits: MI-CML6 (580-63680-6). Evidence of matrix interference is present; therefore, re-extraction or re-analysis was not performed.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Metals
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Definitions/Glossary

Client: Element Environmental, LLC
Project/Site: Central Maui landfill TDSR Sampling

TestAmerica Job ID: 580-63680-1

Qualifiers

GC Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
X	Surrogate is outside control limits

Metals

Qualifier	Qualifier Description
F1	MS and/or MSD Recovery is outside acceptance limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
B	Compound was found in the blank and sample.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client Sample Results

Client: Element Environmental, LLC
Project/Site: Central Maui landfill TDSR Sampling

TestAmerica Job ID: 580-63680-1

Client Sample ID: MI-CML1
Date Collected: 10/24/16 09:15
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-1
Matrix: Solid

5

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HI Residual Range Organics (>C24-C32)	71		16	4.6	mg/Kg		11/04/16 12:12	11/07/16 13:35	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*69*		*37 - 127*	*11/04/16 12:12*	*11/07/16 13:35*	*1*

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	1.9	J F1	5.8	0.62	mg/Kg		11/05/16 16:02	11/08/16 18:30	4
Barium	240		0.97	0.087	mg/Kg		11/05/16 16:02	11/08/16 18:30	4
Cadmium	1.6	J	1.9	0.095	mg/Kg		11/05/16 16:02	11/08/16 18:30	4
Chromium	30		2.5	0.36	mg/Kg		11/05/16 16:02	11/08/16 18:30	4
Lead	11	B	2.9	0.19	mg/Kg		11/05/16 16:02	11/08/16 18:30	4
Selenium	2.9	J F1	9.7	0.39	mg/Kg		11/05/16 16:02	11/08/16 18:30	4
Silver	1.2	J	4.9	1.1	mg/Kg		11/05/16 16:02	11/08/16 18:30	4

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	88.3		0.1	0.1	%			11/01/16 11:48	1
Percent Moisture	11.7		0.1	0.1	%			11/01/16 11:48	1

Client Sample ID: MI-CML1
Date Collected: 10/24/16 09:15
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-1
Matrix: Solid
Percent Solids: 88.3

5

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HI Diesel Range Organics (>C12-C24)	8.3	J	9.2	4.6	mg/Kg	☼	11/04/16 12:12	11/07/16 21:10	1
HI Residual Range Organics (>C24-C32)	31		18	5.2	mg/Kg	☼	11/04/16 12:12	11/07/16 21:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*49*		*37 - 127*	*11/04/16 12:12*	*11/07/16 21:10*	*1*

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.025		0.013	0.0040	mg/Kg	☼	11/07/16 18:12	11/08/16 06:19	1

Client Sample ID: MI-CML2
Date Collected: 10/24/16 09:45
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-2
Matrix: Solid

5

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HI Residual Range Organics (>C24-C32)	45		16	4.6	mg/Kg		11/04/16 12:12	11/07/16 19:08	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*62*		*37 - 127*	*11/04/16 12:12*	*11/07/16 19:08*	*1*

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	2.9	J	5.8	0.62	mg/Kg		11/05/16 16:02	11/08/16 18:52	4
Barium	220		0.97	0.087	mg/Kg		11/05/16 16:02	11/08/16 18:52	4
Cadmium	2.4		1.9	0.095	mg/Kg		11/05/16 16:02	11/08/16 18:52	4
Chromium	39		2.5	0.36	mg/Kg		11/05/16 16:02	11/08/16 18:52	4
Lead	9.1	B	2.9	0.19	mg/Kg		11/05/16 16:02	11/08/16 18:52	4
Selenium	4.3	J	9.7	0.39	mg/Kg		11/05/16 16:02	11/08/16 18:52	4
Silver	1.8	J	4.9	1.1	mg/Kg		11/05/16 16:02	11/08/16 18:52	4

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	87.9		0.1	0.1	%			11/01/16 11:48	1
Percent Moisture	12.1		0.1	0.1	%			11/01/16 11:48	1

Client Sample ID: MI-CML2
Date Collected: 10/24/16 09:45
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-2
Matrix: Solid
Percent Solids: 87.9

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HI Diesel Range Organics (>C12-C24)	6.2	J	9.4	4.7	mg/Kg	☼	11/04/16 12:12	11/07/16 21:30	1
HI Residual Range Organics (>C24-C32)	20		19	5.3	mg/Kg	☼	11/04/16 12:12	11/07/16 21:30	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*43*		*37 - 127*	*11/04/16 12:12*	*11/07/16 21:30*	*1*

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.040		0.014	0.0041	mg/Kg	☼	11/07/16 18:12	11/08/16 06:26	1

Client Sample ID: MI-CML3
Date Collected: 10/24/16 10:00
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-3
Matrix: Solid

5

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HI Residual Range Organics (>C24-C32)	38		16	4.6	mg/Kg		11/04/16 12:12	11/07/16 19:28	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*59*		*37 - 127*	*11/04/16 12:12*	*11/07/16 19:28*	*1*

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	3.6	J	5.9	0.63	mg/Kg		11/05/16 16:02	11/08/16 18:56	4
Barium	250		0.99	0.089	mg/Kg		11/05/16 16:02	11/08/16 18:56	4
Cadmium	3.0		2.0	0.097	mg/Kg		11/05/16 16:02	11/08/16 18:56	4
Chromium	46		2.6	0.36	mg/Kg		11/05/16 16:02	11/08/16 18:56	4
Lead	9.2	B	3.0	0.19	mg/Kg		11/05/16 16:02	11/08/16 18:56	4
Selenium	4.1	J	9.9	0.39	mg/Kg		11/05/16 16:02	11/08/16 18:56	4
Silver	1.7	J	4.9	1.1	mg/Kg		11/05/16 16:02	11/08/16 18:56	4

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	87.5		0.1	0.1	%			11/01/16 11:48	1
Percent Moisture	12.5		0.1	0.1	%			11/01/16 11:48	1

Client Sample ID: MI-CML3
Date Collected: 10/24/16 10:00
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-3
Matrix: Solid
Percent Solids: 87.5

5

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HI Diesel Range Organics (>C12-C24)	10		9.3	4.6	mg/Kg	☼	11/04/16 12:12	11/07/16 21:51	1
HI Residual Range Organics (>C24-C32)	22		19	5.2	mg/Kg	☼	11/04/16 12:12	11/07/16 21:51	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*43*		*37 - 127*	*11/04/16 12:12*	*11/07/16 21:51*	*1*

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.037		0.013	0.0040	mg/Kg	☼	11/07/16 18:12	11/08/16 06:29	1

Client Sample ID: MI-CML4
Date Collected: 10/24/16 10:25
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-4
Matrix: Solid

5

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HI Residual Range Organics (>C24-C32)	43		16	4.5	mg/Kg		11/04/16 12:12	11/07/16 20:09	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*72*		*37 - 127*	*11/04/16 12:12*	*11/07/16 20:09*	*1*

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	3.3	J	5.8	0.62	mg/Kg		11/05/16 16:02	11/08/16 19:00	4
Barium	230		0.97	0.088	mg/Kg		11/05/16 16:02	11/08/16 19:00	4
Cadmium	2.6		1.9	0.095	mg/Kg		11/05/16 16:02	11/08/16 19:00	4
Chromium	37		2.5	0.36	mg/Kg		11/05/16 16:02	11/08/16 19:00	4
Lead	8.4	B	2.9	0.19	mg/Kg		11/05/16 16:02	11/08/16 19:00	4
Selenium	3.1	J	9.7	0.39	mg/Kg		11/05/16 16:02	11/08/16 19:00	4
Silver	1.3	J	4.9	1.1	mg/Kg		11/05/16 16:02	11/08/16 19:00	4

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	86.2		0.1	0.1	%			11/01/16 11:48	1
Percent Moisture	13.8		0.1	0.1	%			11/01/16 11:48	1

Client Sample ID: MI-CML4
Date Collected: 10/24/16 10:25
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-4
Matrix: Solid
Percent Solids: 86.2

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HI Diesel Range Organics (>C12-C24)	24		9.6	4.8	mg/Kg	☼	11/04/16 12:12	11/07/16 22:11	1
HI Residual Range Organics (>C24-C32)	26		19	5.4	mg/Kg	☼	11/04/16 12:12	11/07/16 22:11	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*37*		*37 - 127*	*11/04/16 12:12*	*11/07/16 22:11*	*1*

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.040		0.014	0.0041	mg/Kg	☼	11/07/16 18:12	11/08/16 06:31	1

Client Sample Results

Client: Element Environmental, LLC
Project/Site: Central Maui landfill TDSR Sampling

TestAmerica Job ID: 580-63680-1

Client Sample ID: MI-CML5
Date Collected: 10/24/16 10:55
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-5
Matrix: Solid

5

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HI Residual Range Organics (>C24-C32)	59		16	4.6	mg/Kg		11/04/16 12:12	11/07/16 20:29	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*74*		*37 - 127*	*11/04/16 12:12*	*11/07/16 20:29*	*1*

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	4.4	J	5.8	0.62	mg/Kg		11/05/16 16:02	11/08/16 19:03	4
Barium	190		0.97	0.088	mg/Kg		11/05/16 16:02	11/08/16 19:03	4
Cadmium	2.6		1.9	0.095	mg/Kg		11/05/16 16:02	11/08/16 19:03	4
Chromium	39		2.5	0.36	mg/Kg		11/05/16 16:02	11/08/16 19:03	4
Lead	9.5	B	2.9	0.19	mg/Kg		11/05/16 16:02	11/08/16 19:03	4
Selenium	4.2	J	9.7	0.39	mg/Kg		11/05/16 16:02	11/08/16 19:03	4
Silver	1.8	J	4.9	1.1	mg/Kg		11/05/16 16:02	11/08/16 19:03	4

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	85.9		0.1	0.1	%			11/01/16 11:48	1
Percent Moisture	14.1		0.1	0.1	%			11/01/16 11:48	1

Client: Element Environmental, LLC
Project/Site: Central Maui landfill TDSR Sampling

TestAmerica Job ID: 580-63680-1

Client Sample ID: MI-CML5
Date Collected: 10/24/16 10:55
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-5
Matrix: Solid
Percent Solids: 85.9

5

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HI Diesel Range Organics (>C12-C24)	11		9.0	4.5	mg/Kg	☼	11/04/16 12:12	11/07/16 22:31	1
HI Residual Range Organics (>C24-C32)	16	J	18	5.1	mg/Kg	☼	11/04/16 12:12	11/07/16 22:31	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*40*		*37 - 127*	*11/04/16 12:12*	*11/07/16 22:31*	*1*

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.037		0.013	0.0040	mg/Kg	☼	11/07/16 18:12	11/08/16 06:33	1

Client Sample ID: MI-CML6

Date Collected: 10/24/16 11:15
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-6

Matrix: Solid

5

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HI Residual Range Organics (>C24-C32)	46		16	4.5	mg/Kg		11/04/16 12:12	11/07/16 20:50	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*70*		*37 - 127*	*11/04/16 12:12*	*11/07/16 20:50*	*1*

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	3.3	J	5.8	0.62	mg/Kg		11/05/16 16:02	11/08/16 19:07	4
Barium	250		0.96	0.086	mg/Kg		11/05/16 16:02	11/08/16 19:07	4
Cadmium	2.5		1.9	0.094	mg/Kg		11/05/16 16:02	11/08/16 19:07	4
Chromium	49		2.5	0.35	mg/Kg		11/05/16 16:02	11/08/16 19:07	4
Lead	9.8	B	2.9	0.18	mg/Kg		11/05/16 16:02	11/08/16 19:07	4
Selenium	3.9	J	9.6	0.38	mg/Kg		11/05/16 16:02	11/08/16 19:07	4
Silver	1.9	J	4.8	1.1	mg/Kg		11/05/16 16:02	11/08/16 19:07	4

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	87.1		0.1	0.1	%			11/01/16 11:48	1
Percent Moisture	12.9		0.1	0.1	%			11/01/16 11:48	1

Client: Element Environmental, LLC
Project/Site: Central Maui landfill TDSR Sampling

TestAmerica Job ID: 580-63680-1

Client Sample ID: MI-CML6
Date Collected: 10/24/16 11:15
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-6
Matrix: Solid
Percent Solids: 87.1

5

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HI Diesel Range Organics (>C12-C24)	8.8	J	9.0	4.5	mg/Kg	☼	11/04/16 12:12	11/07/16 22:51	1
HI Residual Range Organics (>C24-C32)	9.0	J	18	5.1	mg/Kg	☼	11/04/16 12:12	11/07/16 22:51	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*36*	*X*	*37 - 127*	*11/04/16 12:12*	*11/07/16 22:51*	*1*

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.039		0.013	0.0040	mg/Kg	☼	11/07/16 18:12	11/08/16 06:40	1

Method: 8015B - Diesel Range Organics (DRO) (GC)

Lab Sample ID: MB 580-231604/1-A
Matrix: Solid
Analysis Batch: 231755

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 231604

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HI Diesel Range Organics (>C12-C24)	ND		8.3	4.1	mg/Kg		11/04/16 12:12	11/07/16 12:34	1
HI Residual Range Organics (>C24-C32)	ND		17	4.7	mg/Kg		11/04/16 12:12	11/07/16 12:34	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*85*		*37 - 127*	*11/04/16 12:12*	*11/07/16 12:34*	*1*

Lab Sample ID: LCS 580-231604/2-A
Matrix: Solid
Analysis Batch: 231755

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 231604

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
HI Diesel Range Organics (>C12-C24)	168	161		mg/Kg		96	62 - 118
HI Residual Range Organics (>C24-C32)	168	187		mg/Kg		112	77 - 144

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*98*		*37 - 127*

Lab Sample ID: LCSD 580-231604/3-A
Matrix: Solid
Analysis Batch: 231755

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 231604

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
HI Diesel Range Organics (>C12-C24)	168	150		mg/Kg		89	62 - 118	7	16
HI Residual Range Organics (>C24-C32)	168	176		mg/Kg		105	77 - 144	6	16

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
o-Terphenyl	*94*		*37 - 127*

Lab Sample ID: 580-63680-1 MS
Matrix: Solid
Analysis Batch: 231755

Client Sample ID: MI-CML1
Prep Type: Total/NA
Prep Batch: 231604

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
HI Diesel Range Organics (>C12-C24)	8.3	J	164	133		mg/Kg		76	62 - 118
HI Residual Range Organics (>C24-C32)	31		164	190		mg/Kg		97	77 - 144

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
o-Terphenyl	*77*		*37 - 127*

Method: 8015B - Diesel Range Organics (DRO) (GC) (Continued)

Lab Sample ID: 580-63680-1 MSD
Matrix: Solid
Analysis Batch: 231755

Client Sample ID: MI-CML1
Prep Type: Total/NA
Prep Batch: 231604

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
HI Diesel Range Organics (>C12-C24)	8.3	J	165	146		mg/Kg		84	62 - 118	10	16
HI Residual Range Organics (>C24-C32)	31		165	214		mg/Kg		111	77 - 144	12	16

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
o-Terphenyl	*82*		*37 - 127*

Method: 6010C - Metals (ICP)

Lab Sample ID: MB 580-231701/9-A
Matrix: Solid
Analysis Batch: 231916

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 231701

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		3.0	0.32	mg/Kg		11/05/16 16:02	11/08/16 18:21	1
Barium	ND		0.50	0.045	mg/Kg		11/05/16 16:02	11/08/16 18:21	1
Cadmium	ND		1.0	0.049	mg/Kg		11/05/16 16:02	11/08/16 18:21	1
Chromium	ND		1.3	0.18	mg/Kg		11/05/16 16:02	11/08/16 18:21	1
Lead	0.105	J	1.5	0.096	mg/Kg		11/05/16 16:02	11/08/16 18:21	1
Selenium	ND		5.0	0.20	mg/Kg		11/05/16 16:02	11/08/16 18:21	1
Silver	ND		2.5	0.56	mg/Kg		11/05/16 16:02	11/08/16 18:21	1

Lab Sample ID: LCS 580-231701/10-A
Matrix: Solid
Analysis Batch: 231916

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 231701

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	200	198		mg/Kg		99	80 - 120
Barium	200	216		mg/Kg		108	80 - 120
Cadmium	5.00	4.96		mg/Kg		99	80 - 120
Chromium	20.0	18.9		mg/Kg		94	80 - 120
Lead	50.0	50.4		mg/Kg		101	80 - 120
Selenium	200	198		mg/Kg		99	80 - 120
Silver	30.0	27.9		mg/Kg		93	80 - 120

Lab Sample ID: LCSD 580-231701/11-A
Matrix: Solid
Analysis Batch: 231916

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 231701

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	200	200		mg/Kg		100	80 - 120	1	20
Barium	200	218		mg/Kg		109	80 - 120	1	20
Cadmium	5.00	5.01		mg/Kg		100	80 - 120	1	20
Chromium	20.0	19.1		mg/Kg		95	80 - 120	1	20
Lead	50.0	50.6		mg/Kg		101	80 - 120	0	20
Selenium	200	200		mg/Kg		100	80 - 120	1	20
Silver	30.0	28.1		mg/Kg		94	80 - 120	1	20

Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: 580-63680-1 MS
Matrix: Solid
Analysis Batch: 231916

Client Sample ID: MI-CML1
Prep Type: Total/NA
Prep Batch: 231701

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	1.9	J F1	97.2	72.8	F1	mg/Kg		73	80 - 120
Barium	240		97.2	356		mg/Kg		114	80 - 120
Cadmium	1.6	J	2.43	3.90		mg/Kg		94	80 - 120
Chromium	30		9.72	38.7		mg/Kg		92	80 - 120
Lead	11	B	24.3	34.4		mg/Kg		95	80 - 120
Selenium	2.9	J F1	97.2	59.9	F1	mg/Kg		59	80 - 120
Silver	1.2	J	14.6	14.5		mg/Kg		92	80 - 120

Lab Sample ID: 580-63680-1 MSD
Matrix: Solid
Analysis Batch: 231916

Client Sample ID: MI-CML1
Prep Type: Total/NA
Prep Batch: 231701

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	1.9	J F1	97.6	73.3	F1	mg/Kg		73	80 - 120	1	20
Barium	240		97.6	350		mg/Kg		108	80 - 120	2	20
Cadmium	1.6	J	2.44	3.98		mg/Kg		98	80 - 120	2	20
Chromium	30		9.76	38.8		mg/Kg		93	80 - 120	0	20
Lead	11	B	24.4	34.5		mg/Kg		96	80 - 120	0	20
Selenium	2.9	J F1	97.6	57.8	F1	mg/Kg		56	80 - 120	4	20
Silver	1.2	J	14.6	14.4		mg/Kg		90	80 - 120	1	20

Method: 7471A - Mercury (CVAA)

Lab Sample ID: MB 580-231807/9-A
Matrix: Solid
Analysis Batch: 231825

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 231807

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.012	0.0036	mg/Kg		11/07/16 18:12	11/08/16 06:13	1

Lab Sample ID: LCS 580-231807/10-A
Matrix: Solid
Analysis Batch: 231825

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 231807

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.100	0.0937		mg/Kg		94	80 - 120

Lab Sample ID: LCSD 580-231807/11-A
Matrix: Solid
Analysis Batch: 231825

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 231807

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.100	0.0948		mg/Kg		95	80 - 120	1	20

Method: 7471A - Mercury (CVAA) (Continued)

Lab Sample ID: 580-63680-1 MS
Matrix: Solid
Analysis Batch: 231825

Client Sample ID: MI-CML1
Prep Type: Total/NA
Prep Batch: 231807

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.025		0.109	0.135		mg/Kg	☼	101	80 - 120

Lab Sample ID: 580-63680-1 MSD
Matrix: Solid
Analysis Batch: 231825

Client Sample ID: MI-CML1
Prep Type: Total/NA
Prep Batch: 231807

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.025		0.110	0.140		mg/Kg	☼	105	80 - 120	4	20

Lab Chronicle

Client: Element Environmental, LLC
Project/Site: Central Maui landfill TDSR Sampling

TestAmerica Job ID: 580-63680-1

Client Sample ID: MI-CML1

Date Collected: 10/24/16 09:15
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-1
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3546			231604	11/04/16 12:12	MMM	TAL SEA
Total/NA	Analysis	8015B		1	231755	11/07/16 13:35	KZ1	TAL SEA
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3050B			231701	11/05/16 16:02	PAB	TAL SEA
Total/NA	Analysis	6010C		4	231916	11/08/16 18:30	HJM	TAL SEA
Total/NA	Analysis	D 2216		1	231250	11/01/16 11:48	DCV	TAL SEA

Client Sample ID: MI-CML1

Date Collected: 10/24/16 09:15
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-1
Matrix: Solid
Percent Solids: 88.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3546			231604	11/04/16 12:12	MMM	TAL SEA
Total/NA	Analysis	8015B		1	231755	11/07/16 21:10	KZ1	TAL SEA
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	7471A			231807	11/07/16 18:12	PAB	TAL SEA
Total/NA	Analysis	7471A		1	231825	11/08/16 06:19	FCW	TAL SEA

Client Sample ID: MI-CML2

Date Collected: 10/24/16 09:45
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-2
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3546			231604	11/04/16 12:12	MMM	TAL SEA
Total/NA	Analysis	8015B		1	231755	11/07/16 19:08	KZ1	TAL SEA
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3050B			231701	11/05/16 16:02	PAB	TAL SEA
Total/NA	Analysis	6010C		4	231916	11/08/16 18:52	HJM	TAL SEA
Total/NA	Analysis	D 2216		1	231250	11/01/16 11:48	DCV	TAL SEA

Client Sample ID: MI-CML2

Date Collected: 10/24/16 09:45
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-2
Matrix: Solid
Percent Solids: 87.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3546			231604	11/04/16 12:12	MMM	TAL SEA
Total/NA	Analysis	8015B		1	231755	11/07/16 21:30	KZ1	TAL SEA
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	7471A			231807	11/07/16 18:12	PAB	TAL SEA
Total/NA	Analysis	7471A		1	231825	11/08/16 06:26	FCW	TAL SEA

Client Sample ID: MI-CML3

Lab Sample ID: 580-63680-3

Date Collected: 10/24/16 10:00

Matrix: Solid

Date Received: 10/26/16 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3546			231604	11/04/16 12:12	MMM	TAL SEA
Total/NA	Analysis	8015B		1	231755	11/07/16 19:28	KZ1	TAL SEA
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3050B			231701	11/05/16 16:02	PAB	TAL SEA
Total/NA	Analysis	6010C		4	231916	11/08/16 18:56	HJM	TAL SEA
Total/NA	Analysis	D 2216		1	231250	11/01/16 11:48	DCV	TAL SEA

Client Sample ID: MI-CML3

Lab Sample ID: 580-63680-3

Date Collected: 10/24/16 10:00

Matrix: Solid

Date Received: 10/26/16 10:00

Percent Solids: 87.5

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3546			231604	11/04/16 12:12	MMM	TAL SEA
Total/NA	Analysis	8015B		1	231755	11/07/16 21:51	KZ1	TAL SEA
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	7471A			231807	11/07/16 18:12	PAB	TAL SEA
Total/NA	Analysis	7471A		1	231825	11/08/16 06:29	FCW	TAL SEA

Client Sample ID: MI-CML4

Lab Sample ID: 580-63680-4

Date Collected: 10/24/16 10:25

Matrix: Solid

Date Received: 10/26/16 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3546			231604	11/04/16 12:12	MMM	TAL SEA
Total/NA	Analysis	8015B		1	231755	11/07/16 20:09	KZ1	TAL SEA
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3050B			231701	11/05/16 16:02	PAB	TAL SEA
Total/NA	Analysis	6010C		4	231916	11/08/16 19:00	HJM	TAL SEA
Total/NA	Analysis	D 2216		1	231250	11/01/16 11:48	DCV	TAL SEA

Client Sample ID: MI-CML4

Lab Sample ID: 580-63680-4

Date Collected: 10/24/16 10:25

Matrix: Solid

Date Received: 10/26/16 10:00

Percent Solids: 86.2

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3546			231604	11/04/16 12:12	MMM	TAL SEA
Total/NA	Analysis	8015B		1	231755	11/07/16 22:11	KZ1	TAL SEA
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	7471A			231807	11/07/16 18:12	PAB	TAL SEA
Total/NA	Analysis	7471A		1	231825	11/08/16 06:31	FCW	TAL SEA

Lab Chronicle

Client: Element Environmental, LLC
Project/Site: Central Maui landfill TDSR Sampling

TestAmerica Job ID: 580-63680-1

Client Sample ID: MI-CML5

Date Collected: 10/24/16 10:55
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-5
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3546			231604	11/04/16 12:12	MMM	TAL SEA
Total/NA	Analysis	8015B		1	231755	11/07/16 20:29	KZ1	TAL SEA
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3050B			231701	11/05/16 16:02	PAB	TAL SEA
Total/NA	Analysis	6010C		4	231916	11/08/16 19:03	HJM	TAL SEA
Total/NA	Analysis	D 2216		1	231250	11/01/16 11:48	DCV	TAL SEA

Client Sample ID: MI-CML5

Date Collected: 10/24/16 10:55
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-5
Matrix: Solid
Percent Solids: 85.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3546			231604	11/04/16 12:12	MMM	TAL SEA
Total/NA	Analysis	8015B		1	231755	11/07/16 22:31	KZ1	TAL SEA
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	7471A			231807	11/07/16 18:12	PAB	TAL SEA
Total/NA	Analysis	7471A		1	231825	11/08/16 06:33	FCW	TAL SEA

Client Sample ID: MI-CML6

Date Collected: 10/24/16 11:15
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-6
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3546			231604	11/04/16 12:12	MMM	TAL SEA
Total/NA	Analysis	8015B		1	231755	11/07/16 20:50	KZ1	TAL SEA
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3050B			231701	11/05/16 16:02	PAB	TAL SEA
Total/NA	Analysis	6010C		4	231916	11/08/16 19:07	HJM	TAL SEA
Total/NA	Analysis	D 2216		1	231250	11/01/16 11:48	DCV	TAL SEA

Client Sample ID: MI-CML6

Date Collected: 10/24/16 11:15
Date Received: 10/26/16 10:00

Lab Sample ID: 580-63680-6
Matrix: Solid
Percent Solids: 87.1

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	3546			231604	11/04/16 12:12	MMM	TAL SEA
Total/NA	Analysis	8015B		1	231755	11/07/16 22:51	KZ1	TAL SEA
Total/NA	ISM Prep	Increment,Prep			231260	11/01/16 12:35	HJM	TAL SEA
Total/NA	Prep	7471A			231807	11/07/16 18:12	PAB	TAL SEA
Total/NA	Analysis	7471A		1	231825	11/08/16 06:40	FCW	TAL SEA

Lab Chronicle

Client: Element Environmental, LLC
Project/Site: Central Maui landfill TDSR Sampling

TestAmerica Job ID: 580-63680-1

Laboratory References:

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Certification Summary

Client: Element Environmental, LLC
Project/Site: Central Maui landfill TDSR Sampling

TestAmerica Job ID: 580-63680-1

Laboratory: TestAmerica Seattle

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska (UST)	State Program	10	UST-022	03-02-17
California	State Program	9	2901	01-31-18
L-A-B	DoD ELAP		L2236	01-19-19
L-A-B	ISO/IEC 17025		L2236	01-19-19
Montana (UST)	State Program	8	N/A	04-30-20
Oregon	NELAP	10	WA100007	11-05-17
US Fish & Wildlife	Federal		LE058448-0	10-31-17
USDA	Federal		P330-14-00126	04-08-17
Washington	State Program	10	C553	02-17-17

Sample Summary

Client: Element Environmental, LLC
Project/Site: Central Maui landfill TDSR Sampling

TestAmerica Job ID: 580-63680-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-63680-1	MI-CML1	Solid	10/24/16 09:15	10/26/16 10:00
580-63680-2	MI-CML2	Solid	10/24/16 09:45	10/26/16 10:00
580-63680-3	MI-CML3	Solid	10/24/16 10:00	10/26/16 10:00
580-63680-4	MI-CML4	Solid	10/24/16 10:25	10/26/16 10:00
580-63680-5	MI-CML5	Solid	10/24/16 10:55	10/26/16 10:00
580-63680-6	MI-CML6	Solid	10/24/16 11:15	10/26/16 10:00

TA Quote # 58010443

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808-486-LABS (5227) • Fax 808-486-2456

LABORATORY USE ONLY
LAB JOB NO. _____

☐ DOD QSM Required?
☐ Report to MDL with J Flag values?

Chain of Custody / Analysis Request Form

Report to: Element Env
Company name: Matt Neal
Address: 98-030 Hekaha St. unit 9
City: Aiea State: HI ZIP: 96701
Phone: 808 479-6075 Fax:
Sampler: M. Neal # samples in shipment: 6

Project identification
Job name: Central Maui Landfill TDSR
Job number:
PO number:
Contact email address: mneal@e2hl.com
Date results needed: Std TAT

Indicate analyses requested

Item no.	Client sample ID	Multi Incremental	Composite	Grab	Matrix: Water	Soil	Wastewater	Drinking water	Liquid	Solid	Oil	Other	Preservation method	Sampling: Date	Time	No. of containers	RCRA metals - Total	TPH - oil	TPH - diesel							Laboratory ID no.
1	MI-CML1	X				X							—	10/24/16	0915	1	X	X	X							
2	MI-CML2	X				X							↓	↓	0945	1	X	X	X							
3	MI-CML3	X				X							↓	↓	1000	1	X	X	X							
4	MI-CML4	X				X							↓	↓	1025	1	X	X	X							
5	MI-CML5	X				X							↓	↓	1055	1	X	X	X							
6	MI-CML6	X				X							↓	↓	1115	1	X	X	X							
7																										
8																										
9																										
10																										

580-63680 Chain of Custody

TB ___ Cooler IR2 Cor 1.7 Unc 1.8
Cooler Dsc 1g B/W @Lab
Wet/Packs Packing Other
Fed P.O w/C.S.

Released by (print / sign)	Date / time released	Delivery method	Received by (print / sign)	Company / Agency affiliation	Date / time received	Condition noted
Matt Neal / [signature]	10/25/16 0708	Hand	Reed Baldomero [signature]	TA HON	10/25/16 0708	no ice 11.1°c / 11.8°c
Reed Baldomero [signature]	10/25/16 1400	Fed Ex	B. Stall / B. Gall	SEA TA	10.26.16 / 1000	IR-81
	/				/	

Comments:

Please check one:
☐ Dispose by lab
☐ Return to client
☐ Archive (fee may apply)

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Login Sample Receipt Checklist

Client: Element Environmental, LLC

Job Number: 580-63680-1

Login Number: 63680
List Number: 1
Creator: Torres, Terri L

List Source: TestAmerica Seattle

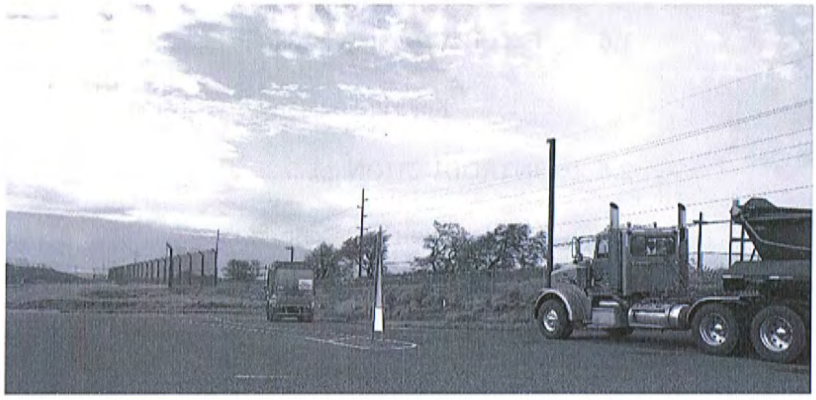
Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

APPENDIX

I

TRAFFIC IMPACT ANALYSIS REPORT

FEHR PEERS



Central Maui Landfill Facilities Project

Transportation Impact Analysis Report (TIAR)



October 2016
Prepared for Munekiyo Hiraga
SD16-0205

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1.0 EXECUTIVE SUMMARY

This report presents the results of the transportation impact analysis report (TIAR) for the proposed additional facilities of the Central Maui Landfill located in Maui. The proposed project will include ancillary uses and the consolidation of refuse operations that are currently occurring at various base yard locations on the island. The new uses include: an administrative office, a metals processing facility, an abandoned vehicle lot, and a construction and demolition materials recovery facility. Vehicle access to the site will be provided via two access driveways on Pūlehu Road, and the project is expected to be completed by 2020.

1.1 KEY FINDINGS AND CONCLUSIONS

The following findings resulted from the transportation assessment:

- Peak hour capacity analysis was conducted at four intersections in the vicinity of the project site based on projected travel patterns and paths of travel by project-generated traffic. The County of Maui and the Hawaii Department of Transportation strive to maintain LOS D as the minimum desirable operating level at intersections.
- Three of the four intersections currently operate acceptably at Level of Service (LOS) C or better. At the location closest to the site, Intersection 3: Pūlehu Road/Hansen Road, the worst-case movement operates at LOS F in the AM peak hour, and LOS C in the PM peak hour. Based on a preliminary evaluation, four of the eight standard traffic signal warrants are met at this intersection *without the proposed project*. It should be noted that the County of Maui makes the final determination on where and when traffic signals are installed on County-maintained roadways.
- The project is estimated to generate 356 net new daily vehicle trips, including 50 trips during the AM peak hour and 47 trips during the PM peak hour. These volumes are based on trip generation assumptions developed through information primarily provided by the County of Maui Department of Environmental Management (DEM), as well as field observations in some cases.
- Analysis of Future (2020) No Project Conditions indicates that Intersection 1: Pūlehu Road/Ho'okele Street and Intersection 3: Pūlehu Road/Hansen Road would operate at an overall intersection LOS E or F during the AM peak hour and/or PM peak hour.
- Analysis of Future (2020) plus Project Conditions indicates that the same two intersections noted in the previous bullet, would operate at an overall intersection LOS F during the AM peak hour, the PM peak hour, or both.
- Although the project would contribute to cumulative traffic operations impacts at Intersection 1: Pūlehu Road/Ho'okele Street and Intersection 3: Pūlehu Road/Hansen Road, it only comprises a maximum of 1% and 4% of the total peak hour traffic at these intersections, respectively.

- Mitigation strategies were developed and evaluated to address the identified deficiencies at the two intersections with projected undesirable peak hour operations (i.e., LOS E or F).
    - The improvement needed to return operations to pre-project conditions or better is the re-striping of northbound and southbound approaches at Intersection 1: Pūlehu Road/Ho'okele Street to include separate left-turn and shared through/right-turn lanes on each approach. With these improvements, the worst-case delays would be less than pre-project conditions, mitigating the project's impact. The project should be responsible for implementing this improvement.
    - At the 3: Pūlehu Road/Hansen Road, installation of an all-way stop control (AWSC) or a traffic signal are two viable improvements to provide operations that will be equal to or better than pre-project levels. Although the AWSC would improve vehicles seconds of delay experienced at this location compared to when it is side-street stop-controlled, the AM peak hour operation for the overall intersection would be at LOS F. A signal would provide LOS D operations under 2020 Plus Project conditions assuming existing lane configurations are maintained. As noted above, four traffic signal warrants are met at this intersection under existing conditions, and the project would contribute a maximum of 4% of the total traffic at this location under 2020 conditions. As such, the project should contribute a fair share towards the installation of a signal when warranted and approved for construction by the County. Additionally, there are trade-offs between implementation of an AWSC and signal. For example, implementation costs of an AWSC compared to a traffic signal is substantially less, but vehicles in the AM peak hour would still experience poor levels of service and high delay.
- Multi-modal and active transportation facilities (i.e. bicycle and pedestrian facilities and transit services) were assessed in the study area. Overall, the project is not expected to significantly impact the active travel modes and transit given its relatively remote location.
- The intersection operations analyses results are summarized in **Table 1**.

TABLE 1: EXISTING & FUTURE INTERSECTION LEVEL OF SERVICE SUMMARY

Intersection	Traffic Control	Peak Hour[1]	Existing (2016)		Future (2020)					Mitigated to:			
					No Project		Plus Project			Pre-Project or Better Conditions (≤ LOS D)		LOS D or Better Conditions	
			Del/Veh[2]	LOS[3,4]	Del/Veh[2]	LOS[3,4]	Del/Veh[2]	LOS[3,4]	Impact?[5]	Del/Veh[2]	LOS[3,4]	Del/Veh[2]	LOS[3,4]
1. Pūlehu Road/Ho'okele Street	SSSC	7:30-8:30 AM	15.2	C	22.6	C	23.7	C	NO	23.3	C	16.4	B
		4:15-5:15 PM	20.4	C	**52.0**	**F**	**55.6**	**F**	**Cumulative Impact**	**49.5**	**E**	11.0	B
2. Ho'okele Street/Hana Highway	Signalized	7:15-8:15 AM	12.4	B	15.3	B	15.6	B	NO	No Mitigation Required			
		3:45-4:45 PM	16.9	B	22.4	C	22.5	C	NO				
3. Pūlehu Road/Hansen Road	SSSC	7:00-8:00 AM	**172.8**	**F**	**>180**	**F**	**>180**	**F**	**Cumulative Impact**	**60.4**	**F**	10.1	B
		3:30-4:30 PM	23.3	C	**42.8**	**E**	**79.8**	**F**	**Cumulative Impact**	20.6	C	7.1	A
4. Mokulele Highway/Hansen Road	Signalized	7:00-8:00 AM	21.7	C	25.6	C	26.9	C	NO	No Mitigation Required			
		3:30-4:30 PM	15.0	B	16.5	B	17.3	B	NO				
5. Pūlehu Road/Access Road (South Project Driveway)	Signalized	N/A	Does Not Exist		Does Not Exist		11.1	B	NO	No Mitigation Required			
							9.4	A	NO				

Source: Fehr & Peers, June 2016

Notes:

[1] Weekday AM and PM peak hour for each intersection. Traffic volumes used in the intersection operations analysis were based on the individual intersection's peak hour.

[2] 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.

[3] LOS calculations performed using the 2010 Highway Capacity Manual (HCM) method.

[4] Unacceptable seconds of delay per vehicle and LOS highlighted in **bold.**

[5] Each of the identified significant impacts is categorized as either a project impact or cumulative impact. A project-specific impact is when the addition of project-related traffic degrades intersection operations from LOS D or better to LOS E or F. When an intersection is already operating at 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.

2.0 INTRODUCTION

Fehr & Peers has completed a transportation impact analysis for the proposed additional facilities of the Central Maui Landfill (i.e., the "project") located in the Pu'unēnē area outside Kahului on the island of Maui. The purpose of this analysis is to identify the potential transportation impacts associated with the additional landfill facilities as part of the project team's environmental assessment (EA) process. This analysis is to also be used to address potential concerns about traffic that may be raised by agencies, the public, and County of Maui decision-makers. This first chapter describes the project and traffic methodologies used, while the remainder of this report describes existing conditions, the project's potential vehicle trip generation and distribution, and potential areas of impact.

2.1 PROJECT DESCRIPTION

The County of Maui Department of Environmental Management (DEM) Solid Waste Division is responsible for the planning, operation, and maintenance of the County's landfills, including the Central Maui Landfill located on Pūlehu Road southeast of Hansen Road in the Pu'unēnē area of Central Maui. **Figure 1** illustrates the study area of the proposed project.



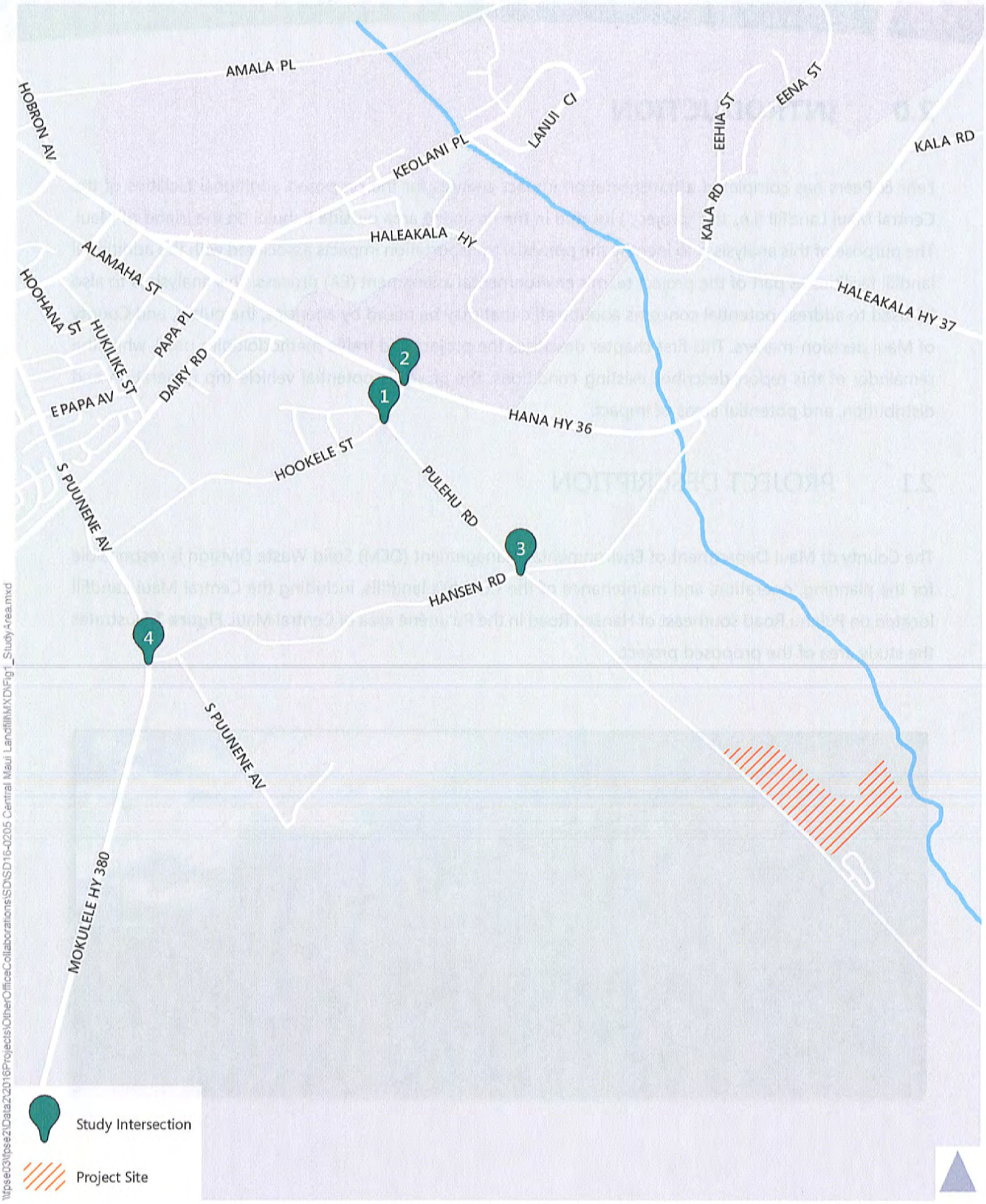


Figure 1

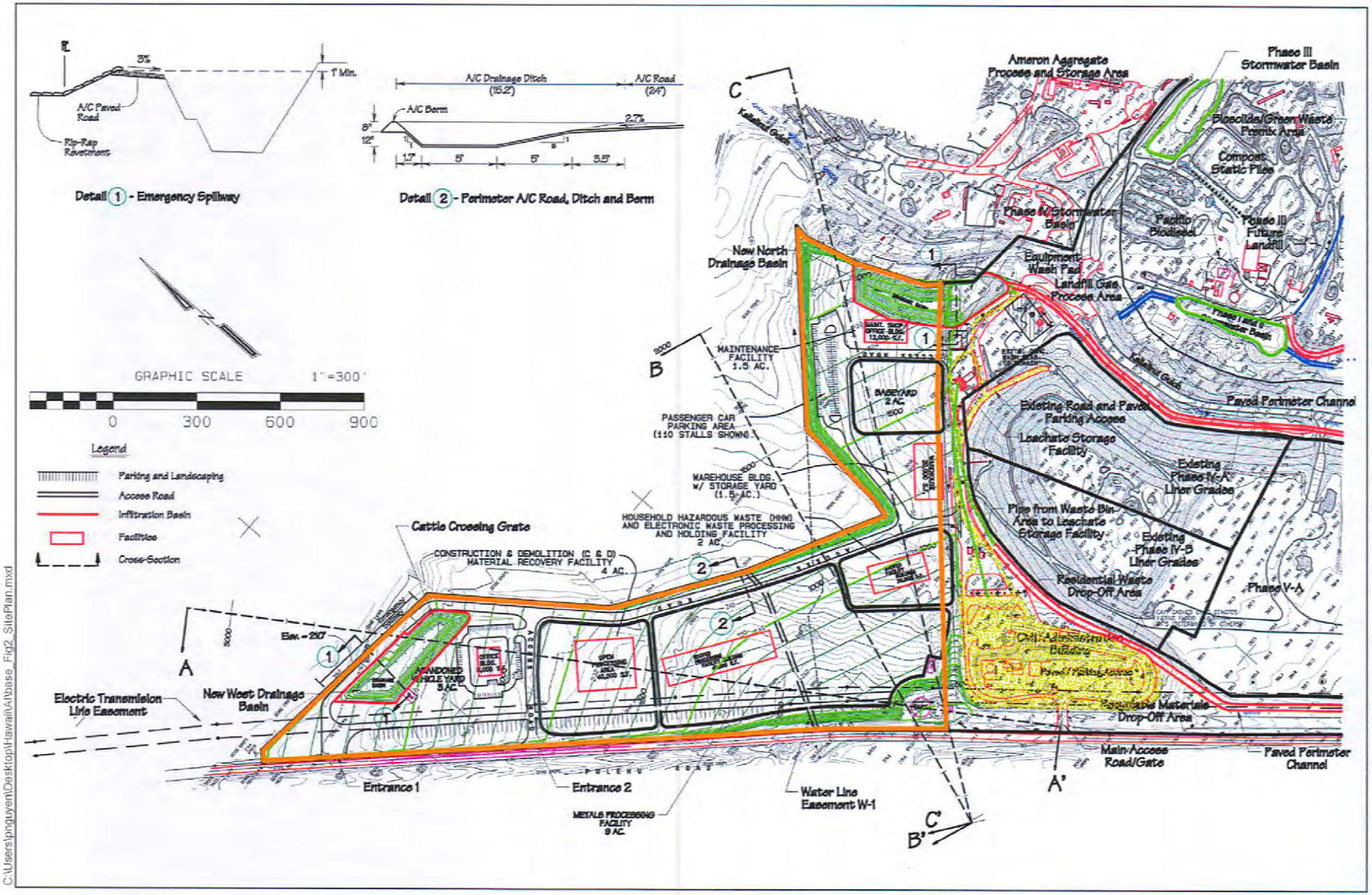
Study Area and Analyzed Intersections

The Central Maui Landfill currently accepts green waste and all other types of municipal waste, except for hazardous wastes. In addition to the landfill itself, existing supporting facilities include administrative offices, a recycling facility, and self-haul disposal area. The proposed project will develop approximately 40 acres adjacent to and west of the existing landfill and will provide ancillary uses to the site, which are illustrated on **Figure 2** and highlighted below.

- Relocation of the existing abandoned vehicle storage lot from the northeast quadrant of the intersection of Pūlehu Road and Hansen to the project site
- Relocation of the electronics collection facility on Lower Main Street in Wailuku to the project site
- Relocation and consolidation of the refuse operations from various base yards (i.e. Upcountry, Central/Wailuku, and West Side base yards) to the project site
- A new household hazardous waste disposal and service area
- A new construction and demolition materials recovery facility
- A new maintenance facility
- A new landfill facilities building
- A new administrative office
- A new metals processing facility

Access to the new and relocated uses will be provided via two driveways on Pūlehu Road. The southernmost driveway is the primary entrance/exit and provides full access, while the northernmost driveway is secondary and right in/right out only. The project is planned to be completed by 2020. The driveway to the existing landfill area east of the project site is shown below.





Source: A-Mehr, Inc.

Figure 2

Site Plan

2.2 PROJECT STUDY AREA

The assessment focused on evaluating the potential project-related traffic impacts at four (4) existing intersections in the vicinity of the Central Maui Landfill. These intersections were selected based on the amount of project traffic expected to be added to each location. The analyzed intersections are listed below and are shown on **Figure 1**:

1. Pūlehu Road/Ho'okele Street
2. Ho'okele Street/Hana Highway (Highway 36)
3. Pūlehu Road/Hansen Road
4. Mokulele Highway (Highway 311)/Hansen Road

2.3 INTERSECTION ANALYSIS SCENARIOS

The operations of the study intersections were evaluated during the weekday morning (AM) and evening (PM) peak hours for the following scenarios:

- **Existing (2016) Conditions** – The analysis of existing traffic conditions was based on 2016 counts collected for the analyzed peak hours. The existing conditions analysis also includes a description of key area roadways and an assessment of bicycle, pedestrian, and transit facilities and services in the study area.
- **Future (2020) No Project Conditions** – Future traffic volumes in the anticipated completion year of full project buildout were projected by increasing the existing volumes using an annual growth factor to account for ambient growth including entitled and pending developments in the area. This scenario does not include any project traffic.
- **Future (2020) plus Project Conditions** – Traffic projections from 2020 No Project Conditions *plus* traffic estimated from the completion and full occupancy of the expanded Central Maui Landfill facilities.

2.4 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 2010. The operations of roadway facilities are described with the term level of service (LOS). 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.

2.4.1 SIGNALIZED INTERSECTIONS

The method described in Chapter 18 of the *Highway Capacity Manual 2010* 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 alone is used to characterize LOS for the entire intersection or an approach. 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 9.0 analysis software and is correlated to a LOS designation as shown in **Table 2**.

TABLE 2: SIGNALIZED INTERSECTION LEVEL OF SERVICE CRITERIA

Level of Service	Description	Delay in Seconds
A	Progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	≤ 10.0
B	Progression is good, cycle lengths are short, or both. More vehicles stop than with LOS A, causing higher levels of average delay.	> 10.0 to 20.0
C	Higher congestion may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.	> 20.0 to 35.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	> 35.0 to 55.0
E	This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55.0 to 80.0
F	This level is considered unacceptable with oversaturation, which is when arrival flow rates exceed the capacity of the intersection. This level may also occur at high V/C ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.	> 80.0

Source: *Highway Capacity Manual*, Transportation Research Board, 2010.

2.4.2 UNSIGNALIZED INTERSECTIONS

The operations of the unsignalized intersections were evaluated using the method contained in Chapter 19: Two-Way Stop-Controlled Intersections of the *HCM 2010*. 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 (TWSC or SSSC) intersections, the average control delay is calculated for each minor-street stopped movement and the major-street left turns, 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 for TWSC. As shown in the **Table 3**, LOS F is assigned to the movement if the volume-to-capacity (V/C) ratio for the movement exceed 1.0 regardless of control delay. The average control delay for unsignalized intersections is calculated using Synchro 9.0 analysis software and is correlated to a LOS designation as shown in **Table 3**.

TABLE 3: UNSIGNALIZED INTERSECTION LEVEL OF SERVICE DEFINITIONS

Level of Service (v/c ≤ 1.0)	Level of Service (v/c > 1.0)[1]	Description	Average Control Delay Per Vehicle (Seconds)
A	F	Little or no delay.	≤ 10.0
B	F	Short traffic delay.	> 10.0 to 15.0
C	F	Average traffic delays.	> 15.0 to 25.0
D	F	Long traffic delays.	> 25.0 to 35.0
E	F	Very long traffic delays.	> 35.0 to 50.0
F	F	Extreme traffic delays with intersection capacity exceeded.	> 50.0

Source: *Highway Capacity Manual*, Transportation Research Board, 2010.

Notes:

[1] For approach-based and intersection-wide assessments, such as that used for all-way stop controlled intersections, LOS is defined solely by control delay.

2.4.3 SIGNIFICANT IMPACT CRITERIA

The analysis of Future Conditions compares the future baseline or "No project" condition with the project assuming full build-out and occupancy, to determine whether or not the addition of 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 desired operating standard for a signalized intersection is LOS D for the overall intersection. Additionally, the Hawai'i Department of Transportation (HDOT) strives to universally maintain LOS D intersection operations and in their *Draft 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-specific 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 expected to be 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 to be project-specific.

3.0 EXISTING CONDITIONS

This chapter describes the study area's existing transportation network and includes a discussion of the roadway, bicycle, pedestrian, and transit facilities. Overall, the assessment of the existing conditions relevant to this study established an existing baseline condition against which the proposed project changes can be evaluated against.

3.1 ROADWAY SYSTEM

The key roadways providing access to the site are described below. **Figure 1** illustrates the proposed project location and the surrounding roadway system.

Hana Highway (Highway 36) is approximately a 64-mile long roadway comprised of Route 36 and Route 360 and connects Kahului with the town of Hana in east Maui. Hana Highway is a major tourist attraction for Maui as the arterial facility through Kahului transitions into a winding and narrow two-lane roadway makai and east of the project site. In the study area, the facility is a 45 miles per hour (mph) four-lane arterial (two lanes in each direction) that extends east-west and is divided by a landscaped median. Hana Highway is a State facility from Kahumanu Avenue to Kaupakalua Road (Route 36) and from Kaupakalua Road to Keawa Place before Hana Bay (Route 360).

Mokulele Highway (Highway 311) is approximately a seven-mile major arterial highway that connects Kahului and the Upcountry areas with Kihei. Leaving Kahului, Mokulele Highway begins as a continuation of Pu'unēnē Road and continues southward cutting through agricultural land (primarily sugarcane fields) and terminates at the junction with North Kihei Road and Pi'ilani Highway. It is a State-owned, four-lane roadway (two lanes in each direction) with a posted speed limit of 45 mph and divided by grass medians.

Hansen Road is a County-owned, two-lane rural roadway (one lane in each direction) with a 30 mph speed limit and advisory speeds of 20 mph when the facility curves just south of its intersection with Hana Highway. The roadway links Mokulele Highway and Hana Highway and is primarily used for local traffic between East Maui and Upcountry to South Maui.

Ho'okele Street is a county-owned, four-lane roadway (two lanes in each direction) divided by raised, landscaped medians. The roadway provides an alternative connection between Mokulele Highway and Hana Highway, as well as provides access to various existing and future commercial uses. The posted speed limit of the roadway is predominately 35 mph, but includes advisory speeds of 20 mph as it traverses through the more developed commercial frontages and approaches its intersection with Mokulele Highway.

Pūlehu Road is a County-owned, two-lane roadway (one lane in each direction) that serves the existing landfill and provides access to Upcountry. The speed limit along the roadway varies by segment. For example, from the cul-de-sac north of Ho'okele Street to approximately 600 feet south of Ho'okele Street the posted limit is 35 mph. As the roadway narrows between Ho'okele Street and Hansen Road the speed limit increases to 45 mph, and immediately south of Hansen Road the posted speed limit is 30 mph. However, roughly 1,800 feet it returns back to 45 mph as it fronts the future project site and the existing landfill.

3.2 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. There is no transit route that directly provides service to the Central Maui Landfill nor the immediate study area. The Kihei Islander Route (#10) is the only Maui Bus that traverses on one of the study roadway facilities, Mokulele Highway. In the study area, this route operates along Mokulele Highway and provides hourly service between the Queen Ka'ahumanu in Kahului and Kihei. Overall, the limited transit service is reflective of the more rural and remote surroundings and lack of key higher-density, activity centers in the vicinity of the Central Maui Landfill. Service expansion is not anticipated in this area within the timeframe of the project.

3.3 PEDESTRIAN FACILITIES

Pedestrian facilities consist of sidewalks, crosswalks, and pedestrian signals at signalized intersections. Since the landfill is located in the Pu'unēnē area, which is more rural with its primary industry related to growing and processing agricultural products, the pedestrian facilities, such as sidewalks and marked crosswalks, are non-existent along Pūlehu Road and Hansen Road. Pedestrian facilities are only provided at intersections along Hana Highway and Mokulele Highway. Ho'okele Street fronts a variety of existing and future commercial uses and is therefore the only study facility that provides sidewalks with landscaped buffers along both sides of the roadway.

Despite the limited pedestrian facilities at the roadway segment level in the study area, there are pedestrian facilities provided at three of four study intersections and are described below.

1. Pūlehu Road/Ho'okele Street
    - Two-way stop controlled with high visibility crosswalks on all four legs
2. Ho'okele Street/Hana Highway (Highway 36)
    - Signalized with a high visibility crosswalk and pedestrian signals on the south leg

3. Pūlehu Road/Hansen Road
    - No pedestrian facilities provided
4. Mokulele Highway (Highway 311)/Hansen Road
    - Signalized with a high visibility crosswalk and pedestrian signals on the east leg

3.4 BICYCLE FACILITIES

Within the project study area, bicycle facilities are limited, and no bicycle facilities directly serve the project site. Along some segments of Hana Highway on the south side (eastbound side) there are dedicated bicycle lanes. The only *continuous* bicycle facility that exists along any of the study roadways is the Mokulele bike path located on the east side of Mokulele Highway between North Kihei Road and Ho'okele Street. As shown in the image to the right, the bike path provides a two-directional, completely separate right-of-way designated for the exclusive use of bicyclists with vehicle and pedestrian cross-flow minimized.



3.5 EXISTING INTERSECTION LEVEL OF SERVICE

The study intersections were evaluated during weekday morning (6:00 to 9:00 AM) and evening (3:00 to 6:00 PM) peak period conditions. Single-day traffic counts were collected during the weekday AM and PM peak periods at the study intersections in mid-May 2016, when local schools were in session. The study area's AM peak hour of traffic generally occurs between the hours of 7:00 AM and 8:00 AM, while the PM peak hour of traffic generally occurs 3:30 PM to 4:30 PM. Although the peak hours of traffic generally occur around the same time frame at each of the study intersections, the absolute peak hour of traffic at each of the study intersections slightly differ as shown in **Table 4**. It should also be noted that traffic volumes used in the intersection operations analysis were based on the individual intersection's peak hour.

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.**

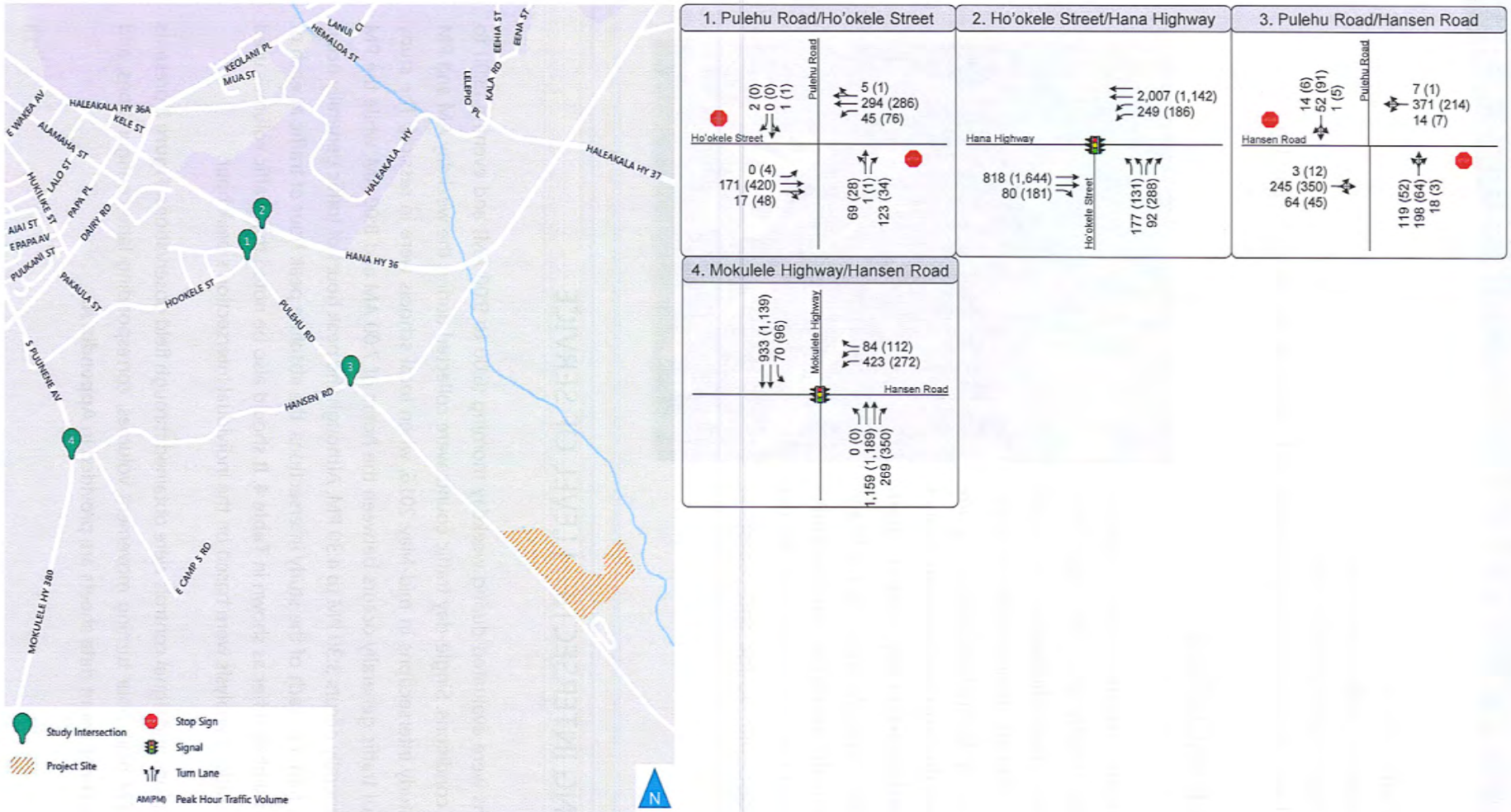


Figure 3
Peak Hour Traffic Volumes and Lane Configurations
Existing (2016) Conditions

TABLE 4: EXISTING INTERSECTION LEVEL OF SERVICE

Intersection	Traffic Control	Peak Hour[1]	Delay (sec/veh)[2]	LOS[3,4]
1. Pūlehu Road/Ho'okele Street	SSSC	7:30-8:30 AM	15.2	C
		4:15-5:15 PM	20.4	C
2. Ho'okele Street/Hana Highway	Signalized	7:15-8:15 AM	12.4	B
		3:45-4:45 PM	16.9	B
3. Pūlehu Road/Hansen Road	SSSC	7:00-8:00 AM	**172.8**	**F**
		3:30-4:30 PM	23.3	C
4. Mokulele Highway/Hansen Road	Signalized	7:00-8:00 AM	21.7	C
		3:30-4:30 PM	15.0	B

Source: Fehr & Peers, June 2016.

Notes:

SSSC = Side-street stop-controlled intersection

[1] Weekday AM and PM peak hour for each intersection. Traffic volumes used in the intersection operations analysis were based on the individual intersection's peak hour.

[2] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. The vehicular delay for the worst movement is reported for side-street stop-controlled (SSSC) intersections.

[3] LOS calculations performed using the *2010 Highway Capacity Manual (HCM)* method.

[4] Unacceptable seconds of delay per vehicle and LOS highlighted in **bold.**

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 above in **Table 4** and the corresponding LOS calculation sheets are included in **Appendix B**.

The results of the LOS calculations indicate that all of the existing study intersections operate at an overall desirable service level (LOS D or better) during the weekday AM and PM peak hours, with the exception of the following location:

- Intersection 3: Pūlehu Road/Hansen Road (LOS F – AM peak hour)
    - The side-street stop-controlled intersection's worst approach (i.e. the northbound approach) is composed of a shared left/through/right lane with a calculated average control delay of nearly three minutes in the morning peak hour. Poor operating conditions for this approach are due to the limited gap opportunities in Hansen Road traffic for vehicles to turn onto or travel through from northbound Pūlehu Road.

3.6 TRAFFIC CONTROL EVALUATION

As mentioned in the previous section, side-street stop controlled Intersection 3: Pūlehu Road/Hansen Road is operating at LOS F in the AM peak hour with an average vehicle delay of almost three minutes at the worst movement. Both an all-way stop evaluation and a traffic signal warrant analysis were conducted to see if installation of a different traffic control at the intersection is either currently justified and/or will help relieve vehicular delay.

3.6.1 ALL-WAY STOP APPLICATION

The decision to install multi-way stop control, such as an all-way stop control (AWSC), should be based on an engineering study. The *Manual of Uniform Traffic Control Devices* (MUTCD) *2009 Edition* provides guidelines and criterion about when installation of an AWSC at an intersection is satisfied. Using existing volume data at Intersection 3: Pūlehu Road/Hansen Road, we evaluated the MUTCD's following minimum volume criterion:

1. The vehicle volume entering the intersection from the major street approaches averages at least 300 vehicles per hour for any eight hours of an average day; and
2. The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches averages at least 200 units per hour for the same eight hours.

Based on the volume assessment, the intersection does not warrant the application of an AWSC at this location because the volumes along Pūlehu Road and Hansen Road are too low to meet any single criterion described above.

3.6.2 SIGNAL WARRANT ANALYSIS

Traffic signal warrants were developed by the Federal Highway Administration (FHWA) and are described in the MUTCD. The MUTCD calls for the analysis of up to nine (9) sets of warrant criteria that take into account a combination of traffic conditions, pedestrian characteristics, and physical characteristics to determine if the installation of a traffic control signal is justified for a proposed location.

Under this transportation assessment, a total of four (4) traffic signal warrants were tested for the intersection of Pūlehu Road/Hansen Road. These included Warrant 1: Eight Hour Volume, Warrant 2: Four Hour Volume, Warrant 3: Peak Hour Volume, and Warrant 8: Roadway Network. The remaining five (5) warrants were not tested due to data that was not available (e.g., Warrant 7: Crash Experience) and/or not applicable (e.g., Warrant 5: School Crossing). Satisfying one or more of the nine (9) warrants could justify

the installation of a signal at an intersection. Also the hourly traffic volume for Warrants 1 and 2 were developed using AM and PM peak period counts collected at this intersection and existing 48-hour roadway segment counts at Pulehu Road south of Hansen provided in **Appendix A.**

Based on the analysis, all four of the warrants (Warrants 1, 2, 3, 8) are currently satisfied and so this location already justifies the need for signal at this location prior to the construction of the proposed project. The detailed information for the signal warrant analysis is included in **Appendix C.** It is important to note that the recommended traffic signal should not be solely based on the satisfaction of warrants, and that the responsible agency (County of Maui) will make the final determination on the need for a signal at this location.

3.7 FIELD OBSERVATIONS

Field observations conducted in May 2016 showed that traffic moves fairly well throughout the study area during the AM and PM peak hours at three of the four study intersections. The notable exception occurs at Intersection 3 during the AM peak hour, where queues of three (3) to seven (7) vehicles were seen on the northbound Pūlehu Road approach as cars were observed to wait for several minutes before turning onto Hansen Road or continuing through along Pūlehu Road. It was also observed that heavy vehicles did not make northbound right turns at this location due to the tight radius. However, for other parts of the day no substantial delays were observed at Intersection 3: Pūlehu Road/Hansen Road. Overall, the calculated existing peak hour intersection LOS at the study intersections shown in **Table 4** were representative of field conditions.

Negligible pedestrian activity was observed at the study intersections and roadways. Cycling activity was also minimal in the study area; however, a few bicyclists were observed riding along Ho'okele Street and the cycle track adjacent to Mokulele Highway during the AM peak period. The minimal active transportation activity in the study area is also reflected in the bicycle and pedestrian counts collected at the intersections.

4.0 PROJECT TRAFFIC ESTIMATES

Development of future traffic projections related to the amount of traffic added to the roadway system by the proposed landfill facilities is estimated using a three-step process: (1) trip generation, (2) trip distribution, and (3) trip assignment. The first step estimates the amount of project-generated traffic that will be added to the roadway network. The second step identifies the direction of travel to and from the project site and the proportion of traffic on each potential travel path. 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.

4.1 TRIP GENERATION

A variety of trip generation data sources were considered in estimating the number of new trips generated by the proposed project uses. Trip generation estimates were broken down by each ancillary use that will comprise the project and were primarily derived using information provided from County of Maui DEM staff. As part of the proposed landfill facilities, several existing uses, such as base yard refuse operations and abandoned vehicle storage, will be consolidated at the project site. For these relocated uses, traffic was estimated based on their existing data and operations including the number of employees and/or the number of truck trips. For example, AM and PM peak period driveway counts were collected over the course of one typical weekday in May 2016 at the existing abandoned vehicle storage facility, and the peak hour driveway counts were used for the project's abandoned vehicle yard trip generation. National data sources, such as the Institute of Transportation Engineers' (ITE) trip generation rates, were not applied since none of the land uses presented in ITE's *Trip Generation* were applicable nor reflective of the unique combination of ancillary uses and rural location of the project. Overall, details of the project's trip generation assumptions and data source are described in **Appendix D**.

As shown in **Table 5**, the proposed project is expected to generate a total of 356 net new daily vehicle trips, including 50 trips during the AM peak hour (30 inbound/20 outbound) and 47 trips during the PM peak hour (11 inbound/36 outbound).

For traffic analysis purposes, the project's truck trips were converted into passenger-car-equivalents (PCEs) since these heavy vehicles have a larger impact on traffic variables like speed, headway, and density compared to a private automobile. The *HCM 2010* provides PCE factors for trucks and buses as follows: Level Terrain – 1.5; Rolling Terrain – 2.5; and Mountainous Terrain – 4.5. The terrain within the study area is predominately level, but there are some grade changes along the Hansen Road and Pūlehu Road in the vicinity of the Central Maui Landfill. Therefore, for conservative purposes, a PCE factor of 2.0 was applied to

the project's estimated peak hour truck trips. With the application of the PCE factor to truck trips, the proposed project is expected to generate a total of 520 net new daily PCE trips, including 73 PCE trips during the AM peak hour (40 inbound/33 outbound) and 71 PCE trips during the PM peak hour (21 inbound/50 outbound). These trip values were used for calculating intersection level of service.

TABLE 5: AM & PM PEAK HOUR TRIP GENERATION FOR THE CENTRAL MAUI LANDFILL FACILITIES PROJECT

New Traffic Generating Uses	Daily	AM Peak Hour									PM Peak Hour								
		Autos			Trucks			Auto & Trucks			Autos			Trucks			Auto & Trucks		
		In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
Abandoned Vehicle Yard																			
Customers	130	4	7	11	1	2	3	***5***	***9***	***14***	1	6	7	2	4	6	***3***	***10***	***13***
Employees	6	3	0	3	0	0	0	***3***	***0***	***3***	0	3	3	0	0	0	***0***	***3***	***3***
Consolidation of Base Yard Refuse Operations																			
Refuse Truck Drivers	90	0	0	0	0	0	0	***0***	***0***	***0***	0	0	0	0	0	0	***0***	***0***	***0***
New Refuse Truck Trips	48	0	0	0	0	0	0	***0***	***0***	***0***	0	0	0	0	0	0	***0***	***0***	***0***
Construction & Demolition Materials Recovery Facility																			
Customers	50	0	0	0	8	8	16	***8***	***8***	***16***	0	0	0	8	8	16	***8***	***8***	***16***
Employees	6	3	0	3	0	0	0	***3***	***0***	***3***	0	3	3	0	0	0	***0***	***3***	***3***
Metals Processing Facility[1]																			
Processed Metal Truck Drivers	4	0	0	0	0	2	2	***0***	***2***	***2***	0	0	0	0	2	2	***0***	***2***	***2***
White Goods Truck Drivers	2	0	0	0	1	1	2	***1***	***1***	***2***	0	0	0	0	0	0	***0***	***0***	***0***
Employees	6	3	0	3	0	0	0	***3***	***0***	***3***	0	3	3	0	0	0	***0***	***3***	***3***

TABLE 5: AM & PM PEAK HOUR TRIP GENERATION FOR THE CENTRAL MAUI LANDFILL FACILITIES PROJECT

New Traffic Generating Uses	Daily	AM Peak Hour									PM Peak Hour								
		Autos			Trucks			Auto & Trucks			Autos			Trucks			Auto & Trucks		
		In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
Other Ancillary Uses[2]																			
Administrative Office Staff	4	2	0	2	0	0	0	***2***	***0***	***2***	0	2	2	0	0	0	***0***	***2***	***2***
Refuse Office Staff	6	3	0	3	0	0	0	***3***	***0***	***3***	0	3	3	0	0	0	***0***	***3***	***3***
Maintenance Facility Mechanics	4	2	0	2	0	0	0	***2***	***0***	***2***	0	2	2	0	0	0	***0***	***2***	***2***
Total Net New Traffic	**356**	**20**	**7**	**27**	**10**	**13**	**23**	***30***	***20***	***50***	**1**	**22**	**23**	**10**	**14**	**24**	***11***	***36***	***47***

Source: Fehr & Peers, June 2016

Notes:

[1] Per discussion with County of Maui staff, truck traffic related to the metals processing facility does not occur daily; however, some truck traffic have been included in the trip generation estimate to provide a conservative analysis. For example, vehicles that are not sold at the abandoned vehicle yard's auction are sent to the metals process facility (an internal trip). Once the vehicles are processed they would leave the landfill on a truck, but similar to the auction, this processing and outbound trip would occur every two months. Depending on the volume of unsold cars this outgoing truck trip might be ongoing for a month or so, and so we have conservatively assumed in the project's trip generation that there would be a total of four (4) outgoing trucks leaving the metals processing facility a day and that half of these trucks would leave in the AM peak hour and the other half in the PM peak hour. Another conservative assumption included in the trip generation, is the inclusion of white goods refuse traffic in the AM peak hour despite it occurring only once a week.

[2] Traffic related to electronic waste and household hazardous waste activities do not occur every weekday day. Due to the infrequencies/irregular occurrence of these activities, they were excluded from the trip generation.

4.2 TRIP DISTRIBUTION & ASSIGNMENT

The geographic distribution of trips generated by the proposed project is dependent on characteristics of the street system serving the project site; the level of accessibility of routes to and from the project site; and residential areas from which local customers and employees would be drawn.

The project's trip distribution pattern was primarily developed by assessing Maui's population density data provided by the 2010 U.S. Census Bureau and presented in the *Maui County Data Book 2011*. This directional distribution was further refined and adjusted based on a review of the following information: distribution of the existing traffic counts, the residences of current refuse truck drivers, complementary land uses (i.e. the residences of Central Maui Landfill customers and employees), and access to local arterial streets and the regional transportation system.

The resulting overall trip distribution pattern estimates for the project-generated traffic are as follows:

- 25% along Mokulele Highway to/from Kihei or South Maui (south)
- 25% along Mokulele to/from Central Maui (west)
- 20% along Hana Highway to/from Kahului or Wailuku (north)
- 25% along Hana Highway to/from Makawao or East Maui (east)
- 5% along Pulehu to/from Upcountry or East Maui (east)

Figure 4 illustrates the project trip distribution pattern described above.

Using the estimated trip generation and the distribution patterns discussed above, the traffic generated by the proposed project was assigned to the street network. **Figure 5** details the project's trip assignment using the project trip generation.[1]

Although some vehicles are expected to enter and exit the site from the secondary driveway (i.e. the northernmost driveway labeled Entrance 1 on the site plan), the amount of traffic is marginal compared to the main driveway (Entrance 2). Thus, for the purpose of this transportation assessment, all the project traffic has been assigned to the primary, full access driveway (i.e. the southernmost driveway) to yield a conservative analysis.

[1] It should be noted that the project trip assignment depicted in Figure 5 is based on the trip generation presented in Table 5 and does not account for PCE conversion of the truck trips.

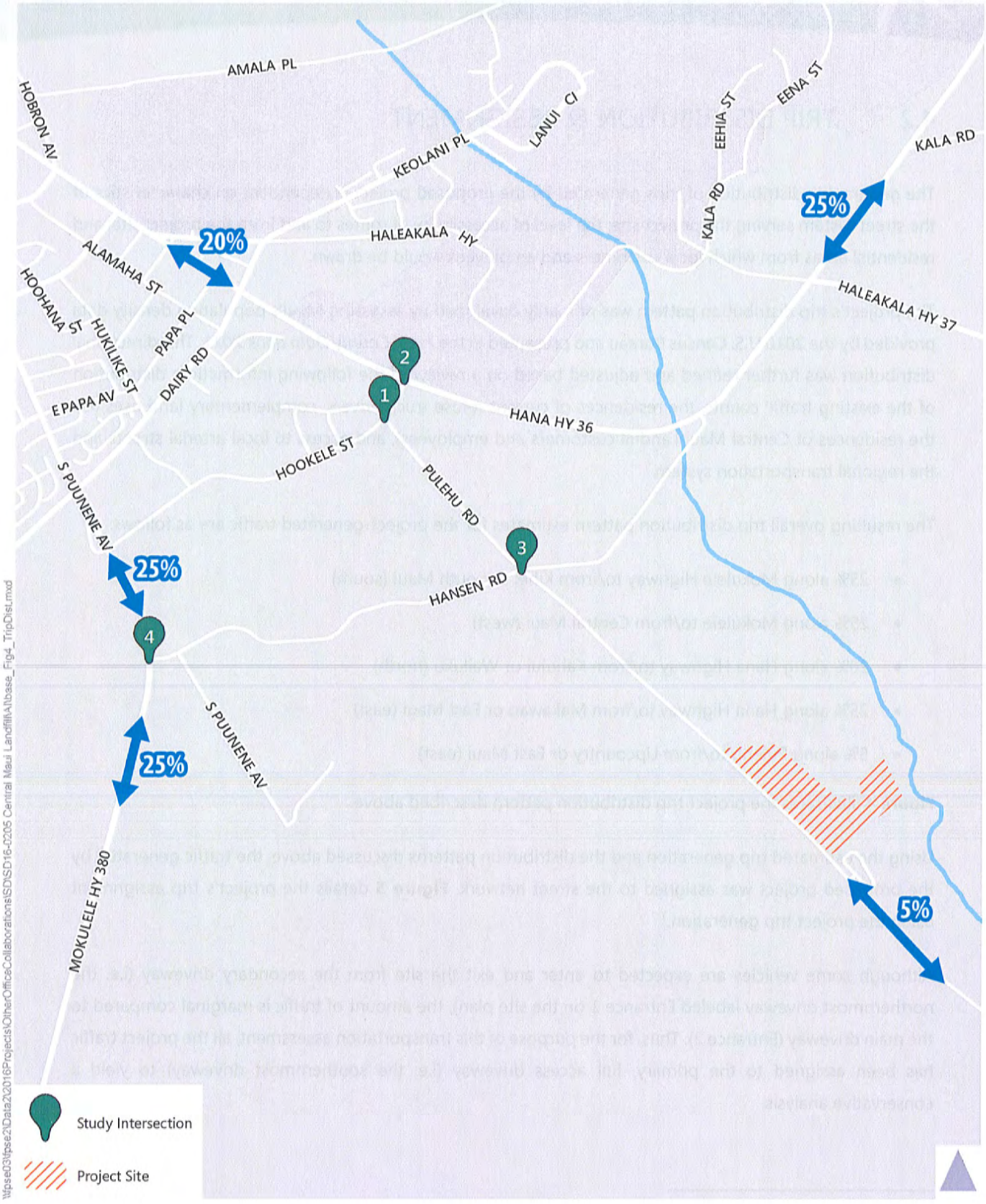
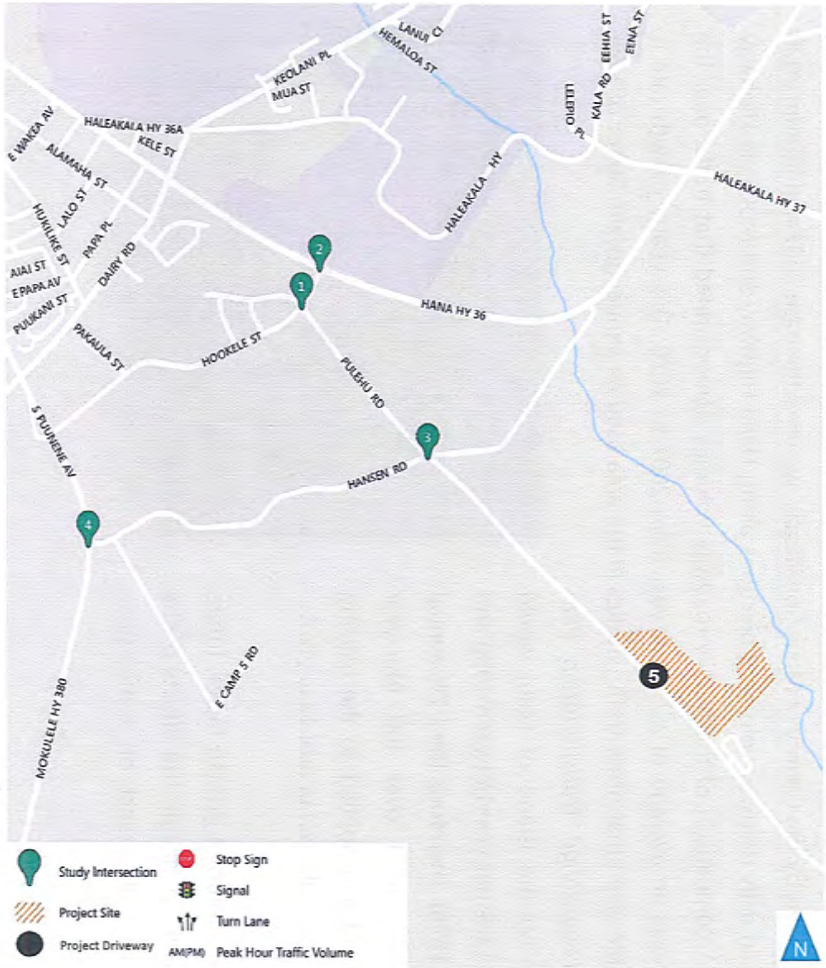


Figure 4

Project Trip Distribution



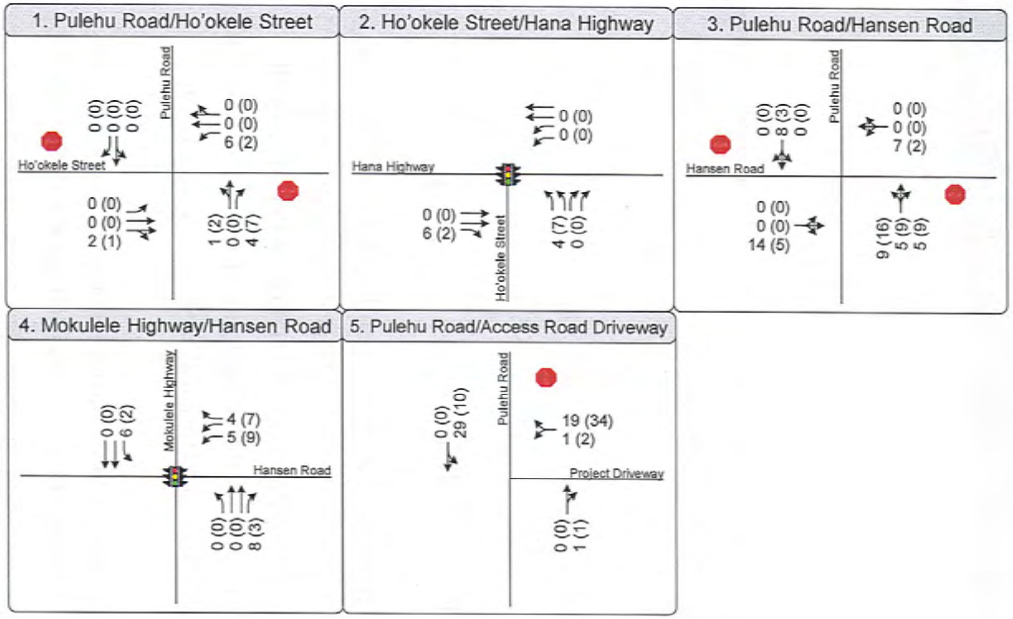


Figure 5
Project Trip Assignment

5.0 FUTURE CONDITIONS

This chapter summarizes the methodology used to forecast the study area's traffic volumes under the project's 2020 opening year, as well as presents the results of the operations analysis under Future Conditions with and without the proposed project.

5.1 TRAFFIC PROJECTIONS

5.1.1 FUTURE (2020) NO PROJECT TRAFFIC VOLUMES

To evaluate the potential impact of traffic generated by the project on the surrounding street system, it was necessary to first develop estimates of future traffic conditions in the area without the project. Future traffic conditions without the project reflect traffic increases due to 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 "no project" condition used as a baseline to identify impacts on the roadway system.

A growth factor was applied to the existing traffic to account for future growth along the major highways in the study area. This factor was derived using the Maui Travel Demand Forecasting Model (TDFM), which assigns traffic across the roadway network for the base and horizon years generated by land use and socioeconomic data provided by the County of Maui. Specifically, we used the base 2007 and interim 2020 No Build model to obtain daily roadway volume projections along Hana Highway and Mokulele Highway within the study area. A comparison of these daily roadway volumes demonstrated that traffic near the project site would increase an average of 1.7% per year from 2007 to 2020. This yearly growth rate is consistent and reasonable given that other traffic studies in the area used an annual growth factor of 1.6% based on the *Maui Long-Range Transportation Plan* concluding that traffic on the island of Maui would increase an average of 1.6% per year between 1990 and 2020 (Kaku Associates, 1996). Therefore, the 1.7% annual growth rate was compounded over the four-year timeframe (2016 to 2020) and applied to the existing intersection traffic volumes collected in mid-May 2016.



In addition to the application of a growth factor, future base traffic forecasts need to include the effects of the Maui Business Park Phase II project on traffic since

portions or possibly all of this industrial park project is expected to be constructed within the Central Maui Landfill Facilities Project's four-year development timeframe and is expected to add traffic in the vicinity of the project site. Using the *Traffic Impact Assessment Report for the Maui Business Park Phase II and Hookele Street Extension* (Phillip Rowell and Associates, 2004) as a reference, trip assumptions for this cumulative project were made and then manually distributed and assigned to the network. Overall, the resulting volumes were also then rounded to the nearest ten (10). **Figure 6** illustrates the Future (2020) No Project AM and PM peak-hour turning movement volumes, corresponding lane configurations, and traffic control devices.

5.1.2 FUTURE (2020) PLUS PROJECT TRAFFIC VOLUMES

Per consultation with the County of Maui staff, refuse truck and public/visitor traffic to the existing Central Maui Landfill Refuse & Recycling Center is not expected to substantially change between now and 2020 and would most likely remain the same even with the project expansion in place. It should also be noted that no existing Central Maui Landfill employees are expected to relocate to the project's new ancillary uses. Therefore, net new trips generated from the proposed project **(Figure 5)** were added to the Future (2020) No Project traffic projections (**Figure 6**) to develop traffic volumes for Future (2020) plus Project Conditions. The resulting volumes are shown on **Figure 7**.[2]

5.2 STREET SYSTEM IMPROVEMENTS

County of Maui staff has confirmed that no roadway infrastructure improvements are planned or approved in the study area within the 2020 timeframe; therefore, the existing roadway network and intersection configuration and control at the study intersections were assumed for Future (2020) Conditions.

[2] It should be noted that the intersection turning movement volumes depicted in Figure 7 do not match the Future (2020) plus Project analysis volumes presented in the Synchro outputs provided in Appendix B. The differences in volumes are due to the application of PCE factors to the truck trips for intersection analysis purposes.

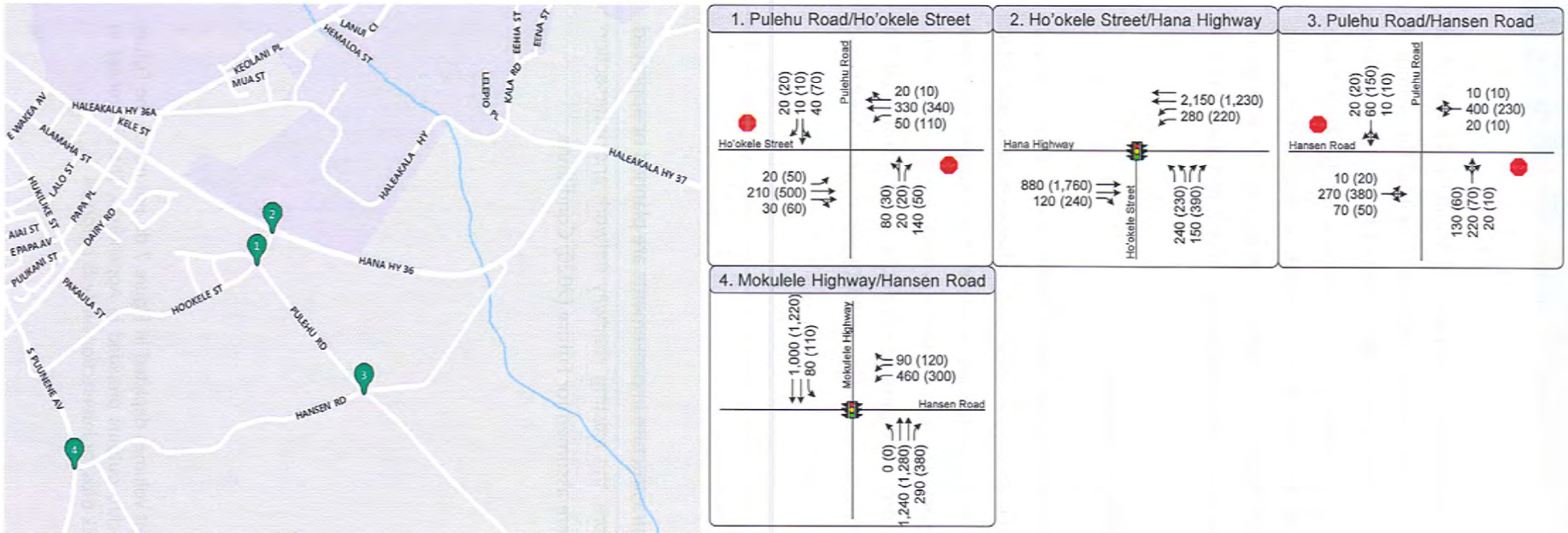


Figure 6
Peak Hour Traffic Volumes and Lane Configurations
Future (2020) No Project Conditions

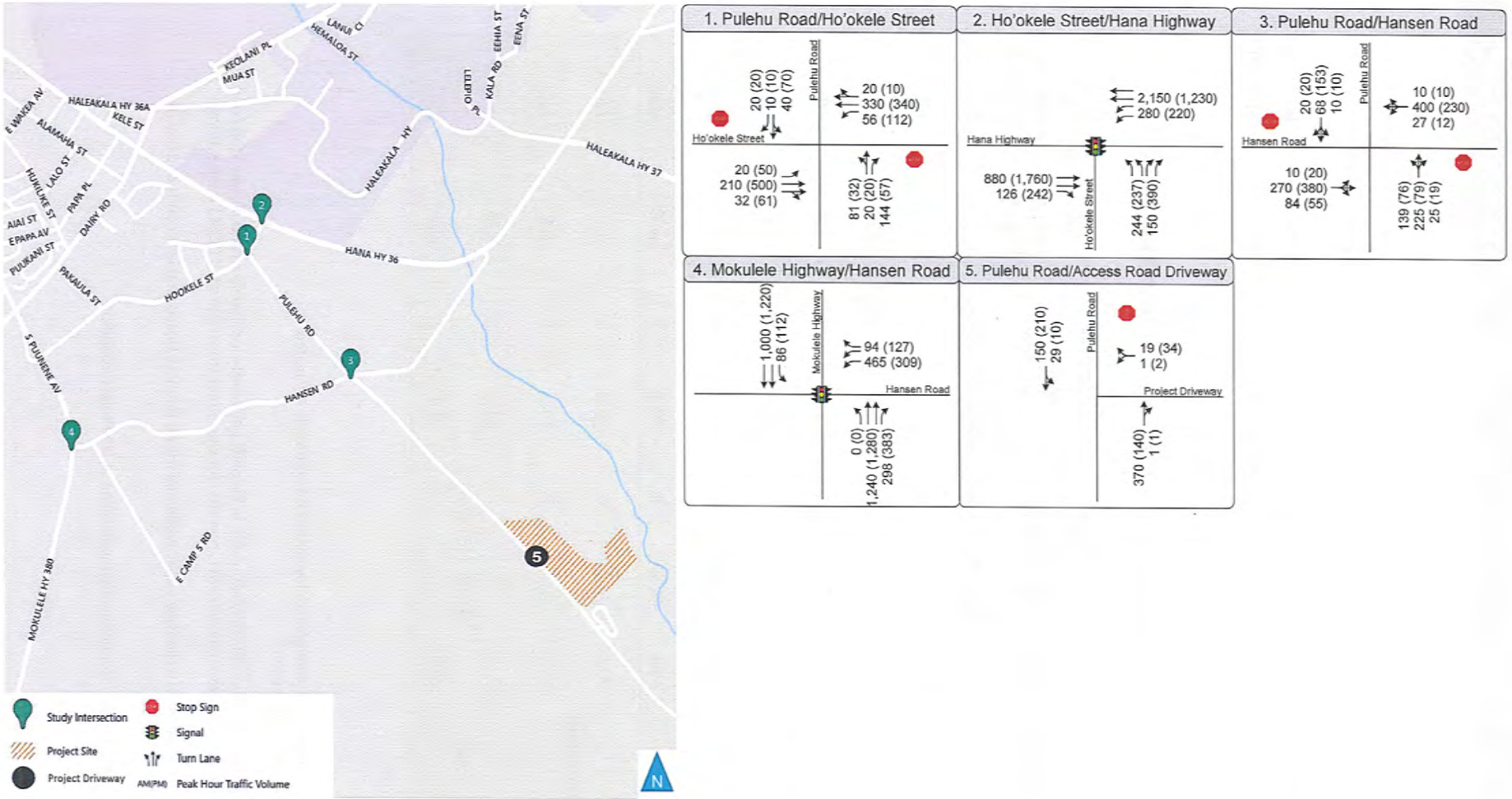


Figure 7
Peak Hour Traffic Volumes and Lane Configuration
Future (2020) plus Project Conditions

5.3 FUTURE INTERSECTION ANALYSIS

Table 6 presents the delay and level of service calculation results for the study intersections under Future (2020) No Project and Future (2020) plus Project Conditions. **Appendix B** contains the corresponding calculation sheets.

TABLE 6: FUTURE (2020) LEVEL OF SERVICE WITH AND WITHOUT THE PROJECT

Intersection	Traffic Control	Peak Hour	2020 No Project Conditions		2020 Plus Project Conditions		Delay Change[3]	Impacted Peak Hour?
			Del/Veh[1]	LOS[2]	Del/Veh[1]	LOS[2]		
1. Pūlehu Road/ Ho'okele Street	SSSC	AM	22.6	C	23.7	C	1.1	NO
		PM	**52.0**	**F**	**55.6**	**F**	3.6	**YES**
2. Ho'okele Street/ Hana Highway	Signalized	AM	15.3	B	15.6	B	0.3	NO
		PM	22.4	C	22.5	C	0.1	NO
3. Pūlehu Road/ Hansen Road	SSSC	AM	**>180**	**F**	**>180**	**F**	**	**YES**
		PM	**42.8**	**E**	**79.8**	**F**	37.0	**YES**
4. Mokulele Highway/ Hansen Road	Signalized	AM	25.6	C	26.9	C	1.3	NO
		PM	16.5	B	17.3	B	0.8	NO
5. Pūlehu Road/ Access Road (South Project Driveway)	SSSC	AM	Does Not Exist		11.1	B	N/A	NO
		PM			9.4	A	N/A	NO

Source: Fehr & Peers, June 2016

Notes:

** Indicates oversaturated conditions. The change in delay cannot be accurately calculated.
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 (SSSC) intersections.

[2] LOS calculations performed using the 2010 Highway Capacity Manual (HCM) method. Unacceptable seconds of delay per vehicle and LOS highlighted in **bold.**

[3] Delay change between the "Plus Project" Condition and the Baseline or No Project Condition.

The results of the LOS calculations indicate that all the future study intersections operate at an overall desirable service level (LOS D or better) during the AM and PM peak hours under Future (2020) No Project and Future (2020) plus Project Conditions, with the exception of the following locations:

- Intersection 1: Pūlehu Road/Ho'okele Street (LOS F – PM peak hour)
- Intersection 3: Pūlehu Road/Hansen Road (LOS F – AM and PM peak hour)

The poor operating conditions projected to occur at the unsignalized study intersections, where the vehicular delay for the worst movement is reported. This delay is primarily due to the limited number of gaps for vehicles on the northbound Pūlehu Road stop-controlled approaches to make turns onto or cross the uncontrolled main roadways that they intersect (i.e. Ho'okele Street and Hansen Road). Also as shown in **Table 6**, the proposed project would contribute to cumulative impacts (exacerbating baseline LOS E or LOS F operations) at these two side-street stop-controlled intersections.

Although the remaining three study intersections are expected to continue operating at a desirable LOS (LOS D or better) at an overall intersection level during both peak hours in 2020 with and without the project in place, it should also be noted that it is possible that individual turning movements/approaches may operate below LOS D (the HDOT desired minimum operating level). The identified movement deficiencies at each location are summarized in **Table 7**.

TABLE 7: FUTURE (2020) SUMMARY OF TURNING MOVEMENTS OPERATING AT LOS E OR F

Intersection	Baseline Conditions		Plus Project	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
1. Pūlehu Road/ Ho'okele Street	Acceptable	NB L/T – LOS E SB L/T – LOS F	Acceptable	NB L/T – LOS E SB L/T – LOS F
2. Ho'okele Street/ Hana Highway	Acceptable	WBL – LOS E	Acceptable	WBL – LOS E
3. Pūlehu Road/ Hansen Road	NB LTR – LOS F SB LTR – LOS E	NB LTR – LOS E	NB LTR – LOS F SB LTR – LOS F	NB LTR – LOS F

TABLE 7: FUTURE (2020) SUMMARY OF TURNING MOVEMENTS OPERATING AT LOS E OR F

Intersection	Baseline Conditions		Plus Project	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
4. Mokulele Highway/ Hansen Road	WBL – LOS F SBL – LOS E	WBL – LOS E SBL – LOS E	WBL – LOS F SBL – LOS E	WBL – LOS E SBL – LOS E
5. Pūlehu Road/Access Road (South Project Driveway)	Does Not Exist		Acceptable	Acceptable

Source: Fehr & Peers, June 2016.

Notes:

Acceptable = Intersection and movements operate acceptably (LOS D or better).

NB = Northbound, EB = Eastbound, SB = Southbound, WB = Westbound

L = Left-Turn, R = Right-Turn, T = Through, LTR = Shared Left/Through/Right Lane, L/T = Shared Left/Through Lane

6.0 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 measures to address the identified traffic impacts are described later in this chapter. Each of the initially 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 Maui County and HDOT strive to maintain LOS D or better conditions at the movement level, measures to improve turning movement operations are only proposed where feasible and appropriate from a traffic engineering perspective since adding lanes or signal control just to achieve the desired LOS for a particular movement can 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, measures that only return operations to pre-project levels have initially been identified followed by improvements that will result in LOS D or better overall operations. 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., Maui Business Park II, other Pu'unēnē area uses, etc.). The potential improvements are listed in **Table 8**, which also summarizes the projected LOS in 2020 at the impacted locations with these proposed measures in place.

TABLE 8: FUTURE (2020) INTERSECTION LEVEL OF SERVICE RESULTS WITH MITIGATION

Scenario	Potential Improvement	AM Peak Hour		PM Peak Hour		Project Responsibility
		Delay	LOS	Delay	LOS	
1. Pūlehu Road/Ho'okele Street						
2020 No Project Conditions		22.6	C	**52.0**[5]	**F**	0%
Mitigated to Pre-Project or Better Conditions	Re-stripe NB and SB approaches w/ left-turn and shared through/right lane	23.3[1]	C[1]	**49.5**[5]	**E**	100%[3]
Mitigated to LOS D or Better Conditions	New traffic signal	16.4	B	11.0	B	1%[4] (Only when signal is warranted[2])
3. Pūlehu Road/Hansen Road						
2020 No Project Conditions		**>180**[6]	**F**	**42.8**[6]	**E**	0%
Mitigated to Pre-Project or Better Conditions	All-Way Stop Control	**60.4**	**F**	20.6	C	100%[3] (Only when MUTCD criteria is satisfied)
Mitigated to LOS D or Better Conditions	New traffic signal	10.1	B	7.1	A	4%[4] (Only when signal is warranted[2])

Source: Fehr & Peers, June 2016.

[1]Although the mitigation does not bring the delay of the worst movement back to pre-project conditions or better, it is was not identified as impacted in the AM peak hour under Future (2020) Conditions since it is projected to operate better than LOS D.

[2]It is recommended that the need for a traffic signal at these impacted locations be monitored as overall development and roadway extensions proceed in the greater study area and that signal installation be dependent on future traffic engineering studies and full warrant analysis.

[3] Since the costs for re-striping or installation of stop signs are relatively inexpensive we are assuming that the project can cover the costs of these improvements.

[4] Signal installation costs substantially more and so the project can make a fair share contribution to help fund the improvement's implementation based on the percentage of project vehicle trips that make up the total traffic at the intersection.

[5] Southbound shared left/through lane projected to operate with a delay of 52 seconds and movement LOS F during the PM peak hour under 2020 No Project Conditions. When pre-project mitigation is applied, this movement is projected to operate at a delay of 49.5 seconds and movement LOS E.

[6] Northbound shared left/through/right lane projected to operate with a delay of greater than 180 seconds and movement LOS F during the AM peak hour and a delay of 42.5 seconds and movement LOS E during the PM peak hour under 2020 No Project Conditions.

6.1 INTERSECTION 1: PŪLEHU ROAD/HO'OKELE STREET

At Intersection 1: Pūlehu Road/Ho'okele Street both the northbound and southbound through/left-turn movements are operating at LOS E or F in the PM peak hour under Future (2020) Conditions. The movement with the worst operations (i.e. the southbound through/left-turn) is reported in **Table 7** and **Table 8**.

The pre-project improvement would be to re-stripe the northbound and southbound approaches on Pūlehu Road from a shared left-turn/through lane and a separate right-turn lane, to a separate left-turn lane and a shared through/right-turn lane. Although these measures would mitigate the Future (2020) cumulative impact and reduce the vehicle delay to conditions better than the 2020 No Project Conditions, the southbound left-turn would still operate at LOS E. Installation of a traffic signal would be needed to improve PM peak hour operations of this movement to LOS D or better. As shown in **Table 8**, signal control at this intersection would improve peak hour operating conditions to a LOS B and should only be implemented when the warranted.

Overall, the project-generated traffic volume is estimated to represent only 1% of the total traffic at this location in 2020. Therefore, cumulative volumes generated by other developments along Ho'okele Street, such as the Maui Business Park, are projected to be the primary contributor to degrading intersection operations more so than the proposed Central Maui Landfill facilities. Other studies have assumed that this location will eventually be designed to State and/or County standards to provide an acceptable LOS based on the estimated traffic projections, which would include implementation of a signal. Per consultation with County staff, no plans are in place to construct a signal at this location; however, signalization at this location will most likely be a result of recurring signal warrant studies as parcels within the Maui Business Park are developed or as the County updates its own intersection studies.

6.2 INTERSECTION 3: PŪLEHU ROAD/HANSEN ROAD

Under Future (2020) plus Project conditions at Intersection 3: Pūlehu Road/Hansen Road, both the northbound and southbound single lane approaches are operating at LOS F in the AM peak hour, while in the PM peak hour only the northbound shared left/through/right lane is operating at a deficient LOS E. Per the *Traffic Impact Assessment Report for MEO Transportation Center* (Phillip Rowell and Associates, 2008), a separate northbound left turn lane was recommended as mitigation as part of the Pu'unēnē Baseyard project; however, the reconfiguration of the northbound approach on Pūlehu Road from a shared left/through/right lane to a left-turn lane and a shared through/right-turn lane would not bring the delay at this intersection back to pre-project conditions. Similarly, reconfiguration of both the northbound and southbound approach on Pūlehu Road from a shared left/through/right lane to a left-turn lane and a shared

through/right-turn lane would only mitigate the AM peak hour delay to pre-project conditions. In order to bring the intersection operations back to pre-project conditions or better under both peak hours, the traffic control at this intersection would need to be converted into an AWSC. However, the change in traffic control only partially mitigates the impact since the AM peak hour would still operate at LOS F. It should be noted that due to the change in stop control, all approaches would experience an average delay of 60 seconds with the AWSC, whereas if the intersection were to remain a TWSC only the worst approach/movement would operate at LOS F with a vehicle delay of greater than 180 seconds. Still, the AWSC mitigation could be an interim measure that can be installed quickly to improve the average amount of time a vehicle is stopped during the peak hours, while arrangements are being made for implementation of the full mitigation at this location (i.e. traffic signal). Also installation of an AWSC should only occur if it is justified per MUTCD criteria for multi-way stop application and after an in-depth engineering study.

Installation of a traffic signal is needed in order to improve both the AM and PM operating conditions to LOS D or better conditions. As shown in **Table 8**, signal control at this intersection would improve peak hour operating conditions to a LOS B or better and should only be implemented when warranted.

Overall, the added volume from the project makes up only 4% of the total traffic at Intersection 2: Pūlehu Road/Hansen Road Street in 2020. Thus, cumulative volumes generated by other developments and regional growth are projected to have a larger contribution in degrading the operations of this intersection than the proposed Central Maui Landfill facilities. 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. The project's financial responsibility should be commensurate with its traffic contribution.

7.0 ASSESSMENT OF SITE ACCESS & ON-SITE CIRCULATION

This chapter describes the evaluation proposed site access and on-site circulation within the proposed project.

7.1 SITE ACCESS & DRIVEWAY ASSESSMENT

Two driveways on the north side of Pūlehu Road will provide access to the project and into a network of interior roadways providing access to the ancillary uses. The northernmost driveway (Entrance 1 on the site plan) will initially be configured as a right-in/right-out driveway, with the option to be converted into a full access driveway in the future if needed. It is recommended that in lieu of this driveway providing full access, proper advance signage and a raised median island be installed at the driveway to physically restrict left turns in and out of the site. The southernmost driveway (Entrance 2), which intersects with the site's Access Road, would provide full access and is expected to be signed and operated as the main site driveway.

For conservative analysis purposes, this transportation assessment assigned all the project traffic to the primary driveway on Pūlehu Road and Access Road to evaluate traffic operations. The intersection analysis results under Future (2020) conditions demonstrates that this full access driveway would operate at LOS B or better during both the AM and PM peak hours even with all the project traffic assigned to it. Therefore, the driveway may operate at better levels since some project generated traffic is expected to enter and exit the site via the secondary project driveway to the north.

It is recommended that any signage and/or landscaping should not obstruct a driver's view on on-coming traffic on Pūlehu Road. With a posted speed of 45 mph and an assumed design speed of 50 mph, the minimum stopping sight distance of 425 feet should be provided per AASHTO's sight distance guidelines at each of the driveways. Based on a preliminary field assessment and the current site plan, approximately 500 feet of stopping sight distance is provided at Entrance 1 and more than 500 feet of stopping sight distance is provided at Entrance 2. Prior to the installation of any signage or new or modified landscaping as part of site development, available sight distance should be verified to ensure that these minimum distances are maintained.

7.2 ON-SITE CIRCULATION

The network of interior roadways provide access to the project's various ancillary buildings (e.g. the office building, the base yard, and the metals processing facility). On the southern perimeter of the project site, two internal roadways provide access to the existing Central Maui Landfill. The interior roadway aisles accommodate for two-way traffic and provide 90-degree parking spaces. All of the on-site roadways should include traveled ways of 24 feet in width to accommodate two-way traffic and larger vehicles. It should be noted that the expanded Central Maui Landfill is expected to periodically but infrequently host larger events on-site (e.g.. the household hazardous waste collection event held quarterly and car auctions at the abandoned vehicle yard held every two months). Accordingly the proposed parking supply would help accommodate the influx of patrons related to these events. Overall, the on-site vehicular circulation is generally considered to be acceptable, and no modifications are recommended.

APPENDIX A: TRAFFIC COUNTS

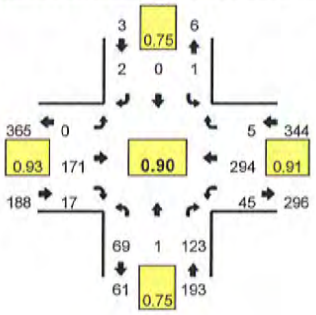
Type of peak hour being reported: Intersection Peak

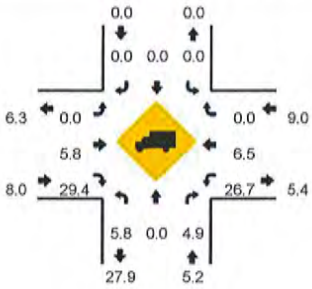
Method for determining peak hour: Total Entering Volume

LOCATION: Pulehu Rd -- Ho'okele St
CITY/STATE: Kahului, HI

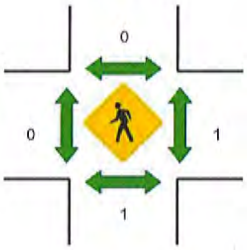
QC JOB #: 13803903
DATE: Tue, May 17 2016

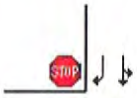
Peak-Hour: 7:30 AM -- 8:30 AM
Peak 15-Min: 7:45 AM -- 8:00 AM

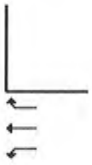




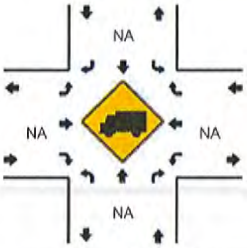
Quality Counts
TRANSPORTATION DATA COLLECTION SERVICES



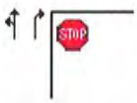


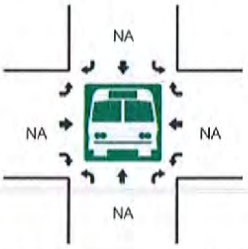












15-Min Count Period Beginning At	Pulehu Rd (Northbound)				Pulehu Rd (Southbound)				Ho'okele St (Eastbound)				Ho'okele St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	11	1	9	0	0	0	0	0	0	15	2	0	10	41	0	0	89	
6:15 AM	9	0	13	0	0	0	0	0	0	15	4	0	9	38	0	0	88	
6:30 AM	12	1	16	0	1	0	0	0	0	20	5	0	7	44	2	0	108	
6:45 AM	18	0	25	0	0	0	0	0	0	32	2	0	11	56	0	0	144	429
7:00 AM	22	0	20	0	1	0	0	0	0	28	6	0	8	52	1	0	138	478
7:15 AM	21	0	25	0	0	1	0	0	0	31	4	0	11	52	0	1	146	536
7:30 AM	17	0	31	0	0	0	0	0	0	34	1	0	8	74	0	0	165	593
7:45 AM	22	1	45	0	0	0	1	0	0	35	6	0	12	79	0	1	202	651
8:00 AM	19	0	21	0	0	0	0	0	0	48	5	0	9	66	1	0	169	682
8:15 AM	11	0	26	0	1	0	1	0	0	54	5	0	15	75	4	0	192	728
8:30 AM	13	0	16	0	0	0	0	0	1	48	7	0	12	54	0	0	151	714
8:45 AM	18	0	25	0	0	0	0	0	1	45	6	0	14	60	2	0	171	683

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	88	4	180	0	0	0	4	0	0	140	24	0	48	316	0	4	808
Heavy Trucks	0	0	4		0	0	0		0	8	12		12	28	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 6/1/2016 8:51 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

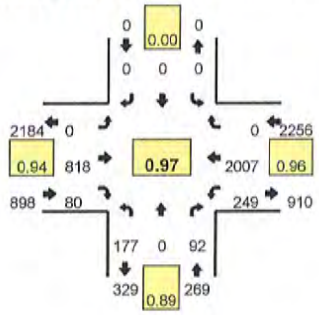
Type of peak hour being reported: Intersection Peak

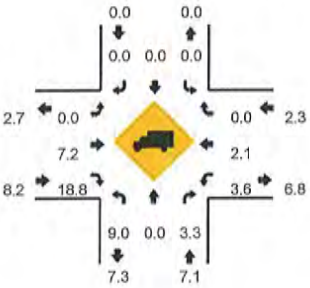
Method for determining peak hour: Total Entering Volume

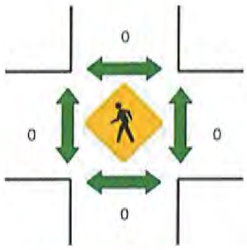
LOCATION: Ho'okele St -- Hana Hwy
CITY/STATE: Kahului, HI

QC JOB #: 13803901
DATE: Tue, May 17 2016

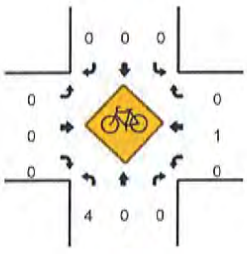
Peak-Hour: 7:15 AM -- 8:15 AM
Peak 15-Min: 7:15 AM -- 7:30 AM



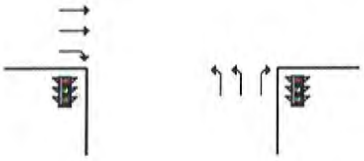


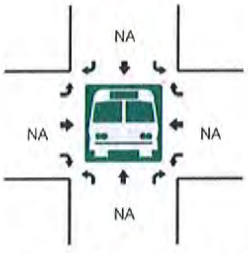












15-Min Count Period	Ho'okele St (Northbound)				Ho'okele St (Southbound)				Hana Hwy (Eastbound)				Hana Hwy (Westbound)				Total	Hourly Totals
Beginning At	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	16	0	7	0	0	0	0	0	0	79	15	0	36	249	0	0	402	
6:15 AM	17	0	13	0	0	0	0	0	0	113	14	0	37	388	0	0	582	
6:30 AM	23	0	8	0	0	0	0	0	0	139	12	0	43	433	0	0	658	
6:45 AM	39	0	18	0	0	0	0	0	0	156	15	0	54	541	0	0	823	2465
7:00 AM	24	0	24	0	0	0	0	0	0	215	21	0	43	486	0	0	813	2876
7:15 AM	41	0	19	0	0	0	0	0	0	225	17	0	52	532	0	0	886	3180
7:30 AM	33	0	23	0	0	0	0	0	0	199	19	0	61	513	0	0	848	3370
7:45 AM	57	0	26	0	0	0	0	0	0	193	22	0	69	478	0	0	845	3392
8:00 AM	46	0	24	0	0	0	0	0	0	201	22	0	67	484	0	0	844	3423
8:15 AM	50	0	33	0	0	0	0	0	0	202	36	0	51	356	0	0	728	3265
8:30 AM	34	0	25	0	0	0	0	0	0	192	20	1	42	334	0	0	648	3065
8:45 AM	47	0	27	0	0	0	0	0	0	179	34	0	46	356	0	0	689	2909

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	164	0	76	0	0	0	0	0	0	900	68	0	208	2128	0	0	3544
Heavy Trucks	20	0	4		0	0	0		0	40	20		0	44	0		128
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 6/1/2016 8:51 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

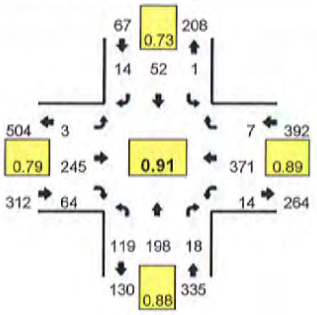
Type of peak hour being reported: Intersection Peak

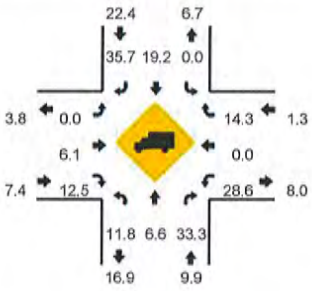
Method for determining peak hour: Total Entering Volume

LOCATION: Pulehu Rd -- Hansen Rd
CITY/STATE: Kahului, HI

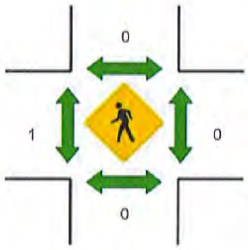
QC JOB #: 13803905
DATE: Thu, May 19 2016

Peak-Hour: 7:00 AM -- 8:00 AM
Peak 15-Min: 7:15 AM -- 7:30 AM



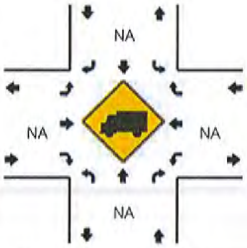


Quality Counts
TRANSPORTATION DATA COLLECTION SERVICES

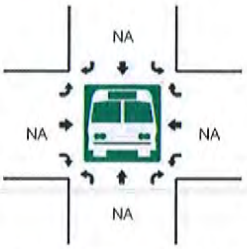












15-Min Count Period Beginning At	Pulehu Rd (Northbound)				Pulehu Rd (Southbound)				Hansen Rd (Eastbound)				Hansen Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	9	13	1	0	0	8	0	0	0	25	7	0	7	52	1	0	123	
6:15 AM	15	19	3	0	0	6	1	0	0	24	21	0	2	76	0	0	167	
6:30 AM	16	32	4	0	0	13	0	0	1	35	14	0	5	72	0	0	192	
6:45 AM	17	29	2	0	0	8	2	0	1	43	6	0	6	76	0	0	190	672
7:00 AM	28	46	0	0	0	9	3	0	0	67	12	0	4	72	2	0	243	792
7:15 AM	27	48	6	0	1	18	4	0	1	75	23	0	3	95	2	0	303	928
7:30 AM	31	59	7	0	0	8	3	0	0	59	15	0	4	98	2	0	286	1022
7:45 AM	33	45	5	0	0	17	4	0	2	44	14	0	3	106	1	0	274	1106
8:00 AM	39	37	5	0	0	10	2	0	0	55	8	0	5	67	0	0	228	1091
8:15 AM	21	35	5	0	0	9	5	0	1	35	14	0	5	63	0	0	193	981
8:30 AM	23	28	2	0	0	9	6	0	2	57	17	0	6	68	2	0	220	915
8:45 AM	13	29	3	0	1	14	1	0	0	46	10	0	10	65	0	0	192	833

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	108	192	24	0	4	72	16	0	4	300	92	0	12	380	8	0	1212
Heavy Trucks	20	8	8		0	16	8		0	12	12		4	0	0		88
Pedestrians		0				0				4				0			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 6/1/2016 8:51 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

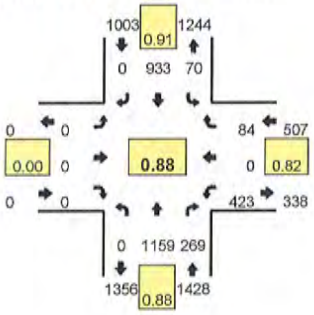
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

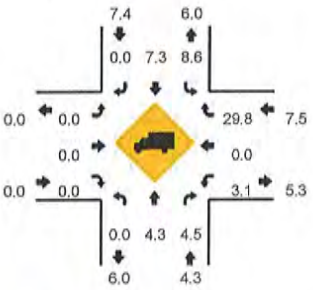
LOCATION: Mokulele Hwy -- Hansen Rd
CITY/STATE: Kahului, HI

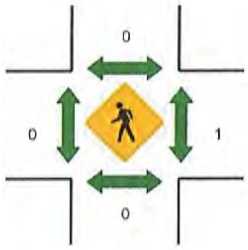
QC JOB #: 13803907
DATE: Tue, May 17 2016

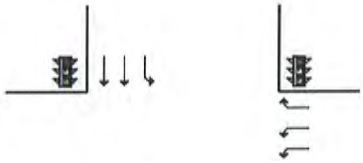
Peak-Hour: 7:00 AM -- 8:00 AM
Peak 15-Min: 7:30 AM -- 7:45 AM

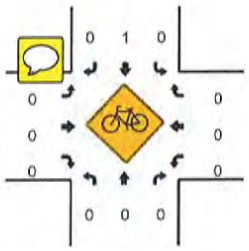


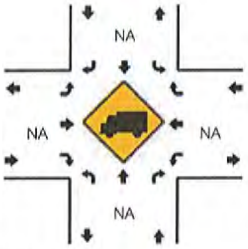


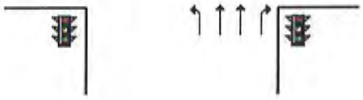


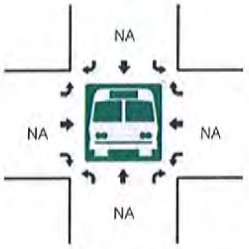












15-Min Count Period Beginning At	Mokulele Hwy (Northbound)				Mokulele Hwy (Southbound)				Hansen Rd (Eastbound)				Hansen Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	0	86	21	0	19	124	0	0	0	0	0	0	55	0	44	0	349	
6:15 AM	0	170	34	0	17	170	0	0	0	0	0	0	86	0	3	0	480	
6:30 AM	0	159	32	0	25	174	0	0	0	0	0	0	89	0	14	1	494	
6:45 AM	0	224	39	0	31	206	0	0	0	0	0	0	95	0	18	0	613	1936
7:00 AM	0	236	67	0	15	224	0	0	0	0	0	0	95	0	17	0	654	2241
7:15 AM	0	295	82	0	12	229	0	0	0	0	0	0	106	0	18	0	742	2503
7:30 AM	0	344	63	0	20	255	0	1	0	0	0	0	125	0	30	0	838	2847
7:45 AM	0	284	57	0	22	225	0	0	0	0	0	0	97	0	19	0	704	2938
8:00 AM	0	244	46	0	22	217	0	1	0	0	0	0	92	0	17	0	639	2923
8:15 AM	0	246	52	0	18	209	0	0	0	0	0	0	96	0	14	0	635	2816
8:30 AM	0	220	59	0	18	216	0	1	0	0	0	0	88	0	18	0	620	2598
8:45 AM	0	235	53	0	20	164	0	0	0	0	0	0	57	0	28	0	557	2451

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	1376	252	0	80	1020	0	4	0	0	0	0	500	0	120	0	3352
Heavy Trucks	0	40	12		8	92	0		0	0	0		8	0	32		192
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 6/1/2016 8:51 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

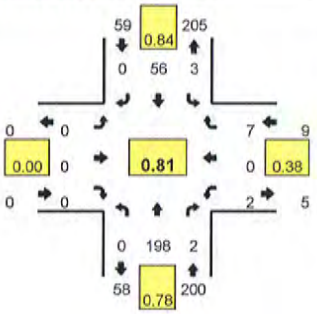
Type of peak hour being reported: Intersection Peak

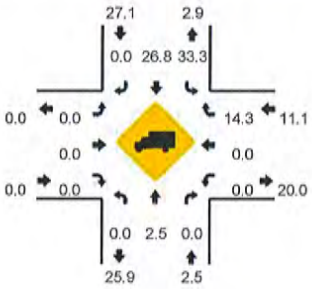
Method for determining peak hour: Total Entering Volume

LOCATION: Pulehu Rd -- Vehicle Yard Dwy
CITY/STATE: Kahului, HI

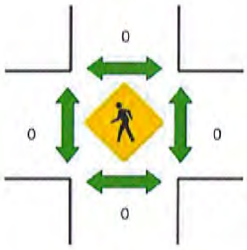
QC JOB #: 13803909
DATE: Tue, May 17 2016

Peak-Hour: 7:00 AM -- 8:00 AM
Peak 15-Min: 7:45 AM -- 8:00 AM



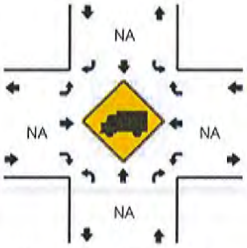


Quality Counts
TRANSPORTATION DATA COLLECTION SERVICES

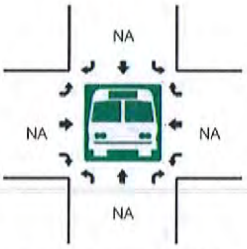












15-Min Count Period Beginning At	Pulehu Rd (Northbound)				Pulehu Rd (Southbound)				Vehicle Yard Dwy (Eastbound)				Vehicle Yard Dwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	0	21	0	0	2	9	0	0	0	0	0	0	0	0	1	0	33	
6:15 AM	0	18	0	0	3	10	0	0	0	0	0	0	0	0	0	0	31	
6:30 AM	0	28	0	0	1	7	0	0	0	0	0	0	0	0	0	0	36	
6:45 AM	0	48	0	0	0	15	0	0	0	0	0	0	0	0	1	0	64	164
7:00 AM	0	41	1	0	0	15	0	0	0	0	0	0	0	0	1	0	58	189
7:15 AM	0	42	0	0	1	15	0	0	0	0	0	0	1	0	5	0	64	222
7:30 AM	0	51	1	0	0	10	0	0	0	0	0	0	0	0	1	0	63	249
7:45 AM	0	64	0	0	2	16	0	0	0	0	0	0	1	0	0	0	83	268
8:00 AM	0	40	1	0	0	13	0	0	0	0	0	0	0	0	1	0	55	265
8:15 AM	0	33	0	0	1	19	0	0	0	0	0	0	0	0	2	0	55	256
8:30 AM	0	37	0	0	1	18	0	0	0	0	0	0	0	0	0	0	56	249
8:45 AM	0	33	0	0	1	21	0	0	0	0	0	0	0	0	2	0	57	223

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	256	0	0	8	64	0	0	0	0	0	0	4	0	0	0	332
Heavy Trucks	0	0	0		4	24	0		0	0	0		0	0	0		28
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 6/1/2016 8:51 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

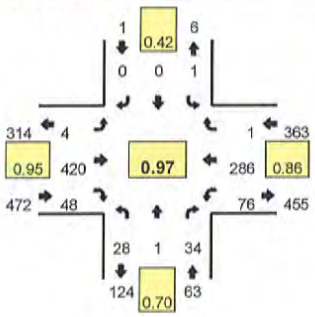
Type of peak hour being reported: Intersection Peak

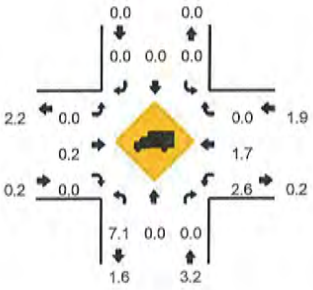
Method for determining peak hour: Total Entering Volume

LOCATION: Pulehu Rd -- Ho'okele St
CITY/STATE: Kahului, HI

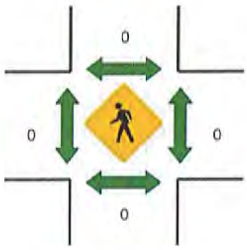
QC JOB #: 13803904
DATE: Tue, May 17 2016

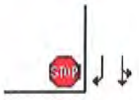
Peak-Hour: 4:15 PM -- 5:15 PM
Peak 15-Min: 4:30 PM -- 4:45 PM

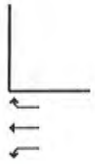


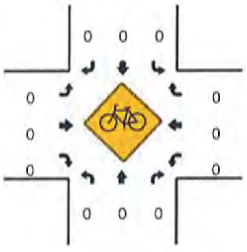


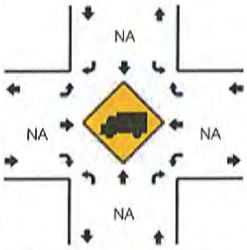
Quality Counts
TRANSPORTATION DATA COLLECTION SERVICES



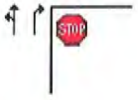


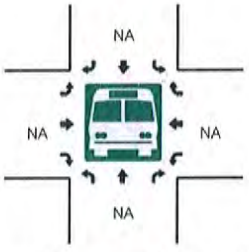












15-Min Count Period Beginning At	Pulehu Rd (Northbound)				Pulehu Rd (Southbound)				Ho'okele St (Eastbound)				Ho'okele St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	10	0	23	0	3	0	0	0	0	88	7	0	17	57	0	0	205	
3:15 PM	6	0	10	0	1	0	0	0	0	80	4	0	17	70	1	0	189	
3:30 PM	12	0	7	0	1	0	0	0	0	87	8	0	11	67	2	0	195	
3:45 PM	6	0	18	0	0	0	0	0	0	73	9	0	20	88	1	0	215	804
4:00 PM	6	0	11	0	1	0	0	0	0	90	8	0	12	66	0	0	194	793
4:15 PM	12	0	10	0	0	0	0	0	0	111	9	0	25	63	0	0	230	834
4:30 PM	5	0	7	0	0	0	0	0	0	111	8	0	19	82	0	0	232	871
4:45 PM	3	1	12	0	1	0	0	0	1	100	23	0	17	72	1	0	231	887
5:00 PM	8	0	5	0	0	0	0	0	3	98	8	0	15	69	0	0	206	899
5:15 PM	6	0	13	0	0	0	0	0	0	88	10	0	20	45	0	0	182	851
5:30 PM	3	0	4	0	0	0	0	0	0	66	10	0	10	67	1	0	161	780
5:45 PM	2	0	8	0	1	0	0	0	0	83	8	0	18	42	0	0	162	711

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	20	0	28	0	0	0	0	0	0	444	32	0	76	328	0	0	928
Heavy Trucks	0	0	0		0	0	0		0	4	0		4	0	0		8
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 6/1/2016 8:51 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

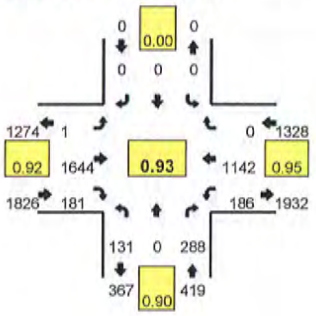
Type of peak hour being reported: Intersection Peak

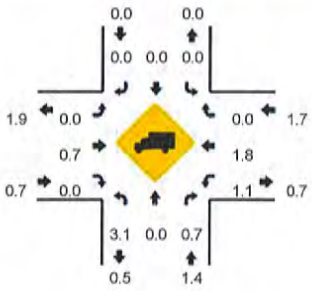
Method for determining peak hour: Total Entering Volume

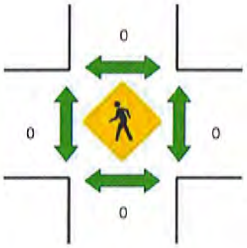
LOCATION: Ho'okele St -- Hana Hwy
CITY/STATE: Kahului, HI

QC JOB #: 13803902
DATE: Tue, May 17 2016

Peak-Hour: 3:45 PM -- 4:45 PM
Peak 15-Min: 4:30 PM -- 4:45 PM

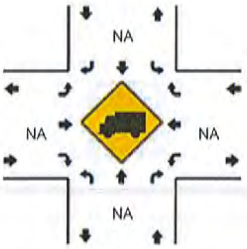


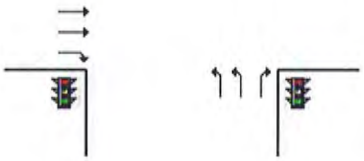


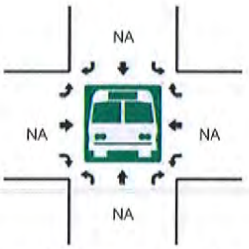












15-Min Count Period Beginning At	Ho'okele St (Northbound)				Ho'okele St (Southbound)				Hana Hwy (Eastbound)				Hana Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	55	0	58	0	0	0	0	0	0	293	36	0	38	292	0	0	772	
3:15 PM	43	0	47	0	0	0	0	0	0	306	49	0	41	318	0	0	804	
3:30 PM	36	0	53	0	0	0	0	0	0	334	42	0	44	314	0	0	823	
3:45 PM	32	0	55	0	0	0	0	0	0	395	45	1	57	318	0	0	903	3302
4:00 PM	33	0	65	0	0	0	0	0	0	405	43	0	42	296	0	0	884	3414
4:15 PM	29	0	83	0	0	0	0	0	0	394	41	0	34	248	0	0	829	3439
4:30 PM	37	0	85	0	0	0	0	0	0	450	52	0	53	280	0	0	957	3573
4:45 PM	36	0	70	0	0	0	0	0	0	455	41	0	45	234	0	0	881	3551
5:00 PM	20	0	80	0	0	0	0	0	0	488	49	1	37	214	0	0	889	3556
5:15 PM	38	0	61	0	0	0	0	0	0	403	27	0	31	238	0	0	798	3525
5:30 PM	19	0	46	0	0	0	0	0	0	404	43	0	38	230	0	0	780	3348
5:45 PM	26	0	62	0	0	0	0	0	0	328	26	0	28	202	0	0	672	3139

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	148	0	340	0	0	0	0	0	0	1800	208	0	212	1120	0	0	3828
Heavy Trucks	4	0	0		0	0	0		0	4	0		0	16	0		24
Pedestrians		0				0				0				0			0
Bicycles	0	0	2		0	0	0		0	0	0		0	0	0		2
Railroad																	
Stopped Buses																	

Comments:

Report generated on 6/1/2016 8:51 AM

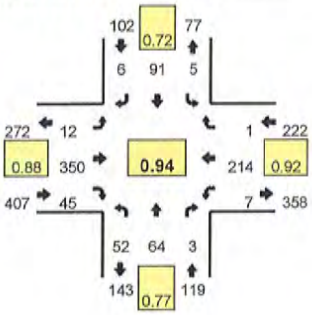
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

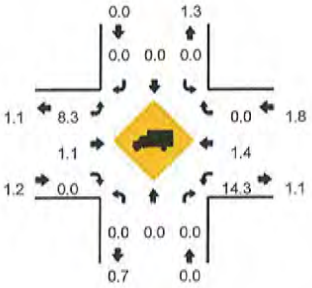
Method for determining peak hour: Total Entering Volume

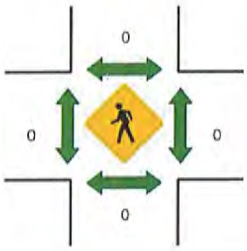
LOCATION: Pulehu Rd -- Hansen Rd
CITY/STATE: Kahului, HI

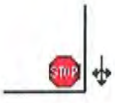
QC JOB #: 13803906
DATE: Wed, May 18 2016



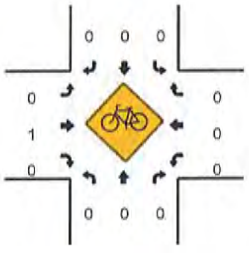
Peak-Hour: 3:30 PM -- 4:30 PM
Peak 15-Min: 3:30 PM -- 3:45 PM





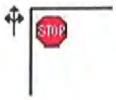


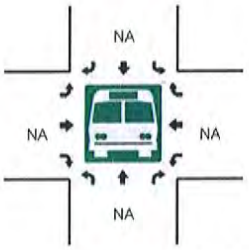












15-Min Count Period Beginning At	Pulehu Rd (Northbound)				Pulehu Rd (Southbound)				Hansen Rd (Eastbound)				Hansen Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	11	16	2	0	1	6	2	0	3	74	7	0	1	62	1	0	186	
3:15 PM	16	24	3	0	2	16	2	0	0	73	7	0	1	49	0	0	193	
3:30 PM	15	16	1	0	3	18	3	0	5	94	7	0	5	59	1	0	227	
3:45 PM	12	16	1	0	2	24	0	0	1	81	13	0	2	57	0	0	209	815
4:00 PM	16	13	0	0	0	23	3	0	2	79	13	0	0	46	0	0	195	824
4:15 PM	9	19	1	0	0	26	0	0	4	96	12	0	0	52	0	0	219	850
4:30 PM	17	11	0	0	1	18	1	0	4	103	13	0	4	46	0	0	218	841
4:45 PM	13	15	1	0	1	19	3	0	0	75	13	1	1	39	1	0	182	814
5:00 PM	3	4	0	0	2	35	0	0	1	65	13	0	1	42	0	0	166	785
5:15 PM	8	15	2	0	1	20	4	0	1	88	13	0	2	44	0	0	198	764
5:30 PM	8	11	2	0	0	19	0	0	0	75	10	0	3	37	0	0	165	711
5:45 PM	6	5	0	0	0	17	0	0	4	68	6	0	1	32	1	0	140	669

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	60	64	4	0	12	72	12	0	20	376	28	0	20	236	4	0	908
Heavy Trucks	0	0	0		0	0	0		0	8	0		4	8	0		20
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	1	0		0	0	0		1
Railroad Stopped Buses																	

Comments:

Report generated on 6/1/2016 8:51 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

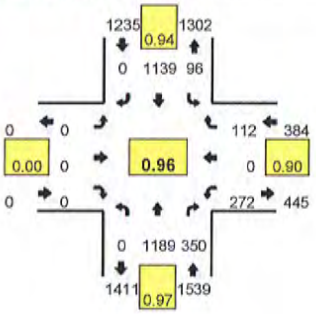
LOCATION: Mokulele Hwy -- Hansen Rd

QC JOB #: 13803908

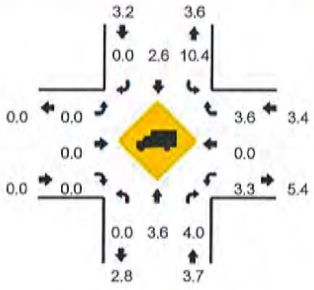
CITY/STATE: Kahului, HI

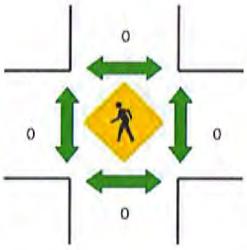
DATE: Tue, May 17 2016

Peak-Hour: 3:30 PM -- 4:30 PM
Peak 15-Min: 3:30 PM -- 3:45 PM





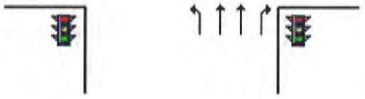


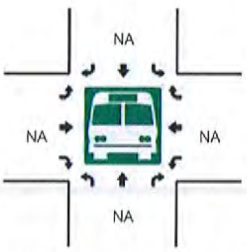












15-Min Count Period Beginning At	Mokulele Hwy (Northbound)				Mokulele Hwy (Southbound)				Hansen Rd (Eastbound)				Hansen Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	0	239	70	0	20	238	0	1	0	0	0	0	72	0	36	0	676	
3:15 PM	0	300	81	0	19	266	0	1	0	0	0	0	66	0	11	0	744	
3:30 PM	0	326	76	0	19	298	0	0	0	0	0	0	59	0	46	0	824	
3:45 PM	0	282	114	0	33	274	0	1	0	0	0	0	74	0	26	0	804	3048
4:00 PM	0	313	68	0	15	289	0	0	0	0	0	0	62	0	27	0	774	3146
4:15 PM	0	268	92	0	28	278	0	0	0	0	0	0	77	0	13	0	756	3158
4:30 PM	0	306	87	0	34	299	0	0	0	0	0	0	56	0	27	0	809	3143
4:45 PM	0	246	85	0	20	269	0	0	0	0	0	0	55	0	16	0	691	3030
5:00 PM	0	217	98	0	20	289	0	1	0	0	0	0	37	0	17	0	679	2935
5:15 PM	0	225	89	0	39	236	0	0	0	0	0	0	47	0	14	0	650	2829
5:30 PM	0	238	88	0	24	249	0	0	0	0	0	0	51	0	7	0	657	2677
5:45 PM	0	201	70	0	20	234	0	0	0	0	0	0	44	0	12	0	581	2567

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	1304	304	0	76	1192	0	0	0	0	0	0	236	0	184	0	3296
Heavy Trucks	0	40	8		16	40	0		0	0	0		12	0	12		128
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 6/1/2016 8:51 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

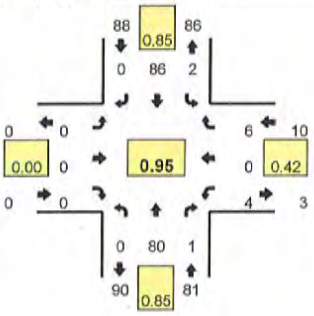
Type of peak hour being reported: Intersection Peak

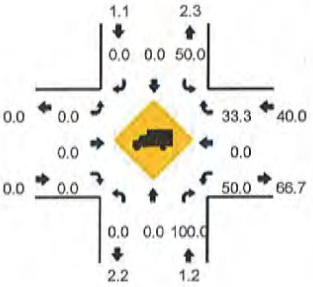
Method for determining peak hour: Total Entering Volume

LOCATION: Pulehu Rd -- Vehicle Yard Dwy
CITY/STATE: Kahului, HI

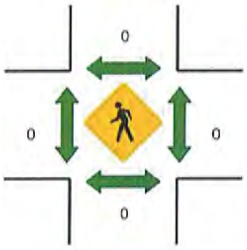
QC JOB #: 13803910
DATE: Wed, May 18 2016

Peak-Hour: 3:15 PM -- 4:15 PM
Peak 15-Min: 3:30 PM -- 3:45 PM

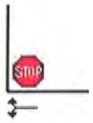


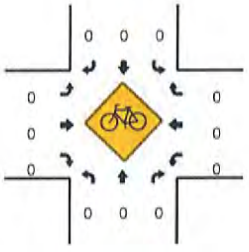


Quality Counts
TRANSPORTATION DATA COLLECTION SERVICES



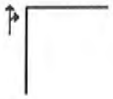


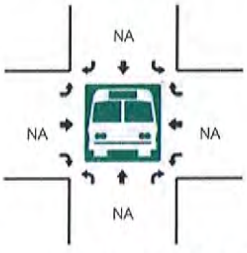












15-Min Count Period Beginning At	Pulehu Rd (Northbound)				Pulehu Rd (Southbound)				Vehicle Yard Dwy (Eastbound)				Vehicle Yard Dwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	0	23	0	0	0	16	0	0	0	0	0	0	0	0	0	0	39	
3:15 PM	0	19	1	0	1	17	0	0	0	0	0	0	1	0	5	0	44	
3:30 PM	0	25	0	0	1	19	0	0	0	0	0	0	2	0	0	0	47	
3:45 PM	0	17	0	0	0	26	0	0	0	0	0	0	1	0	0	0	44	174
4:00 PM	0	19	0	0	0	24	0	0	0	0	0	0	0	0	1	0	44	179
4:15 PM	0	10	0	0	1	29	0	0	0	0	0	0	0	0	0	0	40	175
4:30 PM	0	25	1	0	0	23	0	0	0	0	0	0	2	0	0	0	51	179
4:45 PM	0	15	1	0	0	21	0	0	0	0	0	0	0	0	0	0	37	172
5:00 PM	0	7	0	0	1	30	0	0	0	0	0	0	0	0	2	0	40	168
5:15 PM	0	12	0	0	0	31	0	0	0	0	0	0	0	0	0	0	43	171
5:30 PM	0	15	0	0	1	20	0	0	0	0	0	0	0	0	0	0	36	156
5:45 PM	0	7	0	0	0	21	0	0	0	0	0	0	0	0	0	0	28	147

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	100	0	0	4	76	0	0	0	0	0	0	8	0	0	0	188
Heavy Trucks	0	0	0		4	0	0		0	0	0		4	0	0		8
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 6/1/2016 8:51 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

LOCATION: Pulehu Rd S of Hansen Rd
SPECIFIC LOCATION: Pulehu Rd S of Hansen Rd
CITY/STATE: Kula, HI

QC JOB #: 13803911
DIRECTION: NB
DATE: May 17 2016

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
1:00 AM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
2:00 AM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
3:00 AM	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
4:00 AM	0	3	2	0	1	0	0	0	0	0	0	0	0	0	6
5:00 AM	0	15	18	0	2	0	0	0	0	0	0	0	0	0	35
6:00 AM	2	63	81	0	15	5	0	0	0	0	0	0	0	1	167
7:00 AM	**5**	98	**87**	1	28	5	0	2	0	0	0	0	0	**65**	**291**
8:00 AM	1	**115**	74	1	26	**10**	0	**4**	2	0	0	0	0	9	242
9:00 AM	1	60	69	1	**33**	9	0	2	**3**	0	0	0	0	5	183
10:00 AM	1	54	69	**5**	31	7	0	3	2	0	0	0	0	10	182
11:00 AM	0	42	83	0	32	4	0	3	1	0	0	0	0	4	169
12:00 PM	0	49	**91**	**4**	23	**9**	0	0	0	0	0	0	0	**7**	**183**
1:00 PM	1	53	62	1	**27**	5	0	**4**	0	0	0	0	0	4	157
2:00 PM	1	60	81	2	18	4	0	2	**1**	0	0	0	0	4	173
3:00 PM	0	**67**	52	2	11	1	0	1	0	0	0	0	0	0	134
4:00 PM	0	57	45	0	16	0	0	1	0	0	0	0	0	2	121
5:00 PM	**2**	51	26	0	6	0	0	2	0	0	0	0	0	1	88
6:00 PM	0	32	19	0	5	0	0	0	0	0	0	0	0	2	58
7:00 PM	0	21	15	0	3	0	0	1	0	0	0	0	0	1	41
8:00 PM	0	12	7	0	1	0	0	0	0	0	0	0	0	0	20
9:00 PM	0	4	3	0	1	0	0	0	0	0	0	0	0	0	8
10:00 PM	0	2	2	0	0	0	0	0	0	0	0	0	0	0	4
11:00 PM	0	2	1	0	1	0	0	0	0	0	0	0	0	0	4
Day Total	14	865	887	17	280	59	0	25	9	0	0	0	0	115	2271
Percent	0.6%	38.1%	39.1%	0.7%	12.3%	2.6%	0.0%	1.1%	0.4%	0.0%	0.0%	0.0%	0.0%	5.1%	
ADT 2271															
AM Peak	7:00 AM	8:00 AM	7:00 AM	10:00 AM	9:00 AM	8:00 AM		8:00 AM	9:00 AM					7:00 AM	7:00 AM
Volume	5	115	87	5	33	10		4	3					65	291
PM Peak	5:00 PM	3:00 PM	12:00 PM	12:00 PM	1:00 PM	12:00 PM		1:00 PM	2:00 PM					12:00 PM	12:00 PM
Volume	2	67	91	4	27	9		4	1					7	183

Comments:

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

LOCATION: Pulehu Rd S of Hansen Rd
SPECIFIC LOCATION: Pulehu Rd S of Hansen Rd
CITY/STATE: Kula, HI

QC JOB #: 13803911
DIRECTION: NB
DATE: May 18 2016

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
1:00 AM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
2:00 AM	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
3:00 AM	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
4:00 AM	0	2	2	0	0	0	0	0	0	0	0	0	0	0	4
5:00 AM	0	21	17	0	2	0	0	1	0	0	0	0	0	0	41
6:00 AM	3	61	65	2	13	2	0	1	**1**	0	0	0	0	1	149
7:00 AM	**5**	**125**	76	1	19	**5**	0	4	0	0	0	0	0	**70**	**305**
8:00 AM	1	101	71	2	23	3	0	2	1	0	0	0	0	9	213
9:00 AM	1	73	70	3	31	5	0	3	1	0	0	0	0	4	191
10:00 AM	2	62	**91**	**5**	25	2	0	2	1	0	0	0	0	7	197
11:00 AM	0	53	68	2	**35**	2	0	**5**	1	0	0	0	0	4	170
12:00 PM	0	62	62	**2**	21	**5**	0	**4**	**1**	0	0	0	0	9	166
1:00 PM	0	54	**71**	1	**25**	2	0	0	1	0	0	0	0	**12**	166
2:00 PM	0	61	66	1	23	3	0	3	1	0	0	0	0	9	**167**
3:00 PM	0	**73**	41	0	13	4	0	1	0	0	0	0	0	3	135
4:00 PM	0	57	42	0	16	0	0	1	0	0	0	0	0	3	119
5:00 PM	0	42	19	0	4	0	0	1	0	0	0	0	0	2	68
6:00 PM	0	25	7	0	7	0	0	1	0	0	0	0	0	0	40
7:00 PM	0	13	6	0	5	0	0	0	0	0	0	0	0	0	24
8:00 PM	0	16	6	0	0	0	0	0	0	0	0	0	0	0	22
9:00 PM	0	9	2	0	0	0	0	0	0	0	0	0	0	0	11
10:00 PM	0	3	4	0	0	0	0	0	0	0	0	0	0	0	7
11:00 PM	0	2	1	0	0	0	0	0	0	0	0	0	0	1	4
Day Total	12	921	788	19	262	33	0	29	8	0	0	0	0	134	2206
Percent	0.5%	41.7%	35.7%	0.9%	11.9%	1.5%	0.0%	1.3%	0.4%	0.0%	0.0%	0.0%	0.0%	6.1%	
ADT 2206															
AM Peak	7:00 AM	7:00 AM	10:00 AM	10:00 AM	11:00 AM	7:00 AM		11:00 AM	6:00 AM					7:00 AM	7:00 AM
Volume	5	125	91	5	35	5		5	1					70	305
PM Peak		3:00 PM	1:00 PM	12:00 PM	1:00 PM	12:00 PM		12:00 PM	12:00 PM					1:00 PM	2:00 PM
Volume		73	71	2	25	5		4	1					12	167

Comments:

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

SUMMARY - Tube Count - Vehicle Classification Data

LOCATION: Pulehu Rd S of Hansen Rd
SPECIFIC LOCATION: Pulehu Rd S of Hansen Rd
CITY/STATE: Kula, HI

QC JOB #: 13803911
DIRECTION: NB
DATE: May 17 2016 - May 18 2016

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
Grand Total	26	1786	1675	36	542	92	0	54	17	0	0	0	0	249	4477
Percent	0.6%	39.9%	37.4%	0.8%	12.1%	2.1%	0.0%	1.2%	0.4%	0.0%	0.0%	0.0%	0.0%	5.6%	

ADT 2238



Comments:

Report generated on 5/27/2016 10:24 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Quality Counts

LOCATION: Pulehu Rd S of Hansen Rd
SPECIFIC LOCATION: Pulehu Rd S of Hansen Rd
CITY/STATE: Kula, HI

QC JOB #: 13803911
DIRECTION: NB
DATE: May 17 2016 - May 18 2016

Start Time	Mon	Tue 17-May-16	Wed 18-May-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM		1	2			2			2	
1:00 AM		1	1			1			1	
2:00 AM		1	2			2			2	
3:00 AM		2	2			2			2	
4:00 AM		6	4			5			5	
5:00 AM		35	41			38			38	
6:00 AM		167	149			158			158	
7:00 AM		**291**	**305**			**298**			**298**	
8:00 AM		242	213			228			228	
9:00 AM		183	191			187			187	
10:00 AM		182	197			190			190	
11:00 AM		169	170			170			170	
12:00 PM		**183**	166			**175**			**175**	
1:00 PM		157	166			162			162	
2:00 PM		173	**167**			170			170	
3:00 PM		134	135			135			135	
4:00 PM		121	119			120			120	
5:00 PM		88	68			78			78	
6:00 PM		58	40			49			49	
7:00 PM		41	24			33			33	
8:00 PM		20	22			21			21	
9:00 PM		8	11			10			10	
10:00 PM		4	7			6			6	
11:00 PM		4	4			4			4	
Day Total		2271	2206			2244			2244	
% Weekday Average		101.2%	98.3%							
% Week Average		101.2%	98.3%			100.0%				
AM Peak Volume		7:00 AM 291	7:00 AM 305			7:00 AM 298			7:00 AM 298	
PM Peak Volume		12:00 PM 183	2:00 PM 167			12:00 PM 175			12:00 PM 175	

Comments:

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

LOCATION: Pulehu Rd S of Hansen Rd
SPECIFIC LOCATION: Pulehu Rd S of Hansen Rd
CITY/STATE: Kula, HI

QC JOB #: 13803911
DIRECTION: SB
DATE: May 17 2016

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
1:00 AM	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
2:00 AM	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
3:00 AM	0	0	3	0	0	0	0	0	0	0	0	0	0	1	4
4:00 AM	0	2	6	0	1	0	0	0	0	0	0	0	0	0	9
5:00 AM	0	8	20	1	3	0	0	0	0	0	0	0	0	0	32
6:00 AM	0	26	47	4	20	5	0	**3**	0	0	0	0	0	3	108
7:00 AM	**2**	18	40	1	20	6	0	1	0	0	0	0	0	**37**	125
8:00 AM	0	33	56	4	31	7	0	2	**2**	0	0	0	0	11	146
9:00 AM	0	28	51	4	31	**9**	0	1	1	0	0	0	0	4	129
10:00 AM	0	**40**	**75**	**5**	20	7	0	2	0	0	0	0	0	11	**160**
11:00 AM	0	34	74	4	**33**	2	0	0	1	0	0	0	0	4	152
12:00 PM	0	38	70	1	**32**	**8**	0	2	**1**	0	0	0	0	7	159
1:00 PM	0	48	52	**3**	25	7	0	**3**	0	0	0	0	0	**10**	148
2:00 PM	0	56	**75**	1	29	2	0	2	0	0	0	0	0	6	**171**
3:00 PM	**2**	63	55	1	21	0	0	1	0	0	0	0	0	1	144
4:00 PM	0	**76**	48	0	28	0	0	0	1	0	0	0	0	0	153
5:00 PM	1	74	49	0	14	0	0	0	0	0	0	0	0	3	141
6:00 PM	0	66	31	0	10	0	0	1	0	0	0	0	0	4	112
7:00 PM	0	41	21	0	12	0	0	0	0	0	0	0	0	1	75
8:00 PM	0	24	14	0	3	0	0	0	0	0	0	0	0	0	41
9:00 PM	0	11	12	0	0	0	0	0	0	0	0	0	0	1	24
10:00 PM	0	12	8	0	2	0	0	0	0	0	0	0	0	0	22
11:00 PM	0	5	6	0	0	0	0	0	0	0	0	0	0	0	11
Day Total	5	709	814	29	335	53	0	18	6	0	0	0	0	104	2073
Percent	0.2%	34.2%	39.3%	1.4%	16.2%	2.6%	0.0%	0.9%	0.3%	0.0%	0.0%	0.0%	0.0%	5.0%	
ADT 2073															
AM Peak	7:00 AM	10:00 AM	10:00 AM	10:00 AM	11:00 AM	9:00 AM		6:00 AM	8:00 AM					7:00 AM	10:00 AM
Volume	2	40	75	5	33	9		3	2					37	160
PM Peak	3:00 PM	4:00 PM	2:00 PM	1:00 PM	12:00 PM	12:00 PM		1:00 PM	12:00 PM					1:00 PM	2:00 PM
Volume	2	76	75	3	32	8		3	1					10	171

Comments:

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

LOCATION: Pulehu Rd S of Hansen Rd
SPECIFIC LOCATION: Pulehu Rd S of Hansen Rd
CITY/STATE: Kula, HI

QC JOB #: 13803911
DIRECTION: SB
DATE: May 18 2016

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	2	4	0	0	0	0	0	0	0	0	0	0	0	6
1:00 AM	0	1	1	0	1	0	0	0	0	0	0	0	0	0	3
2:00 AM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
3:00 AM	0	0	2	0	1	0	0	0	0	0	0	0	0	0	3
4:00 AM	0	3	1	0	1	0	0	0	0	0	0	0	0	0	5
5:00 AM	0	12	16	0	9	0	0	0	0	0	0	0	0	0	37
6:00 AM	**1**	26	42	**5**	17	4	0	3	1	0	0	0	0	0	99
7:00 AM	0	24	31	3	20	0	0	0	0	0	0	0	0	**41**	119
8:00 AM	1	34	45	3	27	2	**1**	**4**	1	0	0	0	0	10	128
9:00 AM	0	30	64	5	31	2	0	2	1	0	0	0	0	2	137
10:00 AM	0	**43**	**71**	2	33	2	0	3	**2**	0	0	0	0	8	**164**
11:00 AM	1	40	69	2	**34**	**6**	0	2	2	0	0	0	0	4	160
12:00 PM	0	40	60	3	21	3	0	**5**	**1**	0	0	0	0	**21**	154
1:00 PM	**2**	41	58	**4**	**30**	2	0	0	0	0	0	0	0	19	**156**
2:00 PM	1	51	52	0	30	**4**	0	3	0	0	0	0	0	7	148
3:00 PM	0	49	37	0	12	0	0	2	0	0	0	0	0	1	101
4:00 PM	0	60	63	0	26	0	0	1	0	0	0	0	0	3	153
5:00 PM	0	**65**	**65**	0	13	0	0	1	0	0	0	0	0	5	149
6:00 PM	0	26	42	0	13	0	0	0	0	0	0	0	0	0	81
7:00 PM	1	28	29	0	9	0	0	0	0	0	0	0	0	0	67
8:00 PM	0	17	25	0	4	0	0	0	0	0	0	0	0	0	46
9:00 PM	0	13	11	0	5	0	0	0	0	0	0	0	0	0	29
10:00 PM	0	13	11	0	2	0	0	0	0	0	0	0	0	0	26
11:00 PM	0	7	5	0	0	0	0	0	0	0	0	0	0	0	12
Day Total	7	626	804	27	339	25	1	26	8	0	0	0	0	121	1984
Percent	0.4%	31.6%	40.5%	1.4%	17.1%	1.3%	0.1%	1.3%	0.4%	0.0%	0.0%	0.0%	0.0%	6.1%	
ADT 1984															
AM Peak	6:00 AM	10:00 AM	10:00 AM	6:00 AM	11:00 AM	11:00 AM	8:00 AM	8:00 AM	10:00 AM					7:00 AM	10:00 AM
Volume	1	43	71	5	34	6	1	4	2					41	164
PM Peak	1:00 PM	5:00 PM	5:00 PM	1:00 PM	1:00 PM	2:00 PM		12:00 PM	12:00 PM					12:00 PM	1:00 PM
Volume	2	65	65	4	30	4		5	1					21	156

Comments:

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

SUMMARY - Tube Count - Vehicle Classification Data

LOCATION: Pulehu Rd S of Hansen Rd
SPECIFIC LOCATION: Pulehu Rd S of Hansen Rd
CITY/STATE: Kula, HI

QC JOB #: 13803911
DIRECTION: SB
DATE: May 17 2016 - May 18 2016

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
Grand Total	12	1335	1618	56	674	78	1	44	14	0	0	0	0	225	4057
Percent	0.3%	32.9%	39.9%	1.4%	16.6%	1.9%	0.0%	1.1%	0.3%	0.0%	0.0%	0.0%	0.0%	5.5%	
ADT 2028															

Comments:

Report generated on 5/27/2016 10:24 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Quality Counts

LOCATION: Pulehu Rd S of Hansen Rd
SPECIFIC LOCATION: Pulehu Rd S of Hansen Rd
CITY/STATE: Kula, HI

QC JOB #: 13803911
DIRECTION: SB
DATE: May 17 2016 - May 18 2016

Start Time	Mon	Tue 17-May-16	Wed 18-May-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM		3	6			5			5	
1:00 AM		2	3			3			3	
2:00 AM		2	1			2			2	
3:00 AM		4	3			4			4	
4:00 AM		9	5			7			7	
5:00 AM		32	37			35			35	
6:00 AM		108	99			104			104	
7:00 AM		125	119			122			122	
8:00 AM		146	128			137			137	
9:00 AM		129	137			133			133	
10:00 AM		**160**	**164**			**162**			**162**	
11:00 AM		152	160			156			156	
12:00 PM		159	154			157			157	
1:00 PM		148	**156**			152			152	
2:00 PM		**171**	148			**160**			**160**	
3:00 PM		144	101			123			123	
4:00 PM		153	153			153			153	
5:00 PM		141	149			145			145	
6:00 PM		112	81			97			97	
7:00 PM		75	67			71			71	
8:00 PM		41	46			44			44	
9:00 PM		24	29			27			27	
10:00 PM		22	26			24			24	
11:00 PM		11	12			12			12	
Day Total		2073	1984			2035			2035	
% Weekday Average		101.9%	97.5%							
% Week Average		101.9%	97.5%			100.0%				
AM Peak Volume		10:00 AM 160	10:00 AM 164			10:00 AM 162			10:00 AM 162	
PM Peak Volume		2:00 PM 171	1:00 PM 156			2:00 PM 160			2:00 PM 160	

Comments:

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

LOCATION: Pulehu Rd S of Hansen Rd
SPECIFIC LOCATION: Pulehu Rd S of Hansen Rd
CITY/STATE: Kula, HI

QC JOB #: 13803911
DIRECTION: NB/SB
DATE: May 17 2016

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
1:00 AM	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
2:00 AM	0	2	1	0	0	0	0	0	0	0	0	0	0	0	3
3:00 AM	0	2	3	0	0	0	0	0	0	0	0	0	0	1	6
4:00 AM	0	5	8	0	2	0	0	0	0	0	0	0	0	0	15
5:00 AM	0	23	38	1	5	0	0	0	0	0	0	0	0	0	67
6:00 AM	2	89	128	4	35	10	0	3	0	0	0	0	0	4	275
7:00 AM	**7**	116	127	2	48	11	0	3	0	0	0	0	0	**102**	**416**
8:00 AM	1	**148**	130	5	57	17	0	**6**	**4**	0	0	0	0	20	388
9:00 AM	1	88	120	5	64	**18**	0	3	4	0	0	0	0	9	312
10:00 AM	1	94	144	**10**	51	14	0	5	2	0	0	0	0	21	342
11:00 AM	0	76	**157**	4	**65**	6	0	3	2	0	0	0	0	8	321
12:00 PM	0	87	**161**	**5**	**55**	**17**	0	2	**1**	0	0	0	0	**14**	342
1:00 PM	1	101	114	4	52	12	0	**7**	0	0	0	0	0	14	305
2:00 PM	1	116	156	3	47	6	0	4	1	0	0	0	0	10	**344**
3:00 PM	2	130	107	3	32	1	0	2	0	0	0	0	0	1	278
4:00 PM	0	**133**	93	0	44	0	0	1	1	0	0	0	0	2	274
5:00 PM	**3**	125	75	0	20	0	0	2	0	0	0	0	0	4	229
6:00 PM	0	98	50	0	15	0	0	1	0	0	0	0	0	6	170
7:00 PM	0	62	36	0	15	0	0	1	0	0	0	0	0	2	116
8:00 PM	0	36	21	0	4	0	0	0	0	0	0	0	0	0	61
9:00 PM	0	15	15	0	1	0	0	0	0	0	0	0	0	1	32
10:00 PM	0	14	10	0	2	0	0	0	0	0	0	0	0	0	26
11:00 PM	0	7	7	0	1	0	0	0	0	0	0	0	0	0	15
Day Total	19	1574	1701	46	615	112	0	43	15	0	0	0	0	219	4344
Percent	0.4%	36.2%	39.2%	1.1%	14.2%	2.6%	0.0%	1.0%	0.3%	0.0%	0.0%	0.0%	0.0%	5.0%	
ADT 4344															
AM Peak Volume	7:00 AM 7	8:00 AM 148	11:00 AM 157	10:00 AM 10	11:00 AM 65	9:00 AM 18		8:00 AM 6	8:00 AM 4					7:00 AM 102	7:00 AM 416
PM Peak Volume	5:00 PM 3	4:00 PM 133	12:00 PM 161	12:00 PM 5	12:00 PM 55	12:00 PM 17		1:00 PM 7	12:00 PM 1					12:00 PM 14	2:00 PM 344

Comments:

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

LOCATION: Pulehu Rd S of Hansen Rd
SPECIFIC LOCATION: Pulehu Rd S of Hansen Rd
CITY/STATE: Kula, HI

QC JOB #: 13803911
DIRECTION: NB/SB
DATE: May 18 2016

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
12:00 AM	0	4	4	0	0	0	0	0	0	0	0	0	0	0	8
1:00 AM	0	2	1	0	1	0	0	0	0	0	0	0	0	0	4
2:00 AM	0	2	1	0	0	0	0	0	0	0	0	0	0	0	3
3:00 AM	0	2	2	0	1	0	0	0	0	0	0	0	0	0	5
4:00 AM	0	5	3	0	1	0	0	0	0	0	0	0	0	0	9
5:00 AM	0	33	33	0	11	0	0	1	0	0	0	0	0	0	78
6:00 AM	4	87	107	7	30	6	0	4	2	0	0	0	0	1	248
7:00 AM	**5**	**149**	107	4	39	5	0	4	0	0	0	0	0	**111**	**424**
8:00 AM	2	135	116	5	50	5	**1**	6	2	0	0	0	0	19	341
9:00 AM	1	103	134	**8**	62	7	0	5	2	0	0	0	0	6	328
10:00 AM	2	105	**162**	7	58	4	0	5	**3**	0	0	0	0	15	361
11:00 AM	1	93	137	4	**69**	**8**	0	**7**	3	0	0	0	0	8	330
12:00 PM	0	102	122	**5**	42	**8**	0	**9**	**2**	0	0	0	0	30	320
1:00 PM	**2**	95	**129**	5	**55**	4	0	0	1	0	0	0	0	**31**	**322**
2:00 PM	1	112	118	1	53	7	0	6	1	0	0	0	0	16	315
3:00 PM	0	**122**	78	0	25	4	0	3	0	0	0	0	0	4	236
4:00 PM	0	117	105	0	42	0	0	2	0	0	0	0	0	6	272
5:00 PM	0	107	84	0	17	0	0	2	0	0	0	0	0	7	217
6:00 PM	0	51	49	0	20	0	0	1	0	0	0	0	0	0	121
7:00 PM	1	41	35	0	14	0	0	0	0	0	0	0	0	0	91
8:00 PM	0	33	31	0	4	0	0	0	0	0	0	0	0	0	68
9:00 PM	0	22	13	0	5	0	0	0	0	0	0	0	0	0	40
10:00 PM	0	16	15	0	2	0	0	0	0	0	0	0	0	0	33
11:00 PM	0	9	6	0	0	0	0	0	0	0	0	0	0	1	16
Day Total	19	1547	1592	46	601	58	1	55	16	0	0	0	0	255	4190
Percent	0.5%	36.9%	38.0%	1.1%	14.3%	1.4%	0.0%	1.3%	0.4%	0.0%	0.0%	0.0%	0.0%	6.1%	
ADT 4190															
AM Peak Volume	7:00 AM 5	7:00 AM 149	10:00 AM 162	9:00 AM 8	11:00 AM 69	11:00 AM 8	8:00 AM 1	11:00 AM 7	10:00 AM 3					7:00 AM 111	7:00 AM 424
PM Peak Volume	1:00 PM 2	3:00 PM 122	1:00 PM 129	12:00 PM 5	1:00 PM 55	12:00 PM 8		12:00 PM 9	12:00 PM 2					1:00 PM 31	1:00 PM 322

Comments:

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

SUMMARY - Tube Count - Vehicle Classification Data

LOCATION: Pulehu Rd S of Hansen Rd
SPECIFIC LOCATION: Pulehu Rd S of Hansen Rd
CITY/STATE: Kula, HI

QC JOB #: 13803911
DIRECTION: NB/SB
DATE: May 17 2016 - May 18 2016

Start Time	Motor-cycles	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axle Double	5 Axle Double	>6 Axle Double	<6 Axle Multi	6 Axle Multi	>6 Axle Multi	Not Classified	Total
Grand Total	38	3121	3293	92	1216	170	1	98	31	0	0	0	0	474	8534
Percent	0.4%	36.6%	38.6%	1.1%	14.2%	2.0%	0.0%	1.1%	0.4%	0.0%	0.0%	0.0%	0.0%	5.6%	

ADT 4267



Comments:

Report generated on 5/27/2016 10:24 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Quality Counts
TRANSPORTATION DATA COLLECTION

Type of report: Tube Count - Volume Data

LOCATION: Pulehu Rd S of Hansen Rd
SPECIFIC LOCATION: Pulehu Rd S of Hansen Rd
CITY/STATE: Kula, HI

QC JOB #: 13803911
DIRECTION: NB/SB
DATE: May 17 2016 - May 18 2016

Start Time	Mon	Tue 17-May-16	Wed 18-May-16	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM		4	8			6			6	
1:00 AM		3	4			4			4	
2:00 AM		3	3			3			3	
3:00 AM		6	5			6			6	
4:00 AM		15	9			12			12	
5:00 AM		67	78			73			73	
6:00 AM		275	248			262			262	
7:00 AM		**416**	**424**			**420**			**420**	
8:00 AM		388	341			365			365	
9:00 AM		312	328			320			320	
10:00 AM		342	361			352			352	
11:00 AM		321	330			326			326	
12:00 PM		342	320			**331**			**331**	
1:00 PM		305	**322**			314			314	
2:00 PM		**344**	315			330			330	
3:00 PM		278	236			257			257	
4:00 PM		274	272			273			273	
5:00 PM		229	217			223			223	
6:00 PM		170	121			146			146	
7:00 PM		116	91			104			104	
8:00 PM		61	68			65			65	
9:00 PM		32	40			36			36	
10:00 PM		26	33			30			30	
11:00 PM		15	16			16			16	
Day Total		4344	4190			4274			4274	
% Weekday Average		101.6%	98.0%							
% Week Average		101.6%	98.0%			100.0%				
AM Peak Volume		7:00 AM 416	7:00 AM 424			7:00 AM 420			7:00 AM 420	
PM Peak Volume		2:00 PM 344	1:00 PM 322			12:00 PM 331			12:00 PM 331	

Comments:

Report generated on 5/27/2016 10:24 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

APPENDIX B: LOS WORKSHEETS



LOS Worksheets – Existing (2016) Conditions



Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	171	17	45	294	5	69	1	123	1	0	2
Future Vol, veh/h	0	171	17	45	294	5	69	1	123	1	0	2
Conflicting Peds, #/hr	0	0	1	2	0	1	1	0	2	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	120	-	-	145	-	-	140	-	0	115	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	30	6	2	27	7	2	6	2	5	2	2	2
Mvmt Flow	0	190	19	50	327	6	77	1	137	1	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	333	0	0	211	0	0	465	634	108	528	641	168
Stage 1	-	-	-	-	-	-	201	201	-	430	430	-
Stage 2	-	-	-	-	-	-	264	433	-	98	211	-
Critical Hdwy	4.7	-	-	4.64	-	-	7.62	6.54	7	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.62	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.62	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.5	-	-	2.47	-	-	3.56	4.02	3.35	3.52	4.02	3.32
Pot Cap-1 Maneuver	1044	-	-	1193	-	-	471	395	916	433	391	847
Stage 1	-	-	-	-	-	-	771	734	-	574	582	-
Stage 2	-	-	-	-	-	-	707	580	-	898	726	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1043	-	-	1191	-	-	453	377	913	355	374	845
Mov Cap-2 Maneuver	-	-	-	-	-	-	453	377	-	355	374	-
Stage 1	-	-	-	-	-	-	770	733	-	573	557	-
Stage 2	-	-	-	-	-	-	675	555	-	761	725	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.1	11.4	11.3
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	452	913	1043	-	-	1191	-	-	355	845
HCM Lane V/C Ratio	0.172	0.15	-	-	-	0.042	-	-	0.003	0.003
HCM Control Delay (s)	14.6	9.6	0	-	-	8.2	-	-	15.2	9.3
HCM Lane LOS	B	A	A	-	-	A	-	-	C	A
HCM 95th %tile Q(veh)	0.6	0.5	0	-	-	0.1	-	-	0	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰↰	↑↑	↰↰	↱↱
Traffic Volume (veh/h)	818	80	249	2007	177	92
Future Volume (veh/h)	818	80	249	2007	177	92
Number	6	16	5	2	7	14
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1597	1827	1863	1743	1845
Adj Flow Rate, veh/h	843	0	257	2069	182	95
Adj No. of Lanes	2	1	2	2	2	2
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	7	19	4	2	9	3
Cap, veh/h	2256	907	342	2863	271	512
Arrive On Green	0.67	0.00	0.10	0.81	0.08	0.08
Sat Flow, veh/h	3463	1357	3375	3632	3221	2760
Grp Volume(v), veh/h	843	0	257	2069	182	95
Grp Sat Flow(s),veh/h/ln	1687	1357	1688	1770	1610	1380
Q Serve(g_s), s	11.3	0.0	7.6	27.6	5.6	3.0
Cycle Q Clear(g_c), s	11.3	0.0	7.6	27.6	5.6	3.0
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2256	907	342	2863	271	512
V/C Ratio(X)	0.37	0.00	0.75	0.72	0.67	0.19
Avail Cap(c_a), veh/h	2626	1056	920	2863	1128	1246
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	7.5	0.0	44.9	4.5	45.7	35.3
Incr Delay (d2), s/veh	0.2	0.0	3.3	1.1	2.9	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.3	0.0	3.7	13.7	2.6	2.5
LnGrp Delay(d),s/veh	7.7	0.0	48.3	5.7	48.6	35.5
LnGrp LOS	A		D	A	D	D
Approach Vol, veh/h	843			2326	277	
Approach Delay, s/veh	7.7			10.4	44.1	
Approach LOS	A			B	D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		89.1		13.6	14.4	74.7		
Change Period (Y+Rc), s		6.0		5.0	4.0	6.0		
Max Green Setting (Gmax), s		80.0		36.0	28.0	80.0		
Max Q Clear Time (g_c+I1), s		29.6		7.6	9.6	13.3		
Green Ext Time (p_c), s		48.9		1.0	0.8	55.4		

Intersection Summary	
HCM 2010 Ctrl Delay	12.4
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	53.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	3	245	64	14	371	7	119	198	18	1	52	14
Future Vol, veh/h	3	245	64	14	371	7	119	198	18	1	52	14
Conflicting Peds, #/hr	1	0	1	0	0	0	1	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	13	6	2	29	2	14	12	6	33	2	19	36
Mvmt Flow	3	269	70	15	408	8	131	218	20	1	57	15

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	416	0	0	341	0	0	792	759	305	873	790	414
Stage 1	-	-	-	-	-	-	312	312	-	443	443	-
Stage 2	-	-	-	-	-	-	480	447	-	430	347	-
Critical Hdwy	4.23	-	-	4.39	-	-	7.22	6.56	6.53	7.12	6.69	6.56
Critical Hdwy Stg 1	-	-	-	-	-	-	6.22	5.56	-	6.12	5.69	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.22	5.56	-	6.12	5.69	-
Follow-up Hdwy	2.317	-	-	2.461	-	-	3.608	4.054	3.597	3.518	4.171	3.624
Pot Cap-1 Maneuver	1086	-	-	1082	-	-	295	331	668	271	304	571
Stage 1	-	-	-	-	-	-	678	650	-	594	548	-
Stage 2	-	-	-	-	-	-	548	567	-	603	606	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1085	-	-	1082	-	-	240	323	667	118	297	570
Mov Cap-2 Maneuver	-	-	-	-	-	-	240	323	-	118	297	-
Stage 1	-	-	-	-	-	-	675	647	-	592	538	-
Stage 2	-	-	-	-	-	-	468	556	-	387	604	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.3	172.8	19.5
HCM LOS			F	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	295	1085	-	-	1082	-	-	322
HCM Lane V/C Ratio	1.248	0.003	-	-	0.014	-	-	0.229
HCM Control Delay (s)	172.8	8.3	0	-	8.4	0	-	19.5
HCM Lane LOS	F	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	17.2	0	-	-	0	-	-	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	423	0	84	0	1159	269	70	933	0
Future Volume (veh/h)	0	0	0	423	0	84	0	1159	269	70	933	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1845	0	1462	1863	1827	1810	1743	1776	0
Adj Flow Rate, veh/h				481	0	0	0	1317	0	80	1060	0
Adj No. of Lanes				2	0	1	1	2	1	1	2	0
Peak Hour Factor				0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %				3	0	30	2	4	5	9	7	0
Cap, veh/h				524	0	191	1	2328	1032	100	2569	0
Arrive On Green				0.15	0.00	0.00	0.00	0.67	0.00	0.06	0.76	0.00
Sat Flow, veh/h				3408	0	1242	1774	3471	1538	1660	3463	0
Grp Volume(v), veh/h				481	0	0	0	1317	0	80	1060	0
Grp Sat Flow(s),veh/h/ln				1704	0	1242	1774	1736	1538	1660	1687	0
Q Serve(g_s), s				18.1	0.0	0.0	0.0	26.2	0.0	6.2	14.2	0.0
Cycle Q Clear(g_c), s				18.1	0.0	0.0	0.0	26.2	0.0	6.2	14.2	0.0
Prop In Lane				1.00		1.00	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h				524	0	191	1	2328	1032	100	2569	0
V/C Ratio(X)				0.92	0.00	0.00	0.00	0.57	0.00	0.80	0.41	0.00
Avail Cap(c_a), veh/h				524	0	191	328	2328	1032	306	2569	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh				54.2	0.0	0.0	0.0	11.4	0.0	60.3	5.4	0.0
Incr Delay (d2), s/veh				20.7	0.0	0.0	0.0	1.0	0.0	5.6	0.5	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				10.0	0.0	0.0	0.0	12.8	0.0	3.0	6.7	0.0
LnGrp Delay(d),s/veh				74.9	0.0	0.0	0.0	12.4	0.0	65.9	5.9	0.0
LnGrp LOS				E				B		E	A	
Approach Vol, veh/h					481			1317			1140	
Approach Delay, s/veh					74.9			12.4			10.1	
Approach LOS					E			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2			5	6		8
Phs Duration (G+Y+Rc), s	11.8	92.2			0.0	104.0		26.0
Change Period (Y+Rc), s	4.0	5.0			4.0	5.0		6.0
Max Green Setting (Gmax), s	24.0	71.0			24.0	71.0		20.0
Max Q Clear Time (g_c+I1), s	8.2	28.2			0.0	16.2		20.1
Green Ext Time (p_c), s	0.1	38.9			0.0	48.7		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	21.7
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	420	48	76	286	1	28	1	34	1	0	0
Future Vol, veh/h	4	420	48	76	286	1	28	1	34	1	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	120	-	-	145	-	-	140	-	0	115	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	3	2	2	7	2	2	2	2	2
Mvmt Flow	4	433	49	78	295	1	29	1	35	1	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	296	0	0	482	0	0	770	919	241	677	943	148
Stage 1	-	-	-	-	-	-	466	466	-	452	452	-
Stage 2	-	-	-	-	-	-	304	453	-	225	491	-
Critical Hdwy	4.14	-	-	4.16	-	-	7.64	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.64	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.64	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.23	-	-	3.57	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1262	-	-	1070	-	-	281	270	760	339	261	872
Stage 1	-	-	-	-	-	-	533	561	-	557	569	-
Stage 2	-	-	-	-	-	-	667	568	-	757	546	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1262	-	-	1070	-	-	265	250	760	304	241	872
Mov Cap-2 Maneuver	-	-	-	-	-	-	265	250	-	304	241	-
Stage 1	-	-	-	-	-	-	531	559	-	555	528	-
Stage 2	-	-	-	-	-	-	618	527	-	718	544	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	1.8	14.8	16.9
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	264	760	1262	-	-	1070	-	-	304	-
HCM Lane V/C Ratio	0.113	0.046	0.003	-	-	0.073	-	-	0.003	-
HCM Control Delay (s)	20.4	10	7.9	-	-	8.6	-	-	16.9	0
HCM Lane LOS	C	B	A	-	-	A	-	-	C	A
HCM 95th %tile Q(veh)	0.4	0.1	0	-	-	0.2	-	-	0	-

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰↰	↑↑	↰↰	↱↱
Traffic Volume (veh/h)	1644	181	186	1142	131	288
Future Volume (veh/h)	1644	181	186	1142	131	288
Number	6	16	5	2	7	14
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1863	1881	1863	1845	1881
Adj Flow Rate, veh/h	1768	0	200	1228	141	310
Adj No. of Lanes	2	1	2	2	2	2
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	2	1	2	3	1
Cap, veh/h	2350	1041	275	2732	446	591
Arrive On Green	0.66	0.00	0.08	0.77	0.13	0.13
Sat Flow, veh/h	3668	1583	3476	3632	3408	2814
Grp Volume(v), veh/h	1768	0	200	1228	141	310
Grp Sat Flow(s),veh/h/ln	1787	1583	1738	1770	1704	1407
Q Serve(g_s), s	37.9	0.0	6.4	13.7	4.2	11.1
Cycle Q Clear(g_c), s	37.9	0.0	6.4	13.7	4.2	11.1
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2350	1041	275	2732	446	591
V/C Ratio(X)	0.75	0.00	0.73	0.45	0.32	0.52
Avail Cap(c_a), veh/h	2530	1121	861	2732	1086	1119
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.1	0.0	50.8	4.5	44.5	39.6
Incr Delay (d2), s/veh	1.6	0.0	3.7	0.2	0.4	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	18.9	0.0	3.2	6.6	2.0	0.1
LnGrp Delay(d),s/veh	14.7	0.0	54.5	4.7	44.9	40.4
LnGrp LOS	B		D	A	D	D
Approach Vol, veh/h	1768			1428	451	
Approach Delay, s/veh	14.7			11.7	41.8	
Approach LOS	B			B	D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		93.2		19.8	12.9	80.3		
Change Period (Y+Rc), s		6.0		5.0	4.0	6.0		
Max Green Setting (Gmax), s		80.0		36.0	28.0	80.0		
Max Q Clear Time (g_c+I1), s		15.7		13.1	8.4	39.9		
Green Ext Time (p_c), s		62.0		1.7	0.6	34.4		

Intersection Summary	
HCM 2010 Ctrl Delay	16.9
HCM 2010 LOS	B

Intersection												
Int Delay, s/veh	5.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	350	45	7	214	1	52	64	3	5	91	6
Future Vol, veh/h	12	350	45	7	214	1	52	64	3	5	91	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	8	1	2	14	1	2	2	2	2	2	2	2
Mvmt Flow	13	372	48	7	228	1	55	68	3	5	97	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	229	0	0	420	0	0	717	666	396	700	689	228
Stage 1	-	-	-	-	-	-	422	422	-	243	243	-
Stage 2	-	-	-	-	-	-	295	244	-	457	446	-
Critical Hdwy	4.18	-	-	4.24	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.272	-	-	2.326	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1304	-	-	1078	-	-	345	380	653	354	369	811
Stage 1	-	-	-	-	-	-	609	588	-	761	705	-
Stage 2	-	-	-	-	-	-	713	704	-	583	574	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1304	-	-	1078	-	-	268	372	653	298	362	811
Mov Cap-2 Maneuver	-	-	-	-	-	-	268	372	-	298	362	-
Stage 1	-	-	-	-	-	-	601	580	-	751	700	-
Stage 2	-	-	-	-	-	-	605	699	-	505	567	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.3	23.3	18.7
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	321	1304	-	-	1078	-	-	370
HCM Lane V/C Ratio	0.394	0.01	-	-	0.007	-	-	0.293
HCM Control Delay (s)	23.3	7.8	0	-	8.4	0	-	18.7
HCM Lane LOS	C	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	1.8	0	-	-	0	-	-	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	272	0	112	0	1189	350	96	1139	0
Future Volume (veh/h)	0	0	0	272	0	112	0	1189	350	96	1139	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1845	0	1827	1863	1827	1827	1727	1845	0
Adj Flow Rate, veh/h				283	0	0	0	1239	0	100	1186	0
Adj No. of Lanes				2	0	1	1	2	1	1	2	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				3	0	4	2	4	4	10	3	0
Cap, veh/h				335	0	152	1	2504	1120	120	2885	0
Arrive On Green				0.10	0.00	0.00	0.00	0.72	0.00	0.07	0.82	0.00
Sat Flow, veh/h				3408	0	1553	1774	3471	1553	1645	3597	0
Grp Volume(v), veh/h				283	0	0	0	1239	0	100	1186	0
Grp Sat Flow(s),veh/h/ln				1704	0	1553	1774	1736	1553	1645	1752	0
Q Serve(g_s), s				11.4	0.0	0.0	0.0	21.6	0.0	8.4	12.7	0.0
Cycle Q Clear(g_c), s				11.4	0.0	0.0	0.0	21.6	0.0	8.4	12.7	0.0
Prop In Lane				1.00		1.00	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h				335	0	152	1	2504	1120	120	2885	0
V/C Ratio(X)				0.85	0.00	0.00	0.00	0.49	0.00	0.83	0.41	0.00
Avail Cap(c_a), veh/h				487	0	222	241	2504	1120	223	2885	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh				62.1	0.0	0.0	0.0	8.4	0.0	64.0	3.3	0.0
Incr Delay (d2), s/veh				6.2	0.0	0.0	0.0	0.7	0.0	5.5	0.4	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				5.7	0.0	0.0	0.0	10.6	0.0	4.0	6.1	0.0
LnGrp Delay(d),s/veh				68.3	0.0	0.0	0.0	9.1	0.0	69.5	3.7	0.0
LnGrp LOS				E				A		E	A	
Approach Vol, veh/h					283			1239			1286	
Approach Delay, s/veh					68.3			9.1			8.9	
Approach LOS					E			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2			5	6		8
Phs Duration (G+Y+Rc), s	14.3	106.0			0.0	120.3		19.7
Change Period (Y+Rc), s	4.0	5.0			4.0	5.0		6.0
Max Green Setting (Gmax), s	19.0	86.0			19.0	86.0		20.0
Max Q Clear Time (g_c+I1), s	10.4	23.6			0.0	14.7		13.4
Green Ext Time (p_c), s	0.1	55.1			0.0	62.1		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	15.0
HCM 2010 LOS	B

LOS Worksheets – Future (2020) No Project Conditions

Intersection	
Int Delay, s/veh	5.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	210	30	50	330	20	80	20	140	40	10	20
Future Vol, veh/h	20	210	30	50	330	20	80	20	140	40	10	20
Conflicting Peds, #/hr	0	0	1	2	0	1	1	0	2	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	120	-	-	145	-	-	140	-	0	115	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	30	6	2	27	7	2	6	2	5	2	2	2
Mvmt Flow	22	233	33	56	367	22	89	22	156	44	11	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	390	0	0	269	0	0	597	797	137	664	803	196
Stage 1	-	-	-	-	-	-	296	296	-	490	490	-
Stage 2	-	-	-	-	-	-	301	501	-	174	313	-
Critical Hdwy	4.7	-	-	4.64	-	-	7.62	6.54	7	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.62	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.62	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.5	-	-	2.47	-	-	3.56	4.02	3.35	3.52	4.02	3.32
Pot Cap-1 Maneuver	988	-	-	1128	-	-	378	318	877	346	315	812
Stage 1	-	-	-	-	-	-	677	667	-	529	547	-
Stage 2	-	-	-	-	-	-	672	541	-	811	656	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	987	-	-	1126	-	-	337	295	874	253	292	810
Mov Cap-2 Maneuver	-	-	-	-	-	-	337	295	-	253	292	-
Stage 1	-	-	-	-	-	-	661	651	-	517	519	-
Stage 2	-	-	-	-	-	-	607	514	-	628	640	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	1	14.8	18.9
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	328	874	987	-	-	1126	-	-	260	810
HCM Lane V/C Ratio	0.339	0.178	0.023	-	-	0.049	-	-	0.214	0.027
HCM Control Delay (s)	21.5	10	8.7	-	-	8.4	-	-	22.6	9.6
HCM Lane LOS	C	B	A	-	-	A	-	-	C	A
HCM 95th %tile Q(veh)	1.5	0.6	0.1	-	-	0.2	-	-	0.8	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰↰	↑↑	↰↰	↱↱
Traffic Volume (veh/h)	880	120	280	2150	240	150
Future Volume (veh/h)	880	120	280	2150	240	150
Number	6	16	5	2	7	14
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1597	1827	1863	1743	1845
Adj Flow Rate, veh/h	907	0	289	2216	247	155
Adj No. of Lanes	2	1	2	2	2	2
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	7	19	4	2	9	3
Cap, veh/h	2162	870	373	2793	345	601
Arrive On Green	0.64	0.00	0.11	0.79	0.11	0.11
Sat Flow, veh/h	3463	1357	3375	3632	3221	2760
Grp Volume(v), veh/h	907	0	289	2216	247	155
Grp Sat Flow(s),veh/h/ln	1687	1357	1688	1770	1610	1380
Q Serve(g_s), s	14.0	0.0	8.8	37.5	7.9	4.9
Cycle Q Clear(g_c), s	14.0	0.0	8.8	37.5	7.9	4.9
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2162	870	373	2793	345	601
V/C Ratio(X)	0.42	0.00	0.77	0.79	0.72	0.26
Avail Cap(c_a), veh/h	2543	1023	891	2793	1092	1241
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.4	0.0	45.9	6.3	45.8	34.4
Incr Delay (d2), s/veh	0.3	0.0	3.4	1.9	2.8	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.5	0.0	4.3	18.6	3.6	4.1
LnGrp Delay(d),s/veh	9.6	0.0	49.3	8.2	48.6	34.6
LnGrp LOS	A		D	A	D	C
Approach Vol, veh/h	907			2505	402	
Approach Delay, s/veh	9.6			12.9	43.2	
Approach LOS	A			B	D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		89.8		16.4	15.7	74.0		
Change Period (Y+Rc), s		6.0		5.0	4.0	6.0		
Max Green Setting (Gmax), s		80.0		36.0	28.0	80.0		
Max Q Clear Time (g_c+I1), s		39.5		9.9	10.8	16.0		
Green Ext Time (p_c), s		40.0		1.5	0.9	52.0		

Intersection Summary	
HCM 2010 Ctrl Delay	15.3
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	107.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	270	70	20	400	10	130	220	20	10	60	20
Future Vol, veh/h	10	270	70	20	400	10	130	220	20	10	60	20
Conflicting Peds, #/hr	1	0	1	0	0	0	1	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	13	6	2	29	2	14	12	6	33	2	19	36
Mvmt Flow	11	297	77	22	440	11	143	242	22	11	66	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	452	0	0	375	0	0	892	854	336	979	887	447
Stage 1	-	-	-	-	-	-	358	358	-	490	490	-
Stage 2	-	-	-	-	-	-	534	496	-	489	397	-
Critical Hdwy	4.23	-	-	4.39	-	-	7.22	6.56	6.53	7.12	6.69	6.56
Critical Hdwy Stg 1	-	-	-	-	-	-	6.22	5.56	-	6.12	5.69	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.22	5.56	-	6.12	5.69	-
Follow-up Hdwy	2.317	-	-	2.461	-	-	3.608	4.054	3.597	3.518	4.171	3.624
Pot Cap-1 Maneuver	1053	-	-	1050	-	-	252	292	641	229	266	546
Stage 1	-	-	-	-	-	-	640	621	-	560	521	-
Stage 2	-	-	-	-	-	-	512	539	-	561	575	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1052	-	-	1050	-	-	187	280	640	58	255	545
Mov Cap-2 Maneuver	-	-	-	-	-	-	187	280	-	58	255	-
Stage 1	-	-	-	-	-	-	631	612	-	552	506	-
Stage 2	-	-	-	-	-	-	415	523	-	323	567	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.4	$ 349.7	38.5
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	245	1052	-	-	1050	-	-	203
HCM Lane V/C Ratio	1.66	0.01	-	-	0.021	-	-	0.487
HCM Control Delay (s)	$ 349.7	8.5	0	-	8.5	0	-	38.5
HCM Lane LOS	F	A	A	-	A	A	-	E
HCM 95th %tile Q(veh)	26.1	0	-	-	0.1	-	-	2.4

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	460	0	90	0	1240	290	80	1000	0
Future Volume (veh/h)	0	0	0	460	0	90	0	1240	290	80	1000	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1845	0	1462	1863	1827	1810	1743	1776	0
Adj Flow Rate, veh/h				523	0	0	0	1409	0	91	1136	0
Adj No. of Lanes				2	0	1	1	2	1	1	2	0
Peak Hour Factor				0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %				3	0	30	2	4	5	9	7	0
Cap, veh/h				524	0	191	1	2302	1020	112	2569	0
Arrive On Green				0.15	0.00	0.00	0.00	0.66	0.00	0.07	0.76	0.00
Sat Flow, veh/h				3408	0	1242	1774	3471	1538	1660	3463	0
Grp Volume(v), veh/h				523	0	0	0	1409	0	91	1136	0
Grp Sat Flow(s),veh/h/ln				1704	0	1242	1774	1736	1538	1660	1687	0
Q Serve(g_s), s				19.9	0.0	0.0	0.0	29.9	0.0	7.0	15.7	0.0
Cycle Q Clear(g_c), s				19.9	0.0	0.0	0.0	29.9	0.0	7.0	15.7	0.0
Prop In Lane				1.00		1.00	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h				524	0	191	1	2302	1020	112	2569	0
V/C Ratio(X)				1.00	0.00	0.00	0.00	0.61	0.00	0.81	0.44	0.00
Avail Cap(c_a), veh/h				524	0	191	328	2302	1020	306	2569	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh				55.0	0.0	0.0	0.0	12.4	0.0	59.8	5.6	0.0
Incr Delay (d2), s/veh				38.6	0.0	0.0	0.0	1.2	0.0	5.2	0.6	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.2	0.0	0.0	0.0	14.7	0.0	3.4	7.5	0.0
LnGrp Delay(d),s/veh				93.6	0.0	0.0	0.0	13.6	0.0	65.0	6.1	0.0
LnGrp LOS				F				B		E	A	
Approach Vol, veh/h					523			1409			1227	
Approach Delay, s/veh					93.6			13.6			10.5	
Approach LOS					F			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2			5	6		8
Phs Duration (G+Y+Rc), s	12.8	91.2			0.0	104.0		26.0
Change Period (Y+Rc), s	4.0	5.0			4.0	5.0		6.0
Max Green Setting (Gmax), s	24.0	71.0			24.0	71.0		20.0
Max Q Clear Time (g_c+I1), s	9.0	31.9			0.0	17.7		21.9
Green Ext Time (p_c), s	0.1	36.7			0.0	49.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	25.6
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	6.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	50	500	60	110	340	10	30	20	50	70	10	20
Future Vol, veh/h	50	500	60	110	340	10	30	20	50	70	10	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	120	-	-	145	-	-	140	-	0	115	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	3	2	2	7	2	2	2	2	2
Mvmt Flow	52	515	62	113	351	10	31	21	52	72	10	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	361	0	0	577	0	0	1056	1237	289	953	1262	180
Stage 1	-	-	-	-	-	-	649	649	-	582	582	-
Stage 2	-	-	-	-	-	-	407	588	-	371	680	-
Critical Hdwy	4.14	-	-	4.16	-	-	7.64	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.64	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.64	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.23	-	-	3.57	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1194	-	-	986	-	-	173	175	708	214	169	832
Stage 1	-	-	-	-	-	-	413	464	-	466	497	-
Stage 2	-	-	-	-	-	-	579	494	-	622	449	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1194	-	-	986	-	-	141	148	708	157	143	832
Mov Cap-2 Maneuver	-	-	-	-	-	-	141	148	-	157	143	-
Stage 1	-	-	-	-	-	-	395	444	-	446	440	-
Stage 2	-	-	-	-	-	-	488	437	-	526	429	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	2.2	26.9	43.5
HCM LOS			D	E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	144	708	1194	-	-	986	-	-	155	832
HCM Lane V/C Ratio	0.358	0.073	0.043	-	-	0.115	-	-	0.532	0.025
HCM Control Delay (s)	43.3	10.5	8.2	-	-	9.1	-	-	52	9.4
HCM Lane LOS	E	B	A	-	-	A	-	-	F	A
HCM 95th %tile Q(veh)	1.5	0.2	0.1	-	-	0.4	-	-	2.6	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰↰	↑↑	↰↰	↱↱
Traffic Volume (veh/h)	1760	240	220	1230	230	390
Future Volume (veh/h)	1760	240	220	1230	230	390
Number	6	16	5	2	7	14
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1863	1881	1863	1845	1881
Adj Flow Rate, veh/h	1892	0	237	1323	247	419
Adj No. of Lanes	2	1	2	2	2	2
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	2	1	2	3	1
Cap, veh/h	2208	978	311	2621	571	723
Arrive On Green	0.62	0.00	0.09	0.74	0.17	0.17
Sat Flow, veh/h	3668	1583	3476	3632	3408	2814
Grp Volume(v), veh/h	1892	0	237	1323	247	419
Grp Sat Flow(s),veh/h/ln	1787	1583	1738	1770	1704	1407
Q Serve(g_s), s	51.5	0.0	8.0	18.6	7.8	15.6
Cycle Q Clear(g_c), s	51.5	0.0	8.0	18.6	7.8	15.6
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2208	978	311	2621	571	723
V/C Ratio(X)	0.86	0.00	0.76	0.50	0.43	0.58
Avail Cap(c_a), veh/h	2387	1057	812	2621	1024	1097
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	18.6	0.0	53.3	6.4	44.7	38.9
Incr Delay (d2), s/veh	3.6	0.0	3.9	0.3	0.5	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	26.3	0.0	4.0	9.1	3.7	12.2
LnGrp Delay(d),s/veh	22.2	0.0	57.2	6.8	45.3	39.6
LnGrp LOS	C		E	A	D	D
Approach Vol, veh/h	1892			1560	666	
Approach Delay, s/veh	22.2			14.4	41.7	
Approach LOS	C			B	D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		94.7		25.1	14.7	80.0		
Change Period (Y+Rc), s		6.0		5.0	4.0	6.0		
Max Green Setting (Gmax), s		80.0		36.0	28.0	80.0		
Max Q Clear Time (g_c+I1), s		20.6		17.6	10.0	53.5		
Green Ext Time (p_c), s		58.2		2.5	0.7	20.5		

Intersection Summary	
HCM 2010 Ctrl Delay	22.4
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	11.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	20	380	50	10	230	10	60	70	10	10	150	20
Future Vol, veh/h	20	380	50	10	230	10	60	70	10	10	150	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	8	1	2	14	1	2	2	2	2	2	2	2
Mvmt Flow	21	404	53	11	245	11	64	74	11	11	160	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	255	0	0	457	0	0	835	750	431	787	771	250
Stage 1	-	-	-	-	-	-	473	473	-	271	271	-
Stage 2	-	-	-	-	-	-	362	277	-	516	500	-
Critical Hdwy	4.18	-	-	4.24	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.272	-	-	2.326	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1276	-	-	1043	-	-	287	340	624	309	331	789
Stage 1	-	-	-	-	-	-	572	558	-	735	685	-
Stage 2	-	-	-	-	-	-	657	681	-	542	543	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1276	-	-	1043	-	-	166	329	624	245	320	789
Mov Cap-2 Maneuver	-	-	-	-	-	-	166	329	-	245	320	-
Stage 1	-	-	-	-	-	-	559	546	-	719	677	-
Stage 2	-	-	-	-	-	-	483	673	-	450	531	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.3	42.8	28.8
HCM LOS			E	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	237	1276	-	-	1043	-	-	337
HCM Lane V/C Ratio	0.628	0.017	-	-	0.01	-	-	0.568
HCM Control Delay (s)	42.8	7.9	0	-	8.5	0	-	28.8
HCM Lane LOS	E	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	3.8	0.1	-	-	0	-	-	3.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	300	0	120	0	1280	380	110	1220	0
Future Volume (veh/h)	0	0	0	300	0	120	0	1280	380	110	1220	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1845	0	1827	1863	1827	1827	1727	1845	0
Adj Flow Rate, veh/h				312	0	0	0	1333	0	115	1271	0
Adj No. of Lanes				2	0	1	1	2	1	1	2	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				3	0	4	2	4	4	10	3	0
Cap, veh/h				363	0	165	1	2442	1092	136	2856	0
Arrive On Green				0.11	0.00	0.00	0.00	0.70	0.00	0.08	0.81	0.00
Sat Flow, veh/h				3408	0	1553	1774	3471	1553	1645	3597	0
Grp Volume(v), veh/h				312	0	0	0	1333	0	115	1271	0
Grp Sat Flow(s),veh/h/ln				1704	0	1553	1774	1736	1553	1645	1752	0
Q Serve(g_s), s				12.6	0.0	0.0	0.0	25.9	0.0	9.7	14.7	0.0
Cycle Q Clear(g_c), s				12.6	0.0	0.0	0.0	25.9	0.0	9.7	14.7	0.0
Prop In Lane				1.00		1.00	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h				363	0	165	1	2442	1092	136	2856	0
V/C Ratio(X)				0.86	0.00	0.00	0.00	0.55	0.00	0.84	0.45	0.00
Avail Cap(c_a), veh/h				487	0	222	241	2442	1092	223	2856	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh				61.5	0.0	0.0	0.0	10.0	0.0	63.3	3.8	0.0
Incr Delay (d2), s/veh				9.0	0.0	0.0	0.0	0.9	0.0	7.0	0.5	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				6.4	0.0	0.0	0.0	12.5	0.0	4.7	7.3	0.0
LnGrp Delay(d),s/veh				70.5	0.0	0.0	0.0	10.9	0.0	70.3	4.3	0.0
LnGrp LOS				E				B		E	A	
Approach Vol, veh/h					312			1333			1386	
Approach Delay, s/veh					70.5			10.9			9.8	
Approach LOS					E			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2			5	6		8
Phs Duration (G+Y+Rc), s	15.6	103.5			0.0	119.1		20.9
Change Period (Y+Rc), s	4.0	5.0			4.0	5.0		6.0
Max Green Setting (Gmax), s	19.0	86.0			19.0	86.0		20.0
Max Q Clear Time (g_c+I1), s	11.7	27.9			0.0	16.7		14.6
Green Ext Time (p_c), s	0.1	53.6			0.0	63.0		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	16.5
HCM 2010 LOS	B

LOS Worksheets – Future (2020) plus Project Conditions



Intersection	
Int Delay, s/veh	5.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	210	32	58	330	20	81	20	147	40	10	20
Future Vol, veh/h	20	210	32	58	330	20	81	20	147	40	10	20
Conflicting Peds, #/hr	0	0	1	2	0	1	1	0	2	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	120	-	-	145	-	-	140	-	0	115	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	30	6	2	27	7	2	6	2	5	2	2	2
Mvmt Flow	22	233	36	64	367	22	90	22	163	44	11	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	390	0	0	271	0	0	617	817	138	682	823	196
Stage 1	-	-	-	-	-	-	298	298	-	508	508	-
Stage 2	-	-	-	-	-	-	319	519	-	174	315	-
Critical Hdwy	4.7	-	-	4.64	-	-	7.62	6.54	7	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.62	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.62	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.5	-	-	2.47	-	-	3.56	4.02	3.35	3.52	4.02	3.32
Pot Cap-1 Maneuver	988	-	-	1126	-	-	366	309	876	336	307	812
Stage 1	-	-	-	-	-	-	675	666	-	516	537	-
Stage 2	-	-	-	-	-	-	656	531	-	811	654	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	987	-	-	1124	-	-	324	284	873	241	282	810
Mov Cap-2 Maneuver	-	-	-	-	-	-	324	284	-	241	282	-
Stage 1	-	-	-	-	-	-	659	650	-	504	506	-
Stage 2	-	-	-	-	-	-	588	500	-	621	638	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	1.2	15.2	19.7
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	315	873	987	-	-	1124	-	-	248	810
HCM Lane V/C Ratio	0.356	0.187	0.023	-	-	0.057	-	-	0.224	0.027
HCM Control Delay (s)	22.6	10.1	8.7	-	-	8.4	-	-	23.7	9.6
HCM Lane LOS	C	B	A	-	-	A	-	-	C	A
HCM 95th %tile Q(veh)	1.6	0.7	0.1	-	-	0.2	-	-	0.8	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰↰	↑↑	↰↰	↱↱
Traffic Volume (veh/h)	880	128	280	2150	247	150
Future Volume (veh/h)	880	128	280	2150	247	150
Number	6	16	5	2	7	14
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1597	1827	1863	1743	1845
Adj Flow Rate, veh/h	907	0	289	2216	255	155
Adj No. of Lanes	2	1	2	2	2	2
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	7	19	4	2	9	3
Cap, veh/h	2155	867	373	2785	353	608
Arrive On Green	0.64	0.00	0.11	0.79	0.11	0.11
Sat Flow, veh/h	3463	1357	3375	3632	3221	2760
Grp Volume(v), veh/h	907	0	289	2216	255	155
Grp Sat Flow(s),veh/h/ln	1687	1357	1688	1770	1610	1380
Q Serve(g_s), s	14.1	0.0	8.9	38.0	8.1	4.9
Cycle Q Clear(g_c), s	14.1	0.0	8.9	38.0	8.1	4.9
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2155	867	373	2785	353	608
V/C Ratio(X)	0.42	0.00	0.77	0.80	0.72	0.25
Avail Cap(c_a), veh/h	2536	1020	888	2785	1089	1238
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.5	0.0	46.0	6.5	45.8	34.3
Incr Delay (d2), s/veh	0.3	0.0	3.5	1.9	2.8	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.6	0.0	4.3	18.9	3.7	4.1
LnGrp Delay(d),s/veh	9.8	0.0	49.5	8.4	48.6	34.5
LnGrp LOS	A		D	A	D	C
Approach Vol, veh/h	907			2505	410	
Approach Delay, s/veh	9.8			13.1	43.3	
Approach LOS	A			B	D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		89.8		16.7	15.8	74.0		
Change Period (Y+Rc), s		6.0		5.0	4.0	6.0		
Max Green Setting (Gmax), s		80.0		36.0	28.0	80.0		
Max Q Clear Time (g_c+I1), s		40.0		10.1	10.9	16.1		
Green Ext Time (p_c), s		39.5		1.5	0.9	51.9		

Intersection Summary	
HCM 2010 Ctrl Delay	15.6
HCM 2010 LOS	B

Intersection												
Int Delay, s/veh	156.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	270	88	30	400	10	145	228	28	10	70	20
Future Vol, veh/h	10	270	88	30	400	10	145	228	28	10	70	20
Conflicting Peds, #/hr	1	0	1	0	0	0	1	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	13	6	2	29	2	14	12	6	33	2	19	36
Mvmt Flow	11	297	97	33	440	11	159	251	31	11	77	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	452	0	0	394	0	0	929	885	346	1020	928	447
Stage 1	-	-	-	-	-	-	368	368	-	512	512	-
Stage 2	-	-	-	-	-	-	561	517	-	508	416	-
Critical Hdwy	4.23	-	-	4.39	-	-	7.22	6.56	6.53	7.12	6.69	6.56
Critical Hdwy Stg 1	-	-	-	-	-	-	6.22	5.56	-	6.12	5.69	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.22	5.56	-	6.12	5.69	-
Follow-up Hdwy	2.317	-	-	2.461	-	-	3.608	4.054	3.597	3.518	4.171	3.624
Pot Cap-1 Maneuver	1053	-	-	1032	-	-	238	280	632	215	251	546
Stage 1	-	-	-	-	-	-	632	614	-	545	509	-
Stage 2	-	-	-	-	-	-	495	527	-	547	564	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1052	-	-	1032	-	-	163	264	631	30	236	545
Mov Cap-2 Maneuver	-	-	-	-	-	-	163	264	-	30	236	-
Stage 1	-	-	-	-	-	-	623	605	-	537	487	-
Stage 2	-	-	-	-	-	-	382	504	-	301	556	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.6	$ 490.9	76.2
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	223	1052	-	-	1032	-	-	150
HCM Lane V/C Ratio	1.976	0.01	-	-	0.032	-	-	0.733
HCM Control Delay (s)	$ 490.9	8.5	0	-	8.6	0	-	76.2
HCM Lane LOS	F	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	32.3	0	-	-	0.1	-	-	4.4

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	468	0	97	0	1240	300	88	1000	0
Future Volume (veh/h)	0	0	0	468	0	97	0	1240	300	88	1000	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1845	0	1462	1863	1827	1810	1743	1776	0
Adj Flow Rate, veh/h				532	0	0	0	1409	0	100	1136	0
Adj No. of Lanes				2	0	1	1	2	1	1	2	0
Peak Hour Factor				0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %				3	0	30	2	4	5	9	7	0
Cap, veh/h				524	0	191	1	2282	1011	122	2569	0
Arrive On Green				0.15	0.00	0.00	0.00	0.66	0.00	0.07	0.76	0.00
Sat Flow, veh/h				3408	0	1242	1774	3471	1538	1660	3463	0
Grp Volume(v), veh/h				532	0	0	0	1409	0	100	1136	0
Grp Sat Flow(s),veh/h/ln				1704	0	1242	1774	1736	1538	1660	1687	0
Q Serve(g_s), s				20.0	0.0	0.0	0.0	30.4	0.0	7.7	15.7	0.0
Cycle Q Clear(g_c), s				20.0	0.0	0.0	0.0	30.4	0.0	7.7	15.7	0.0
Prop In Lane				1.00		1.00	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h				524	0	191	1	2282	1011	122	2569	0
V/C Ratio(X)				1.01	0.00	0.00	0.00	0.62	0.00	0.82	0.44	0.00
Avail Cap(c_a), veh/h				524	0	191	328	2282	1011	306	2569	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh				55.0	0.0	0.0	0.0	12.8	0.0	59.4	5.6	0.0
Incr Delay (d2), s/veh				43.0	0.0	0.0	0.0	1.3	0.0	5.1	0.6	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				12.5	0.0	0.0	0.0	14.9	0.0	3.7	7.5	0.0
LnGrp Delay(d),s/veh				98.0	0.0	0.0	0.0	14.1	0.0	64.5	6.1	0.0
LnGrp LOS				F				B		E	A	
Approach Vol, veh/h					532			1409			1236	
Approach Delay, s/veh					98.0			14.1			10.8	
Approach LOS					F			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2			5	6		8
Phs Duration (G+Y+Rc), s	13.6	90.4			0.0	104.0		26.0
Change Period (Y+Rc), s	4.0	5.0			4.0	5.0		6.0
Max Green Setting (Gmax), s	24.0	71.0			24.0	71.0		20.0
Max Q Clear Time (g_c+I1), s	9.7	32.4			0.0	17.7		22.0
Green Ext Time (p_c), s	0.1	36.3			0.0	49.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	26.9
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	1.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	31	370	2	38	150
Future Vol, veh/h	2	31	370	2	38	150
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	34	402	2	41	163

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	649	403	0	0	404	0
Stage 1	403	-	-	-	-	-
Stage 2	246	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	434	647	-	-	1155	-
Stage 1	675	-	-	-	-	-
Stage 2	795	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	417	647	-	-	1155	-
Mov Cap-2 Maneuver	417	-	-	-	-	-
Stage 1	675	-	-	-	-	-
Stage 2	764	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.1	0	1.7
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	626	1155	-
HCM Lane V/C Ratio	-	-	0.057	0.036	-
HCM Control Delay (s)	-	-	11.1	8.2	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	7.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	50	500	61	114	340	10	33	20	60	70	10	20
Future Vol, veh/h	50	500	61	114	340	10	33	20	60	70	10	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	120	-	-	145	-	-	140	-	0	115	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	3	2	2	7	2	2	2	2	2
Mvmt Flow	52	515	63	118	351	10	34	21	62	72	10	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	361	0	0	578	0	0	1065	1246	289	962	1272	180
Stage 1	-	-	-	-	-	-	650	650	-	591	591	-
Stage 2	-	-	-	-	-	-	415	596	-	371	681	-
Critical Hdwy	4.14	-	-	4.16	-	-	7.64	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.64	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.64	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.23	-	-	3.57	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1194	-	-	985	-	-	170	172	708	210	166	832
Stage 1	-	-	-	-	-	-	413	463	-	460	493	-
Stage 2	-	-	-	-	-	-	572	490	-	622	448	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1194	-	-	985	-	-	138	145	708	150	140	832
Mov Cap-2 Maneuver	-	-	-	-	-	-	138	145	-	150	140	-
Stage 1	-	-	-	-	-	-	395	443	-	440	434	-
Stage 2	-	-	-	-	-	-	479	431	-	518	428	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	2.2	27.1	46.4
HCM LOS			D	E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	141	708	1194	-	-	985	-	-	149	832
HCM Lane V/C Ratio	0.388	0.087	0.043	-	-	0.119	-	-	0.554	0.025
HCM Control Delay (s)	45.8	10.6	8.2	-	-	9.1	-	-	55.6	9.4
HCM Lane LOS	E	B	A	-	-	A	-	-	F	A
HCM 95th %tile Q(veh)	1.6	0.3	0.1	-	-	0.4	-	-	2.8	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1760	244	220	1230	240	390
Future Volume (veh/h)	1760	244	220	1230	240	390
Number	6	16	5	2	7	14
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1863	1881	1863	1845	1881
Adj Flow Rate, veh/h	1892	0	237	1323	258	419
Adj No. of Lanes	2	1	2	2	2	2
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	2	1	2	3	1
Cap, veh/h	2207	978	311	2620	572	724
Arrive On Green	0.62	0.00	0.09	0.74	0.17	0.17
Sat Flow, veh/h	3668	1583	3476	3632	3408	2814
Grp Volume(v), veh/h	1892	0	237	1323	258	419
Grp Sat Flow(s),veh/h/ln	1787	1583	1738	1770	1704	1407
Q Serve(g_s), s	51.5	0.0	8.0	18.6	8.2	15.6
Cycle Q Clear(g_c), s	51.5	0.0	8.0	18.6	8.2	15.6
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2207	978	311	2620	572	724
V/C Ratio(X)	0.86	0.00	0.76	0.50	0.45	0.58
Avail Cap(c_a), veh/h	2386	1057	812	2620	1024	1097
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	18.6	0.0	53.3	6.5	44.9	38.8
Incr Delay (d2), s/veh	3.6	0.0	3.9	0.3	0.6	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	26.3	0.0	4.0	9.1	3.9	12.2
LnGrp Delay(d),s/veh	22.2	0.0	57.2	6.8	45.4	39.6
LnGrp LOS	C		E	A	D	D
Approach Vol, veh/h	1892			1560	677	
Approach Delay, s/veh	22.2			14.4	41.8	
Approach LOS	C			B	D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		94.7		25.1	14.7	80.0		
Change Period (Y+Rc), s		6.0		5.0	4.0	6.0		
Max Green Setting (Gmax), s		80.0		36.0	28.0	80.0		
Max Q Clear Time (g_c+I1), s		20.6		17.6	10.0	53.5		
Green Ext Time (p_c), s		58.2		2.6	0.7	20.5		

Intersection Summary	
HCM 2010 Ctrl Delay	22.5
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	19.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	20	380	60	15	230	10	82	83	23	10	155	20
Future Vol, veh/h	20	380	60	15	230	10	82	83	23	10	155	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	8	1	2	14	1	2	2	2	2	2	2	2
Mvmt Flow	21	404	64	16	245	11	87	88	24	11	165	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	255	0	0	468	0	0	854	766	436	817	793	250
Stage 1	-	-	-	-	-	-	479	479	-	282	282	-
Stage 2	-	-	-	-	-	-	375	287	-	535	511	-
Critical Hdwy	4.18	-	-	4.24	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.272	-	-	2.326	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1276	-	-	1034	-	-	279	333	620	295	321	789
Stage 1	-	-	-	-	-	-	568	555	-	725	678	-
Stage 2	-	-	-	-	-	-	646	674	-	529	537	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1276	-	-	1034	-	-	152	320	620	217	308	789
Mov Cap-2 Maneuver	-	-	-	-	-	-	152	320	-	217	308	-
Stage 1	-	-	-	-	-	-	556	543	-	709	666	-
Stage 2	-	-	-	-	-	-	464	662	-	416	525	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.5	79.8	32.3
HCM LOS			F	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	225	1276	-	-	1034	-	-	322
HCM Lane V/C Ratio	0.889	0.017	-	-	0.015	-	-	0.611
HCM Control Delay (s)	79.8	7.9	0	-	8.5	0	-	32.3
HCM Lane LOS	F	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	7.2	0.1	-	-	0	-	-	3.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	312	0	130	0	1280	385	115	1220	0
Future Volume (veh/h)	0	0	0	312	0	130	0	1280	385	115	1220	0
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1845	0	1827	1863	1827	1827	1727	1845	0
Adj Flow Rate, veh/h				325	0	0	0	1333	0	120	1271	0
Adj No. of Lanes				2	0	1	1	2	1	1	2	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				3	0	4	2	4	4	10	3	0
Cap, veh/h				376	0	171	1	2418	1082	141	2843	0
Arrive On Green				0.11	0.00	0.00	0.00	0.70	0.00	0.09	0.81	0.00
Sat Flow, veh/h				3408	0	1553	1774	3471	1553	1645	3597	0
Grp Volume(v), veh/h				325	0	0	0	1333	0	120	1271	0
Grp Sat Flow(s),veh/h/ln				1704	0	1553	1774	1736	1553	1645	1752	0
Q Serve(g_s), s				13.1	0.0	0.0	0.0	26.5	0.0	10.1	15.0	0.0
Cycle Q Clear(g_c), s				13.1	0.0	0.0	0.0	26.5	0.0	10.1	15.0	0.0
Prop In Lane				1.00		1.00	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h				376	0	171	1	2418	1082	141	2843	0
V/C Ratio(X)				0.86	0.00	0.00	0.00	0.55	0.00	0.85	0.45	0.00
Avail Cap(c_a), veh/h				487	0	222	241	2418	1082	223	2843	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh				61.3	0.0	0.0	0.0	10.5	0.0	63.1	3.9	0.0
Incr Delay (d2), s/veh				10.2	0.0	0.0	0.0	0.9	0.0	9.4	0.5	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				6.7	0.0	0.0	0.0	12.9	0.0	4.9	7.4	0.0
LnGrp Delay(d),s/veh				71.4	0.0	0.0	0.0	11.4	0.0	72.5	4.4	0.0
LnGrp LOS				E				B		E	A	
Approach Vol, veh/h					325			1333			1391	
Approach Delay, s/veh					71.4			11.4			10.3	
Approach LOS					E			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2			5	6		8
Phs Duration (G+Y+Rc), s	16.0	102.5			0.0	118.6		21.4
Change Period (Y+Rc), s	4.0	5.0			4.0	5.0		6.0
Max Green Setting (Gmax), s	19.0	86.0			19.0	86.0		20.0
Max Q Clear Time (g_c+I1), s	12.1	28.5			0.0	17.0		15.1
Green Ext Time (p_c), s	0.1	53.1			0.0	62.7		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	17.3
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	1.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	48	140	1	20	210
Future Vol, veh/h	2	48	140	1	20	210
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	52	152	1	22	228

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	425	153	0	0	153	0
Stage 1	153	-	-	-	-	-
Stage 2	272	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	586	893	-	-	1428	-
Stage 1	875	-	-	-	-	-
Stage 2	774	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	575	893	-	-	1428	-
Mov Cap-2 Maneuver	575	-	-	-	-	-
Stage 1	875	-	-	-	-	-
Stage 2	760	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.4	0	0.7
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	874	1428	-
HCM Lane V/C Ratio	-	-	0.062	0.015	-
HCM Control Delay (s)	-	-	9.4	7.6	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

LOS Worksheets – Future (2020) plus Project Conditions with Mitigation



Intersection	
Int Delay, s/veh	5.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	210	32	58	330	20	81	20	147	40	10	20
Future Vol, veh/h	20	210	32	58	330	20	81	20	147	40	10	20
Conflicting Peds, #/hr	0	0	1	2	0	1	1	0	2	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	120	-	-	145	-	-	140	-	-	115	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	30	6	2	27	7	2	6	2	5	2	2	2
Mvmt Flow	22	233	36	64	367	22	90	22	163	44	11	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	390	0	0	271	0	0	617	817	138	682	823	196
Stage 1	-	-	-	-	-	-	298	298	-	508	508	-
Stage 2	-	-	-	-	-	-	319	519	-	174	315	-
Critical Hdwy	4.7	-	-	4.64	-	-	7.62	6.54	7	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.62	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.62	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.5	-	-	2.47	-	-	3.56	4.02	3.35	3.52	4.02	3.32
Pot Cap-1 Maneuver	988	-	-	1126	-	-	366	309	876	336	307	812
Stage 1	-	-	-	-	-	-	675	666	-	516	537	-
Stage 2	-	-	-	-	-	-	656	531	-	811	654	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	987	-	-	1124	-	-	324	284	873	241	282	810
Mov Cap-2 Maneuver	-	-	-	-	-	-	324	284	-	241	282	-
Stage 1	-	-	-	-	-	-	659	650	-	504	506	-
Stage 2	-	-	-	-	-	-	588	500	-	621	638	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	1.2	14.7	18.8
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	324	699	987	-	-	1124	-	-	241	499
HCM Lane V/C Ratio	0.278	0.265	0.023	-	-	0.057	-	-	0.184	0.067
HCM Control Delay (s)	20.3	12	8.7	-	-	8.4	-	-	23.3	12.7
HCM Lane LOS	C	B	A	-	-	A	-	-	C	B
HCM 95th %tile Q(veh)	1.1	1.1	0.1	-	-	0.2	-	-	0.7	0.2

Intersection	
Int Delay, s/veh	35

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↰	↑		↰	↑	
Traffic Vol, veh/h	10	270	88	30	400	10	145	228	28	10	70	20
Future Vol, veh/h	10	270	88	30	400	10	145	228	28	10	70	20
Conflicting Peds, #/hr	1	0	1	0	0	0	1	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	13	6	2	29	2	14	12	6	33	2	19	36
Mvmt Flow	11	297	97	33	440	11	159	251	31	11	77	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	452	0	0	394	0	0	929	885	346	1020	928	447
Stage 1	-	-	-	-	-	-	368	368	-	512	512	-
Stage 2	-	-	-	-	-	-	561	517	-	508	416	-
Critical Hdwy	4.23	-	-	4.39	-	-	7.22	6.56	6.53	7.12	6.69	6.56
Critical Hdwy Stg 1	-	-	-	-	-	-	6.22	5.56	-	6.12	5.69	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.22	5.56	-	6.12	5.69	-
Follow-up Hdwy	2.317	-	-	2.461	-	-	3.608	4.054	3.597	3.518	4.171	3.624
Pot Cap-1 Maneuver	1053	-	-	1032	-	-	238	280	632	215	251	546
Stage 1	-	-	-	-	-	-	632	614	-	545	509	-
Stage 2	-	-	-	-	-	-	495	527	-	547	564	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1052	-	-	1032	-	-	163	264	631	30	236	545
Mov Cap-2 Maneuver	-	-	-	-	-	-	163	264	-	30	236	-
Stage 1	-	-	-	-	-	-	623	605	-	537	487	-
Stage 2	-	-	-	-	-	-	382	504	-	301	556	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.6	103	41.5
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	163	282	1052	-	-	1032	-	-	30	270
HCM Lane V/C Ratio	0.978	0.998	0.01	-	-	0.032	-	-	0.366	0.366
HCM Control Delay (s)	120.7	92.9	8.5	0	-	8.6	0	-	182.7	25.8
HCM Lane LOS	F	F	A	A	-	A	A	-	F	D
HCM 95th %tile Q(veh)	7.5	10.2	0	-	-	0.1	-	-	1.2	1.6

Intersection	
Int Delay, s/veh	6.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	50	500	61	114	340	10	33	20	60	70	10	20
Future Vol, veh/h	50	500	61	114	340	10	33	20	60	70	10	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	120	-	-	145	-	-	140	-	-	115	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	3	2	2	7	2	2	2	2	2
Mvmt Flow	52	515	63	118	351	10	34	21	62	72	10	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	361	0	0	578	0	0	1065	1246	289	962	1272	180
Stage 1	-	-	-	-	-	-	650	650	-	591	591	-
Stage 2	-	-	-	-	-	-	415	596	-	371	681	-
Critical Hdwy	4.14	-	-	4.16	-	-	7.64	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.64	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.64	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.23	-	-	3.57	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1194	-	-	985	-	-	170	172	708	210	166	832
Stage 1	-	-	-	-	-	-	413	463	-	460	493	-
Stage 2	-	-	-	-	-	-	572	490	-	622	448	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1194	-	-	985	-	-	138	145	708	150	140	832
Mov Cap-2 Maneuver	-	-	-	-	-	-	138	145	-	150	140	-
Stage 1	-	-	-	-	-	-	395	443	-	440	434	-
Stage 2	-	-	-	-	-	-	479	431	-	518	428	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	2.2	24.2	40
HCM LOS			C	E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	138	359	1194	-	-	985	-	-	150	314
HCM Lane V/C Ratio	0.247	0.23	0.043	-	-	0.119	-	-	0.481	0.098
HCM Control Delay (s)	39.4	18	8.2	-	-	9.1	-	-	49.5	17.7
HCM Lane LOS	E	C	A	-	-	A	-	-	E	C
HCM 95th %tile Q(veh)	0.9	0.9	0.1	-	-	0.4	-	-	2.3	0.3

Intersection	
Int Delay, s/veh	11.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↰	↑		↰	↑	
Traffic Vol, veh/h	20	380	60	15	230	10	82	83	23	10	155	20
Future Vol, veh/h	20	380	60	15	230	10	82	83	23	10	155	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	8	1	2	14	1	2	2	2	2	2	2	2
Mvmt Flow	21	404	64	16	245	11	87	88	24	11	165	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	255	0	0	468	0	0	854	766	436	817	793	250
Stage 1	-	-	-	-	-	-	479	479	-	282	282	-
Stage 2	-	-	-	-	-	-	375	287	-	535	511	-
Critical Hdwy	4.18	-	-	4.24	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.272	-	-	2.326	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1276	-	-	1034	-	-	279	333	620	295	321	789
Stage 1	-	-	-	-	-	-	568	555	-	725	678	-
Stage 2	-	-	-	-	-	-	646	674	-	529	537	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1276	-	-	1034	-	-	152	320	620	217	308	789
Mov Cap-2 Maneuver	-	-	-	-	-	-	152	320	-	217	308	-
Stage 1	-	-	-	-	-	-	556	543	-	709	666	-
Stage 2	-	-	-	-	-	-	464	662	-	416	525	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.5	35.7	28.6
HCM LOS			E	D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	152	358	1276	-	-	1034	-	-	217	331
HCM Lane V/C Ratio	0.574	0.315	0.017	-	-	0.015	-	-	0.049	0.562
HCM Control Delay (s)	56.5	19.6	7.9	0	-	8.5	0	-	22.4	29
HCM Lane LOS	F	C	A	A	-	A	A	-	C	D
HCM 95th %tile Q(veh)	3	1.3	0.1	-	-	0	-	-	0.2	3.3

Intersection	
Intersection Delay, s/veh	60.4
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations			↕				↕				↕	
Traffic Vol, veh/h	0	10	270	88	0	30	400	10	0	145	228	28
Future Vol, veh/h	0	10	270	88	0	30	400	10	0	145	228	28
Peak Hour Factor	0.92	0.91	0.91	0.91	0.92	0.91	0.91	0.91	0.92	0.91	0.91	0.91
Heavy Vehicles, %	2	13	6	2	2	29	2	14	2	12	6	33
Mvmt Flow	0	11	297	97	0	33	440	11	0	159	251	31
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	41.5	90.3	55.9
HCM LOS	E	F	F

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	36%	3%	7%	10%
Vol Thru, %	57%	73%	91%	70%
Vol Right, %	7%	24%	2%	20%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	401	368	440	100
LT Vol	145	10	30	10
Through Vol	228	270	400	70
RT Vol	28	88	10	20
Lane Flow Rate	441	404	484	110
Geometry Grp	1	1	1	1
Degree of Util (X)	0.934	0.849	1.069	0.274
Departure Headway (Hd)	7.971	7.893	7.956	9.334
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	458	461	459	387
Service Time	5.971	5.893	5.963	7.334
HCM Lane V/C Ratio	0.963	0.876	1.054	0.284
HCM Control Delay	55.9	41.5	90.3	15.8
HCM Lane LOS	F	E	F	C
HCM 95th-tile Q	10.9	8.5	15.6	1.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations			↕	
Traffic Vol, veh/h	0	10	70	20
Future Vol, veh/h	0	10	70	20
Peak Hour Factor	0.92	0.91	0.91	0.91
Heavy Vehicles, %	2	2	19	36
Mvmt Flow	0	11	77	22
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	15.8
HCM LOS	C

Intersection	
Intersection Delay, s/veh	20.6
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations			↕				↕				↕	
Traffic Vol, veh/h	0	20	380	60	0	15	230	10	0	82	83	23
Future Vol, veh/h	0	20	380	60	0	15	230	10	0	82	83	23
Peak Hour Factor	0.92	0.94	0.94	0.94	0.92	0.94	0.94	0.94	0.92	0.94	0.94	0.94
Heavy Vehicles, %	2	8	1	2	2	14	1	2	2	2	2	2
Mvmt Flow	0	21	404	64	0	16	245	11	0	87	88	24
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	28.9	15.6	14
HCM LOS	D	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	44%	4%	6%	5%
Vol Thru, %	44%	83%	90%	84%
Vol Right, %	12%	13%	4%	11%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	188	460	255	185
LT Vol	82	20	15	10
Through Vol	83	380	230	155
RT Vol	23	60	10	20
Lane Flow Rate	200	489	271	197
Geometry Grp	1	1	1	1
Degree of Util (X)	0.378	0.804	0.488	0.369
Departure Headway (Hd)	6.803	5.918	6.479	6.747
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	528	612	553	531
Service Time	4.865	3.966	4.538	4.811
HCM Lane V/C Ratio	0.379	0.799	0.49	0.371
HCM Control Delay	14	28.9	15.6	13.7
HCM Lane LOS	B	D	C	B
HCM 95th-tile Q	1.7	8	2.7	1.7

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations			↕	
Traffic Vol, veh/h	0	10	155	20
Future Vol, veh/h	0	10	155	20
Peak Hour Factor	0.92	0.94	0.94	0.94
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	11	165	21
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	13.7
HCM LOS	B

HCM 2010 Signalized Intersection Summary
1: Pulehu Road & Ho'okele Street

6/30/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	210	32	58	330	20	81	20	147	40	10	20
Future Volume (veh/h)	20	210	32	58	330	20	81	20	147	40	10	20
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1462	1802	1900	1496	1780	1900	1900	1806	1810	1900	1863	1863
Adj Flow Rate, veh/h	22	233	36	64	367	22	90	22	163	44	11	22
Adj No. of Lanes	1	2	0	1	2	0	0	1	1	0	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	30	6	6	27	7	7	2	2	5	2	2	2
Cap, veh/h	37	578	88	89	745	45	153	21	652	153	22	672
Arrive On Green	0.03	0.19	0.19	0.06	0.23	0.23	0.42	0.42	0.42	0.42	0.42	0.42
Sat Flow, veh/h	1392	2978	454	1425	3243	194	0	49	1536	0	52	1582
Grp Volume(v), veh/h	22	133	136	64	191	198	112	0	163	55	0	22
Grp Sat Flow(s),veh/h/ln	1392	1711	1720	1425	1691	1745	49	0	1536	52	0	1582
Q Serve(g_s), s	0.7	2.9	2.9	1.9	4.1	4.2	0.0	0.0	2.9	0.0	0.0	0.3
Cycle Q Clear(g_c), s	0.7	2.9	2.9	1.9	4.1	4.2	18.0	0.0	2.9	18.0	0.0	0.3
Prop In Lane	1.00		0.26	1.00		0.11	0.80		1.00	0.80		1.00
Lane Grp Cap(c), veh/h	37	332	334	89	389	401	174	0	652	175	0	672
V/C Ratio(X)	0.59	0.40	0.41	0.72	0.49	0.49	0.64	0.00	0.25	0.31	0.00	0.03
Avail Cap(c_a), veh/h	164	727	731	185	738	762	174	0	652	175	0	672
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	20.4	14.9	14.9	19.5	14.2	14.2	17.9	0.0	7.8	14.1	0.0	7.1
Incr Delay (d2), s/veh	13.7	0.8	0.8	10.4	1.0	0.9	7.8	0.0	0.2	1.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	1.4	1.5	1.0	2.0	2.1	1.7	0.0	1.2	0.7	0.0	0.2
LnGrp Delay(d),s/veh	34.1	15.7	15.7	29.9	15.1	15.1	25.7	0.0	8.0	15.1	0.0	7.1
LnGrp LOS	C	B	B	C	B	B	C		A	B		A
Approach Vol, veh/h		291			453			275			77	
Approach Delay, s/veh		17.1			17.2			15.2			12.8	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		22.5	7.1	12.7		22.5	5.6	14.2
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		18.0	5.5	18.0		18.0	5.0	18.5
Max Q Clear Time (g_c+I1), s		20.0	3.9	4.9		20.0	2.7	6.2
Green Ext Time (p_c), s		0.0	0.0	3.1		0.0	0.0	3.0

Intersection Summary	
HCM 2010 Ctrl Delay	16.4
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	10	270	88	30	400	10	145	228	28	10	70	20
Future Volume (veh/h)	10	270	88	30	400	10	145	228	28	10	70	20
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1806	1900	1900	1825	1900	1900	1726	1900	1900	1574	1900
Adj Flow Rate, veh/h	11	297	97	33	440	11	159	251	31	11	77	22
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	6	6	6	2	2	2	6	6	6	19	19	19
Cap, veh/h	109	492	157	129	636	15	300	354	39	129	421	110
Arrive On Green	0.38	0.38	0.38	0.38	0.38	0.38	0.37	0.37	0.37	0.37	0.37	0.37
Sat Flow, veh/h	16	1290	411	58	1669	40	443	962	106	50	1145	299
Grp Volume(v), veh/h	405	0	0	484	0	0	441	0	0	110	0	0
Grp Sat Flow(s),veh/h/ln	1717	0	0	1766	0	0	1511	0	0	1493	0	0
Q Serve(g_s), s	0.0	0.0	0.0	1.2	0.0	0.0	7.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	6.8	0.0	0.0	8.2	0.0	0.0	9.2	0.0	0.0	1.8	0.0	0.0
Prop In Lane	0.03		0.24	0.07		0.02	0.36		0.07	0.10		0.20
Lane Grp Cap(c), veh/h	758	0	0	781	0	0	692	0	0	660	0	0
V/C Ratio(X)	0.53	0.00	0.00	0.62	0.00	0.00	0.64	0.00	0.00	0.17	0.00	0.00
Avail Cap(c_a), veh/h	961	0	0	987	0	0	889	0	0	850	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	9.0	0.0	0.0	9.4	0.0	0.0	10.0	0.0	0.0	7.7	0.0	0.0
Incr Delay (d2), s/veh	0.6	0.0	0.0	0.8	0.0	0.0	1.0	0.0	0.0	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.3	0.0	0.0	4.1	0.0	0.0	4.0	0.0	0.0	0.8	0.0	0.0
LnGrp Delay(d),s/veh	9.6	0.0	0.0	10.2	0.0	0.0	10.9	0.0	0.0	7.8	0.0	0.0
LnGrp LOS	A			B			B			A		
Approach Vol, veh/h		405			484			441			110	
Approach Delay, s/veh		9.6			10.2			10.9			7.8	
Approach LOS		A			B			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		17.7		18.2		17.7		18.2
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		18.0		18.0		18.0		18.0
Max Q Clear Time (g_c+I1), s		11.2		8.8		3.8		10.2
Green Ext Time (p_c), s		2.0		3.9		3.1		3.5

Intersection Summary	
HCM 2010 Ctrl Delay	10.1
HCM 2010 LOS	B

HCM 2010 Signalized Intersection Summary
1: Pulehu Road & Ho'okele Street

6/30/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	500	61	114	340	10	33	20	60	70	10	20
Future Volume (veh/h)	50	500	61	114	340	10	33	20	60	70	10	20
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1845	1863	1900	1776	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	52	515	63	118	351	10	34	21	62	72	10	21
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	3	2	2	7	2	2	2	2	2
Cap, veh/h	102	1016	124	175	1272	36	426	73	217	389	95	199
Arrive On Green	0.06	0.32	0.32	0.10	0.36	0.36	0.18	0.18	0.18	0.18	0.18	0.18
Sat Flow, veh/h	1774	3177	387	1757	3515	100	1309	416	1229	1310	537	1127
Grp Volume(v), veh/h	52	286	292	118	176	185	34	0	83	72	0	31
Grp Sat Flow(s),veh/h/ln	1774	1770	1794	1757	1770	1845	1309	0	1646	1310	0	1664
Q Serve(g_s), s	1.0	4.4	4.4	2.2	2.4	2.4	0.7	0.0	1.5	1.7	0.0	0.5
Cycle Q Clear(g_c), s	1.0	4.4	4.4	2.2	2.4	2.4	1.3	0.0	1.5	3.1	0.0	0.5
Prop In Lane	1.00		0.22	1.00		0.05	1.00		0.75	1.00		0.68
Lane Grp Cap(c), veh/h	102	566	574	175	641	668	426	0	290	389	0	293
V/C Ratio(X)	0.51	0.51	0.51	0.67	0.28	0.28	0.08	0.00	0.29	0.18	0.00	0.11
Avail Cap(c_a), veh/h	266	954	968	289	981	1023	901	0	887	865	0	897
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.3	9.2	9.2	14.5	7.5	7.5	12.1	0.0	11.9	13.3	0.0	11.5
Incr Delay (d2), s/veh	3.9	0.7	0.7	4.5	0.2	0.2	0.1	0.0	0.5	0.2	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	2.3	2.3	1.3	1.2	1.2	0.3	0.0	0.7	0.6	0.0	0.3
LnGrp Delay(d),s/veh	19.2	9.9	9.9	19.0	7.8	7.8	12.2	0.0	12.5	13.5	0.0	11.7
LnGrp LOS	B	A	A	B	A	A	B		B	B		B
Approach Vol, veh/h		630			479			117			103	
Approach Delay, s/veh		10.7			10.5			12.4			13.0	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		10.4	7.8	15.2		10.4	6.4	16.6
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		18.0	5.5	18.0		18.0	5.0	18.5
Max Q Clear Time (g_c+I1), s		3.5	4.2	6.4		5.1	3.0	4.4
Green Ext Time (p_c), s		0.8	0.0	4.3		0.7	0.0	4.7

Intersection Summary	
HCM 2010 Ctrl Delay	11.0
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	20	380	60	15	230	10	82	83	23	10	155	20
Future Volume (veh/h)	20	380	60	15	230	10	82	83	23	10	155	20
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1873	1900	1900	1866	1900	1900	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	21	404	64	16	245	11	87	88	24	11	165	21
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	1	1	1	1	1	1	2	2	2	2	2	2
Cap, veh/h	154	645	99	159	714	31	323	213	47	154	380	47
Arrive On Green	0.42	0.42	0.42	0.42	0.42	0.42	0.24	0.24	0.24	0.24	0.24	0.24
Sat Flow, veh/h	31	1537	236	39	1701	73	532	878	193	47	1568	193
Grp Volume(v), veh/h	489	0	0	272	0	0	199	0	0	197	0	0
Grp Sat Flow(s),veh/h/ln	1805	0	0	1813	0	0	1603	0	0	1807	0	0
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	5.7	0.0	0.0	2.7	0.0	0.0	2.5	0.0	0.0	2.4	0.0	0.0
Prop In Lane	0.04		0.13	0.06		0.04	0.44		0.12	0.06		0.11
Lane Grp Cap(c), veh/h	899	0	0	904	0	0	583	0	0	581	0	0
V/C Ratio(X)	0.54	0.00	0.00	0.30	0.00	0.00	0.34	0.00	0.00	0.34	0.00	0.00
Avail Cap(c_a), veh/h	1351	0	0	1350	0	0	1218	0	0	1351	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	6.1	0.0	0.0	5.3	0.0	0.0	8.6	0.0	0.0	8.6	0.0	0.0
Incr Delay (d2), s/veh	0.5	0.0	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	0.0	0.0	1.3	0.0	0.0	1.3	0.0	0.0	1.3	0.0	0.0
LnGrp Delay(d),s/veh	6.6	0.0	0.0	5.4	0.0	0.0	8.9	0.0	0.0	8.9	0.0	0.0
LnGrp LOS	A			A			A			A		
Approach Vol, veh/h		489			272			199			197	
Approach Delay, s/veh		6.6			5.4			8.9			8.9	
Approach LOS		A			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		11.0		15.7		11.0		15.7
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		18.0		18.0		18.0		18.0
Max Q Clear Time (g_c+I1), s		4.5		7.7		4.4		4.7
Green Ext Time (p_c), s		2.0		3.6		2.0		4.1

Intersection Summary	
HCM 2010 Ctrl Delay	7.1
HCM 2010 LOS	A

APPENDIX C: SIGNAL WARRANT WORKSHEETS



Warrant Summary

Warrant 1: 8-Hour Vehicular Volume	**Met**
Warrant 1A: Minimum Vehicular Volume	Met
OR	
Warrant 1B: Interruption of Continuous Traffic	Met
OR	
Warrant 1C: 80% of Warrant 1A and 1B	Not Met
Warrant 2: 4-Hour Vehicular Volume	**Met**
Warrant 3: Peak Hour Vehicular Volume	**Met**
Warrant 3A: Peak Hour Delay	Met
OR	
Warrant 3B: Peak Hour Volume	Met
Warrant 4: Pedestrian Volume	**N/A**
Warrant 4A: 4 Hours Pedestrian Volume	N/A
OR	
Warrant 4B: Peak Hour Pedestrian Volume	N/A
AND	
Warrant 4C: Gap Analysis	N/A
Warrant 5: School Crossing	**N/A**
Warrant 6: Coordinated Signal System	**N/A**
Warrant 7: Crash Experience	**N/A**
Warrant 7A: Five or more reported crashes	Not Met
AND ONE OF	
Warrant 7B: 80% of Warrant 1A Met?	Met
OR	
Warrant 7C: 80% of Warrant 1B Met?	Not Met
OR	
Warrant 7D: 80% of Warrant 4 Met?	Not Met
Warrant 8: Roadway Network	**Met**
Warrant 9: Intersection near a Grade Crossing	**N/A**

Warrant 1A: Minimum Vehicular Volume

The warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street and on the higher-volume minor street approach to the intersection.

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total ofboth approaches)	Vehicles per hour on higher-volume minor-street approach (one direction only)
Major Street	Minor Street		
1	1	500	150
2 or more	1	600	150
2 or more	2 or more	600	200
1	2 or more	500	200

When the 85-percentile speed of major-street exceeds 40 mph in either an urban or rural area, or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the Minimum Vehicular Volume warrant is 70 percent of the requirements above.

Analysis

Major/Minor Info 2

Urban/Rural Info 2

	No of lanes
Major Street	1
Minor Street	1

Time	Major Street		Minor Street		Warrants MET/NOT	Use Turn Move instead of Tube?	Conflict	Adjusted
	Volume on major street (total of both approaches)	Threshhold RURAL 350	Veh/hour on higher volume minor street (one direction only)	Threshhold RURAL 105				
7:00 AM	704		299		MET	No	1	0
8:00 AM	536		229		MET	No	1	0
9:00 AM	634		188		MET	No	1	0
10:00 AM	642		191		MET	No	1	0
11:00 AM	575		170		MET	No	1	0
2:00 PM	578		171		MET	No	1	0
3:00 PM	603		136		MET	No	1	0
4:00 PM	604		121		MET	No	1	0

Number of hours for which warrant met	8
Percentage by which warrant met	100.0%

Warrant	Met

80% Warrant

	No of lanes
Major Street	1
Minor Street	1

Time	Major Street		Minor Street		Warrants MET/NOT
	Volume on major street (total of both	Threshhold RURAL 400	Veh/hour on higher volume minor street	Threshhold RURAL 120	
7:00 AM	704		299		MET
8:00 AM	536		229		MET
9:00 AM	634		188		MET
10:00 AM	642		191		MET
11:00 AM	575		170		MET
2:00 PM	578		171		MET
3:00 PM	603		136		MET
4:00 PM	604		121		MET

Number of hours for which warrant met	8
Percentage by which warrant met	100.0%

Warrant	Met

Warrant 1B: Interruption of Continuous Traffic

The warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street and on the higher-volume minor street approach to the intersection, and signal installation will not seriously disrupt progressive traffic flow.

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total ofboth approaches)	Vehicles per hour on higher-volume minor-street approach (one direction only)
Major Street	Minor Street		
1	1	750	75
2 or more	1	900	75
2 or more	2 or more	900	100
1	2 or more	750	100

The major-street and minor -street volumes are for the same 8 hours. During those 8 hours, the direction of higher volume on the minor street may be on one approach during some hours and on the opposite approach during other hours.

When the 85-percentile speed of major-street exceeds 40 mph in either an urban or rural area, or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the Interruption of Continuous Traffic warrant is 70 percent of the requirements above.

Analysis

	No of lanes
Major Street	1
Minor Street	1

Time	Major Street		Minor Street		Warrants MET/NOT
	Volume on major (total of both approaches)	Threshhold RURAL 525	Veh/hour on higher volume minor (one direction only)	Threshhold RURAL 52	
7:00 AM	704		299		MET
8:00 AM	536		229		MET
9:00 AM	634		188		MET
10:00 AM	642		191		MET
11:00 AM	575		170		MET
2:00 PM	578		171		MET
3:00 PM	603		136		MET
4:00 PM	604		121		MET

Use Turn Tube?	Conflict	Move instead of Adjusted
No	1	0
No	1	0
No	1	0
No	1	0
No	1	0
No	1	0
No	1	0
No	1	0

Number of hours for which warrant met	8
Percentage by which warrant met	100.0%

Warrant	Met

80% Warrant

	No of lanes
Major Street	1
Minor Street	1

Time	Major Street		Minor Street		Warrants MET/NOT
	Volume on major (total of both	Threshhold RURAL 600	Veh/hour on higher volume minor (one	Threshhold RURAL 60	
7:00 AM	704		299		MET
8:00 AM	536		229		NOT MET
9:00 AM	634		188		MET
10:00 AM	642		191		MET
11:00 AM	575		170		NOT MET
2:00 PM	578		171		NOT MET
3:00 PM	603		136		MET
4:00 PM	604		121		MET

Number of hours for which warrant met	5
Percentage by which warrant met	62.5%

Warrant	Not Met

Warrant 1C: Combination of Warrants

In exceptional cases, signals occasionally may be justified where no single warrant is satisfied but where Warrants 1A and 1B are satisfied to the extent of 80% or more of the stated values.

Analysis

80% of Warrant 1A Met	YES
80% of Warrant 1B Met	NO

Warrant	**Not Met**

Warrant 2: Four-Hour Vehicular Volumes

The Four Hour Volume Warrant is satisfied when each of any four hours of an average day the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher volume minor street approach (one direction only) all fall above the curve in Figure 4-7 for the existing combination of approach lanes.

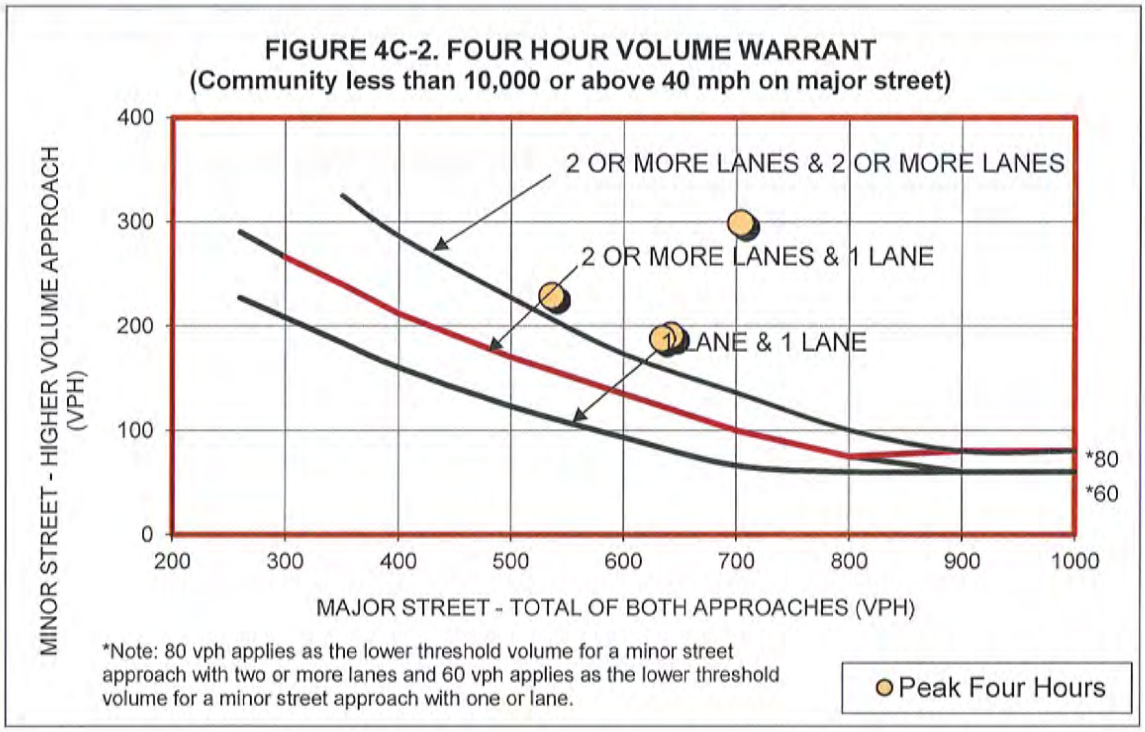
When the 85-percentile speed of the major-street exceeds 40 mile per hour or when the intersection lies within a built-up area of an isolated community having a population less than 10,000, the four hour volume requirement is satisfied when the plotted points referred to fall above the curve in Figure 4-8 for the existing combination of approach lanes.

Analysis

	No of lanes
Major Street	1
Minor Street	1

Peak Four Hours

Time	Vehicles Per Hour	
	Major Street (Sum of both approaches)	Minor street (High volume approach)
10:00 AM	642	191
7:00 AM	704	299
8:00 AM	536	229
9:00 AM	634	188



Warrant	Met

Warrant 3A: Peak Hour Delay

The peak hour delay warrant is intended for application where traffic conditions are such that for one hour of the day minor street traffic suffers undue delay in entering or crossing the major street. The peak hour delay warrant is satisfied when the conditions given below exist for one hour (any four consecutive 15-minute periods) of an average weekday.

The peak hour delay warrant is met when:

1. The total delay experienced by the traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one-lane approach and five vehicle-hours for a two-lane approach, and

2. The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes, and

3. The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four (or more) approaches or 650 vph for intersections with three approaches.

Analysis

Minor Street Lanes	1
Total Approaches	4
Time	7:00 AM

Yes
No

Use Turn Move instead of tube?

Peak Hour Volume on Minor	Peak Hour Entering Volume
No	No

	Peak Hour Delay on Minor Approach (vehicle-hours)	Peak Hour Volume on Minor Approach (vph)	Peak Hour Entering Volume Serviced for the Intersection (vph)
Existing	16.1	299	1,070
Limiting Value	4	100	800
Met/ Not Met	Met	Met	Met

Warrant	Met

Warrant 3B: Peak Hour Volume

The peak hour volume warrant is satisfied when the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour of the higher volume minor street approach (one direction only) for one hour (any four consecutive 15-minute periods) of an average day falls above the curve in Figure 4-5 for the existing combination of approach lanes.

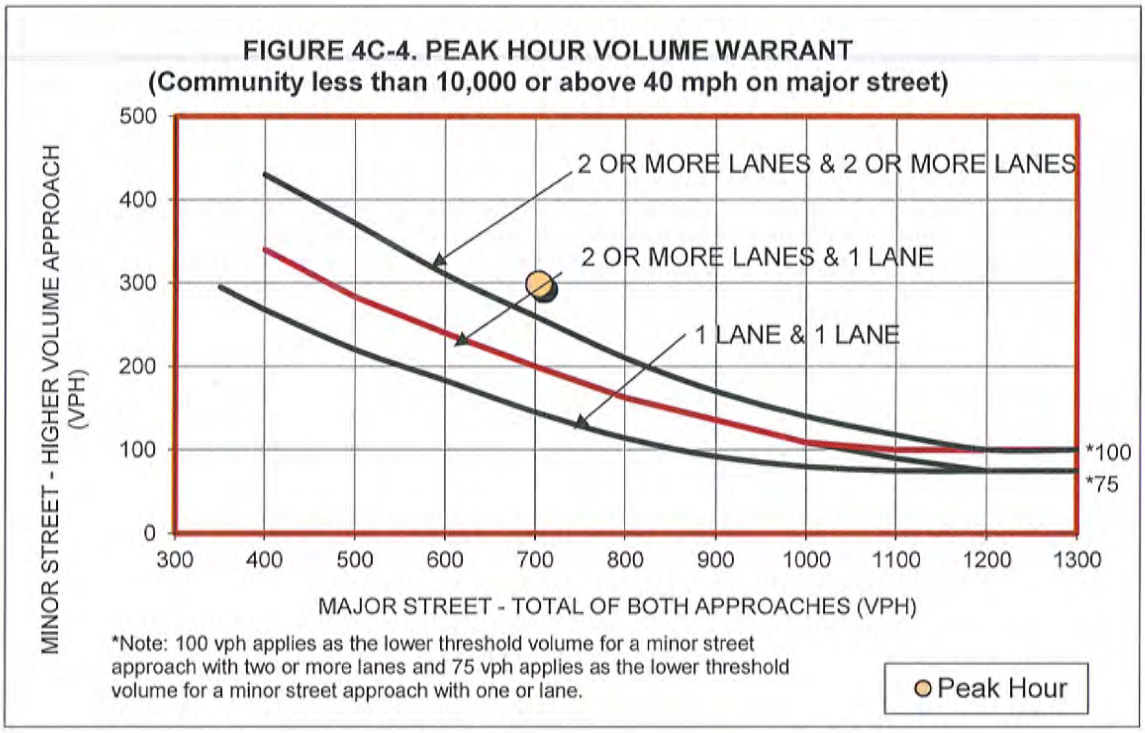
When the 85-percentile speed of the major street traffic exceeds 40 mile per hour or when the intersection lies within a built-up area of an isolated community having a population less than 10,000, the peak hour volume requirement is satisfied when the plotted point referred to above falls above the curve in Figure 4-6 for the existing combination of approach lanes.

Analysis

	No of lanes
Major Street	1
Minor Street	1

Peak Hour

Time	Vehicles Per Hour	
	Major Street (Sum of both approaches)	Minor street (High volume approach)
7:00 AM	704	299



Warrant	Met

Warrant 4: Pedestrian Volumes

The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

Standard: The need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that both of the following criteria are met:
A. The pedestrian volume crossing the major street at an intersection or midblock location during an average day is 100 or more for each of any 4 hours or 190 or more during any 1 hour; and
B. There are fewer than 60 gaps per hour in the traffic stream of adequate length to allow pedestrians to cross during the same period when the pedestrian volume criterion is satisfied. Where there is a divided street having a median of sufficient width for pedestrians to wait, the requirement applies separately to each direction of vehicular traffic.

Analysis

Warrant 4A - 4 Hours Pedestrian Volume

	Pedestrian Volume	Greater than 100?
6:00 AM	0	No
8:15 AM	0	No
2:00 PM	0	No
3:00 PM	0	No

Sub-Warrant	N/A

Warrant 4B - Peak Hour Pedestrian Volume

Hour	Pedestrian Volume	Greater than 190?
7:15 AM	40	No

Sub-Warrant	N/A

Warrant 4C - Gap Analysis

Hour	Gaps per Hour	Less than 60?
6:00 AM	N/A	N/A
8:15 AM	N/A	N/A
2:00 PM	N/A	N/A
3:00 PM	N/A	N/A

Sub-Warrant	N/A

Warrant	N/A

Warrant 5: School Crossing

The School Crossing signal warrant is intended for applicaiton where the fact that schoolchildren cross the major street is the principal reason to consider installing a traffic control signal. For the purposes of this warrant, the word "schoolchildren" includes elementary through high school students.

Standard: The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of schoolchildren at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the schoolchildren are using the crossing is less than the number of minutes in the same period and there are a minimum of 20 schoolchildren during the highest crossing hour.

Analysis

Warrant 5A - School present?

Yes	No
X	

Sub-Warrant	Met

Warrant 5B - Pedestrians across major street

Hour	Pedestrian Volume	Greater than 20?
7:15 AM	40	Yes

Sub-Warrant	Met

Warrant	N/A

Warrant 5: Coordinated Signal System

Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles.

Standard: The need for a traffic control signal shall be considered if an engineering study finds that one of the following criteria is met:

A. On a one-way street or a street that has traffic predominantly in one direction, the adjacent traffic control signals are so far apart that they do not provide the necessary degree of vehicular platooning.

B. On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.

Warrant	N/A

Warrant 7: Crash Experience

The Crash Experience signal warrant conditions are intended for application where severity and frequency of crashes are the principal reasons to consider installing a traffic control signal.

Standard:

A. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occured within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and

B. Warrant 1A or Warrant 1B or 80% of the pedestrian volume warrant is met

Warrant 7A - Five or more reported crashes

	Number	5 or more?
Number of crashes within a 12-month period, of types susceptible to correction by a traffic signal, each involving personal injury or property damage (reportable)	1	N

Plus at least one of the following:	Yes	No
Warrant 7B - 80% Warrant 1A		
Warrant 1A: 80% threshold met?	X	
Warrant 7C - 80% Warrant 1B		
Warrant 1B: 80% threshold met?		X
Warrant 7D - 80% Warrant 4		
Warrant 4: 80% threshold met (152 or more peds for any hour, and 80 or more peds for any 4 hours)?		X

Warrant	**N/A**

Warrant 8: Roadway Network

Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network.

Standard: The need for a traffic control signal shall be considered if an engineering study finds that the common intersection of two or more major routes meets one or both of the following criteria:

A. The intersection has a total existing, or immediately projects, entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday and has 5-year projected volumes, based on an engineering study, that meet one or more of Warrants 1, 2, and 3 during an average weekday; or

B. The intersection has a total existing or immediately projected entering volume of at least 1,000 vehicles per hour for each of any 5 hours of a non-normal business day (Saturday or Sunday)

A major route as used in this signal warrant shall have at least one of the following characteristics:

A. It is part of the street or highway system that serves as the principal roadway network for through traffic flow.

B. It includes rural or suburban highways outside, entering, or traversing a city.

C. It appears as a major route on an official plan, such as a major street plan in an urban area traffic and

Warrant	Met

Total AM Vol	Total PM Vol
1106 > 1000	850

Warrant 9: Intersection near a Grade Crossing

The Intersection Near a Grade Crossing signal warrant is intended for use at a location where none of the conditions described in the other eight traffic signal warrants are met, but the proximity to the intersection of a grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal.

Standard: The need for a traffic control signal shall be considered if an engineering study finds that both of the following criteria are met:

A. A grade crossing exists of an approach controlled by a STOP or YIELD sign and the center of the track nearest to the intersection is within 140 feet of the stop line or yield line on the approach; and

B. During the highest traffic volume hour during which rail traffic uses the crossing, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour of the minor-street approach that crosses the track (one direction only, approaching the intersection) falls above the applicable curve in Figure 4C-9 or 4C-10 for the existing combination of

Warrant	N/A

APPENDIX D: DETAILED TRIP GENERATION ASSUMPTIONS



6/30/2016

New Vehicle Trip Generation for the Central Maui Landfill Operations Expansion Project

New Traffic Generating Uses at Central Maui Landfill Site (Project)	Daily	Daily PCEs[1]	AM Peak Hour															PM Peak Hour													Notes & Assumptions
			Autos			Trucks			Trucks to PCEs[1]			Auto & Trucks			Total PCEs[1]			Autos			Trucks			Trucks to PCEs[1]			Auto & Trucks			Total PCEs[1]			
			In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Abandoned Vehicle Yard																																
Customers	130	190	4	7	11	1	2	3	2	4	6	5	9	14	6	13	17	1	6	7	2	4	6	4	8	12	3	10	13	5	14	19	• Weekday AM and PM peak trip generation were derived using driveway counts collected in May 2016 at the existing abandoned vehicle yard located on the northwest quadrant of the Pulehu Road and Hansen Road intersection
Employees	6	6	3	0	3	0	0	0	0	0	0	3	0	3	3	0	3	0	1	1	0	0	0	0	0	0	0	3	3	0	3	3	• 3 employees would staff the office at ABV yard (Source: County of Maui) • Assuming that the employees arrive and depart during the peak period
Relocation of Upcountry Base Yard Refuse Operations																																
Refuse Truck Drivers	32	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	• 18 employees from Upcountry Base Yard (Source: County of Maui) • Employees usually arrive at the base yards at 5:30 AM; No AM peak hour trips were assumed • Employees do not necessarily have a standard 8 hour work day and start their shift early. Thus, no traffic related to refuse trucks and refuse drivers were assumed in the PM peak hour (Source: County of Maui) • Of the 18 employees, all but 3 live upcountry (Source: County of Maui)
New Refuse Truck Trips	16	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	• Refuse trucks will be moved from the Upcountry base yard to the expanded Central Maui landfill, where they will be stored • Trucks deploy before the AM peak (i.e. 5:30 AM) • Conservatively assuming that all trucks return to the Central Maui landfill for storage in the PM peak hour • Upcountry has 5 automated trucks & 3 manual trucks (Source: County of Maui)
Relocation of Central/Wailuku Base Yard Refuse Operations																																
Refuse Truck Drivers	42	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	• 21 employees from Wailuku Base Yard (Source: County of Maui) • Employees usually arrive at the base yards at 5:30 AM; No AM peak hour trips were assumed • Although employees do not necessarily have a standard 8 hour work day, we are conservatively assuming that all employee vehicles leave in the PM peak hour • General employee location: 6 – Upcountry, 1 Kihei, & 14 – Central (Source: County of Maui)
New Refuse Truck Trips	24	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	• Refuse trucks will be moved from the Central/Wailuku base yard to the expanded Central Maui landfill, where they will be stored • Trucks deploy before the AM peak (i.e. 5:30 AM) • Employees do not necessarily have a standard 8 hour work day and start their shift early. Thus, no traffic related to refuse trucks and refuse drivers were assumed in the PM peak hour (Source: County of Maui) • Wailuku has 10 automated trucks & 2 manual trucks (Source: County of Maui)
Relocation of West Side Base Yard Refuse Operations																																
Refuse Truck Drivers	16	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	• 8 employees from West Side Base Yard (Source: County of Maui) • Employees usually arrive at the base yards at 5:30 AM; No AM peak hour trips were assumed • Employees do not necessarily have a standard 8 hour work day and start their shift early. Thus, no traffic related to refuse trucks and refuse drivers were assumed in the PM peak hour (Source: County of Maui) • General employee location: All but 2 live on the west side/Lahaina Area (Source: County of Maui)
New Refuse Truck Trips	8	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	• Refuse trucks will be moved from the West Side base yard to the expanded Central Maui landfill, where they will be stored • Trucks deploy before the AM peak (i.e. 5:30 AM) • Employees do not necessarily have a standard 8 hour work day and start their shift early. Thus, no traffic related to refuse trucks and refuse drivers were assumed in the PM peak hour (Source: County of Maui) • West Side has 2 automated trucks & 2 manual trucks (Source: County of Maui)
Construction & Demolition Materials Recovery Facility																																
Customers	50	100	0	0	0	8	8	16	16	16	32	8	8	16	16	16	32	0	0	0	8	8	16	16	16	32	8	8	16	16	16	32	• Per discussion with Cheryl Andrade from Maui Construction & Demolition Facility, recent averages related to truck activity equated to about 50 loads per day. Thus, we have assumed that 50 daily trucks (i.e. 1 load per truck) would visit the proposed Construction & Demolition Materials Recovery Facility. • Cheryl had also noted that rush hour at their facility occurs from 7-7:30 AM, 11AM-12 PM, and right before their 4PM close. Based on this information we think it is reasonable to assume that 15% of the truck trips would occur in the peak hour.
Employees	6	6	3	0	3	0	0	0	0	0	0	3	0	3	3	0	3	0	3	3	0	0	0	0	0	0	0	3	3	0	3	3	• 3 people at C&D MRF (Source: County of Maui) • Assuming that the employees arrive and depart during the peak period
Metals Processing Facility[3]																																
Processed Metal Truck Drivers	4	8	0	0	0	0	2	2	0	4	4	0	2	2	0	4	4	0	0	0	0	2	2	0	4	4	0	2	2	0	4	4	• Unsold abandoned vehicles are processed in the metals processing facility and sent off-site via outgoing trucks. Although this truck traffic is not a daily occurrence, we are conservatively assuming that 2 outgoing trucks leave the metals processing facility in the AM and PM peak hour to relocate the processed metal. (Source: County of Maui)
White Goods Refuse Truck Drivers	2	4	0	0	0	1	1	2	2	2	4	1	1	2	2	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	• White goods are brought in by 1 refuse truck once a week in the morning. Although this truck traffic is not a daily occurrence, we are conservatively assuming it in the trip generation and that the refuse truck drops of the white goods in the AM peak hour. (Source: County of Maui)
Employees	6	6	3	0	3	0	0	0	0	0	0	3	0	3	3	0	3	0	3	3	0	0	0	0	0	0	0	3	3	0	3	3	• 3 metals processing facility staff (Source: County of Maui) • Assuming that staff arrive and depart during the peak period
Other Ancillary Uses[2]																																
Administrative Office (Landfill Staff)	4	4	2	0	2	0	0	0	0	0	0	2	0	2	2	0	2	0	2	2	0	0	0	0	0	0	0	2	2	0	2	2	• 2 new staff (Source: County of Maui) • The existing employees just move from the existing landfill to the new maintenance facility • Assuming that staff arrive and depart during the peak period
Refuse Office Staff	6	6	3	0	3	0	0	0	0	0	0	3	0	3	3	0	3	0	3	3	0	0	0	0	0	0	0	3	3	0	3	3	• 3 refuse-related office staff (Source: County of Maui) • Assuming that staff arrive and depart during the peak period
Maintenance Facility (Mechanics)	4	4	2	0	2	0	0	0	0	0	0	2	0	2	2	0	2	0	2	2	0	0	0	0	0	0	0	2	2	0	2	2	• 2 new mechanics (Source: County of Maui) • The existing employees just move from existing landfill to the new administrative offices • Assuming that mechanics arrive and depart during the peak period
Total Net New Traffic	**356**	**536**	20	7	27	10	13	23	20	26	46	30	20	50	43	33	73	1	22	23	10	14	24	20	28	48	32	36	47	51	50	71	• For analyses purposes, we will convert the truck trips into passenger-car equivalents (PCEs) by a factor of 2.0.

Source: Fehr & Peers, June 30, 2016.

Notes:

[1] *Per discussion with County of Maui staff, truck traffic related to the metals processing facility does not occur daily; however, some truck traffic have been included in the trip generation to provide a conservative analysis. For example, vehicles that are not sold at the abandoned vehicle yard's auction are sent to the metals process facility (an interval trip). Once the vehicles are processed they would leave the landfill on a truck, but similar to the auction the processing and outbound trip would occur every two months. Depending on the volume of would cars this outgoing truck trip might be ongoing for a month or so, and so we have conservatively assumed in the project's trip generation that there would be a total of 4 outgoing trucks leaving the metals processing facility a day and that half of these trucks would leave in the AM peak hour and the other half in the PM peak hour. Another conservative assumption included in the trip generation, is the inclusion of white goods refuse traffic in the AM peak hour despite it occurring only once a week*

[2] *Traffic related to electronic waste and household hazardous waste activities do not occur every weekday. Due to the infrequencies/irregular occurrence of these activities, they were excluded from the trip generation.*

[3] *Truck trips were converted to passenger-car equivalents (PCEs) by a factor of 2.0*

APPENDIX J

PRELIMINARY ENGINEERING REPORT

PRELIMINARY ENGINEERING REPORT
For
CENTRAL MAUI LANDFILL FACILITIES PROJECT

Prepared for
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DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
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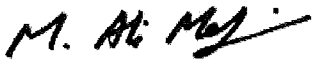
July 2017

This document has been prepared by me or under my supervision.



M. Ali Mehrazarin, P.E.

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ATTACHMENT 1 – HYDROLOGY REPORT

1.0 INTRODUCTION

The County of Maui (County) owns and operates the Central Maui Landfill (CML) located at 1 Pulehu Rd, Puunene. See Figure 1. CML is the primary solid waste disposal facility on the island of Maui.

The County proposes to expand the existing Central Maui Landfill (CML) in 2020 to provide additional and improved municipal solid waste disposal and landfill diversion facilities for the residents of Maui. This project is titled the "CML Facilities Project" (Project).

The County has acquired approximately 40 acres of former sugar cane farmland located on the north side of Pulehu Road and northwest of the existing CML site to accommodate the Project. Figure 1 illustrates the CML landfill property and the 40 acre Project property.

The Project includes the following proposed facilities and related activities:

- refuse collection office, truck parking, and maintenance area;
- storage area for abandoned vehicles prior to final disposition through sale or scrap metal recycling;
- metals processing area (management of scrap vehicles, white goods, batteries, tires, freon, and used motor oil);
- household hazardous waste and electronic waste collection and storage area;
- construction and demolition material recovery area;
- warehouse and storage area;
- office;
- internal access roads; and
- dedicated parking areas.

This report will outline the various development requirements for the facilities and associated structures.

2.0 PROJECT DESCRIPTION

The Project includes the proposed development of 40 acres of farmland northwest of the existing CML site and north of Pulehu Road. As illustrated in Figure 2A, the property is proposed to be graded to accommodate structures, work areas, parking areas, access roads, and drainage facilities. Figures 2C and 2D provide cross-sections of the site with existing and the proposed grades to accommodate the facilities and property improvements.

The following describes the facilities and related structures to be located on the Project site:

- *Abandoned Vehicles Area*: approximately 2 acres;
- *Office Structure*: 8,000 square feet (sf) with a parking lot;
- *Construction and Demolition (C&D) Material Recovery Area*: approximately 4 acres, including a 40,000 sf open materials processing area;
- *Metals Processing Area*: approximately 8.2 acres, including a 40,000 sf processing area with canopy cover;
- *Household Hazardous Waste (HHW) and Electronic Waste (E-Waste) Collection and Storage Area*: approximately 2.4 acres, including a 20,000 sf roofed structure;
- *Warehouse and Storage Area*: approximately 1.4 acres, with a 20,000 sf warehouse structure;
- *Refuse Collection Office, Truck Parking, and Maintenance Area*: approximately 3 acres, including a 12,000 sf structure with office and maintenance area, 2 acre refuse collection vehicle parking area, and an adjacent automobile parking lot;
- *Water Tank:* at the highest site location (south corner of expansion parcel);
- *Parking Stalls:* for truck-type vehicles located along the Pulehu Road frontage;
- *Access Roads:* paved internal access roads connecting the Project facilities with site Entrances 1 and 2 off Pulehu Road, and connecting the Project site to the CML ;
- *Stormwater Infiltration Basin* "A" with a net storage capacity (i.e., after deducting a 1 foot freeboard) of approximately 11,600 cubic yards, or about 7.2 acre-foot; and
- *Stormwater Infiltration Basin "B"*: with a net storage capacity (i.e., after deducting a 1 foot freeboard) of nearly 15,000 cy, or about 9.4 acre-foot.

3.0 EXISTING SITE CONDITIONS

The site is bounded by the existing CML landfill to the east/southeast, former sugar cane fields to the west and north, a gulch to the north and Pulehu Road to the south/southwest. The site is former farmland, and is presently vegetated by a variety of plants and grasses typical of fallow farmland in the area. The property is crossed by a number of former cane roads/trails that run in a northerly direction across the property towards Haiku Ditch.

As shown in Figure 3, the ground surface elevations on the property range from approximately 270 feet above mean sea level (MSL) in the south corner of the property, adjacent to Pulehu Road, decreasing to approximately 205 feet to the northwest, and to 196 feet to the north and northeast, with drainage towards the northwest, north and northeast, respectively, mostly by shallow channel flow.

Natural slope gradients are locally no steeper than about 16 percent around the site's highest elevations, gradually decreasing towards the northwest, north and northeast, with corresponding natural drainage flow directions mostly towards Haiku Ditch. The northeast portion of the property is adjacent to the Kalialinui Gulch, a natural drainage feature that in turn drains to the north/northwest.

Running parallel to Pulehu Road and approximately 120 feet to the northeast, there is a 50-foot-wide electrical utility (MECO) line easement. A 15 feet wide water easement line (W-1) crosses the property in a southwest to northeast direction and is located approximately 450 feet west of the parcel boundary with the adjacent CML property.

The site is relatively dry with approximate average yearly rainfall of 20-inches. Prevailing tradewinds are from the northeast and high velocity gusts are not unusual.

Recently, the County utilized portions of the Project site for a temporary facility to manage collection and processing of storm debris which involved improvements consisting of limited grading of the property and siting of a modular office trailer.

4.0 SEISMICITY & GEOLOGY

4.1 Regional Seismicity

The CML Facility and the Project site are located within a "seismic impact zone" on the island of Maui. The United States Geological Survey (USGS) has classified the island of Maui in UBC Seismic Zone 2B, defined as having a ten percent probability of exceeding a peak ground acceleration of 0.15 g (g = force of gravity) in 50 years (USGS, 2004a). USGS earthquake hazard maps (Klein, Frankel, Mueller, Wesson, and Okubo, 2001) estimate the peak horizontal ground acceleration in central Maui to be 0.36 g with a 2% probability of occurrence in 50 years.

4.2 Site Geology

The natural surface at adjacent CML is composed predominantly of Kula volcanic rocks. Quarrying activities at the CML have provided good exposures of the uppermost 40 feet of lithology, where these volcanic rocks have been weathered to reddish colored silty clay. Where undisturbed, this surficial soil horizon ranges in thickness from about 5 to 15 feet. Relatively fresh volcanic rocks of the Kula Series underlie this surficial soil horizon.

Additional geologic characterization of site lithology was obtained from lithologic logs of six CML groundwater monitoring wells: MW-1 through MW-3 drilled in 1995, and MW-4 through MW-6 drilled in 2001, where MW-5 is the closest to the Project site. These wells range in depth from 245 to 327 feet, and are located as shown on Figure 1. The Kula Series volcanic rocks, which can be up to 30 feet thick locally, are in most areas of the site underlain by:

Saprolite: An approximately 5 to 15-foot thick, reddish brown, silty clay weathering horizon which is, in turn, underlain by

Volcanic clinker: A horizon ranging from less than 5 feet to as much as 20 feet thick.

Volcanic tuff: At monitoring wells MW-4 and MW-5 the clinker horizon apparently changes character somewhat, and is characterized as a moderately weathered tuff, ranging in color from gray to dark brown to red brown. Taken as a whole, this saprolite/clinker/tuff horizon appears to be laterally continuous beneath most of CML.

Volcanic Basaltic Rock: Below the saprolite/clinker/tuff horizon, site-monitoring wells encountered basaltic volcanic rocks thought to be the upper portions of the Honomanu volcanic series. These materials, which extend to the maximum depth explored in the boreholes (327 feet below natural grade), are primarily hard basaltic flow rocks, with some laterally discontinuous weathered horizon and clinker zones.

Groundwater Conditions: The regional aquifers underlying the CML are part of the Paia aquifer system, which is in turn part of the larger Central aquifer sector on Maui. No high-level or perched

aquifer has been identified at the CML site during previous investigations. The lack of perched groundwater is indicated by previous site characterization activities at CML, as follows:

- Lithologic logging of borings for site monitoring wells has included descriptions of moisture conditions. No indication of perched groundwater is noted on lithologic logs from any of the site monitoring wells; and,
- Quarrying activities at the site have locally extended completely through the Kula Series Volcanics - the lithologic unit most likely to contain perched groundwater zone - with no evidence of perched groundwater being noted.

The elevation of the basal groundwater zone has typically ranged from +1.5 to +3.5 feet (MSL) in CML monitoring wells (or approximately 220 to 300 feet below ground surface).

5.0 SITE PREPARATION, EARHWORK, AND FOUNDATIONS

5.1 Site Preparation and Earthwork

To develop building pads, work areas, parking lots, internal roads, and drainage features, the site will be re-graded to a slope of 2% to 2.2%.

Except for landscaped areas, perimeter slopes, and the stormwater basins, the graded area will be covered with either concrete, asphalt, or crushed rock to ensure all weather access and all-weather work areas.

The earthwork is balanced with excavation of 198,000 cy (plus approximately 2,000 cy for road base and building foundation excavation) and fill of 200,000 cy.

The building pad that runs parallel to Pulehu Road will range in elevation from approximately 212 to nearly 245 feet. The building pad that is adjacent to the CML property boundary and existing infiltration basin will range in elevation from approximately 229 to 238 feet. Grading plans are illustrated on Figure 2A. Based on proposed grading plans, cuts and fills generally less than 20 feet in depth will be necessary. Deepest cuts will be made just north of the proposed water tank and at the location of proposed Infiltration Basins "A" and "B" (about 15 to 25 and 12 to 15 feet, respectively). Deepest fill areas will generally be along the northern and western edges of the proposed building pads. See Figures 2C and 2D, which illustrate cross-sections of the existing and proposed grades.

Excavation and Subgrade Preparation: Considering that the thickness of the surficial silty clayey soils is roughly on the order of 10 feet (saprolite), some excavation into volcanic rock (tuff, clinker and basalt) using heavy dozers (Caterpillar D10 or heavier), should be expected. While not anticipated localized use of explosives may become necessary if rock formations are encountered that cannot be removed using heavy equipment as the sole means of excavation.

Before the start of cut operations, the construction area should be cleared of organic matter, debris, or other deleterious materials. These materials should be removed from within the limits of the construction area, and should not be incorporated into structural fill. Existing underground utilities that are not abandoned, such as the water easement W-1 (see Figure 2A), should be protected and/or rerouted.

Recommended excavation should extend to a minimum depth of 3 feet below bottom of shallow spread footings or mat foundations and slabs on grade. Near-surface soil removal and re-compaction should also extend laterally a horizontal distance at least equal to the depth of over excavation beyond the perimeter of footings or foundation mats. If soft spots are encountered, deeper excavation may be locally required, as determined by a representative of the Engineer in the field.

All excavations shall comply with the most current Occupational Safety and Health Administration (OSHA) requirements. Temporary excavation in residual surficial soils and highly weathered volcanic bedrock up to 20 feet in height should not be steeper than 1:1 (H:V). Temporary excavations into soils and moderately weathered to fresh volcanic rock should be no

steeper than 1:1 and 0.5:1 (H:V), respectively. Where a shoring system is used, it shall be designed by a licensed professional engineer and installed to sustain all existing and expected loads.

Engineered Fill: Fill materials should be mostly granular, not contain particles greater than 3 inches in maximum dimension in the upper 5 feet, and have less than 50% of material passing standard US sieve No. 200 (minus 74 microns, per American Society for Testing and Materials (ASTM) D422). Liquid limit and plasticity index of fill soils should be less than 40 and 15, respectively (per ASTM D4318).

Select engineered fill, such as backfill to be placed behind footings, retaining walls and within the upper three feet of fill below all slabs-on-grade and pavements, should additionally have an expansion index (per ASTM D4829, or Unified Building Code (UBC) standard method 18-2) no greater than 20.

Use of On-Site Materials: Excavated materials can be reused for the construction of proposed engineered fill pads, provided they meet the above specifications for engineered fill materials. Some processing may be required to reuse some of these materials, such as screening out and breaking down oversize rock materials (maximum particle dimension greater than 3 inch) for use within the upper 5 feet of the structural fill layer. Excavated materials larger than 3 inches in maximum size should be used for structural fills at depths greater than 5 feet in accordance with the project specifications.

Treatment of Expansive Soils: It is anticipated that some of the near-surface silty clayey soils may have potential for expansion upon wetting. Expansive soils will heave and/or shrink upon moisture change cycles (wetting and drying) and may damage slabs on grades, pavements, and lightly-loaded shallow foundations. Alternatively, the use of post-tensioned slabs on grade and other measures would be required to minimize or eliminate the potential damage to structures. Soil characteristics will be further evaluated during the detailed grading and building design phase to ascertain the potential for expansive soil conditions. The findings of this soil testing will be incorporated into the final structural design to minimize expansive soil impacts.

Permanent Cut and Fill Slopes: Proposed permanent cut slopes into native materials, and engineered fill slopes up to 20 feet in height will not be steeper than 2:1 (H:V). Recommendations for other slopes should be considered on a case-by-case basis.

5.2 Foundation Recommendations

Following the recommended site preparation described above, foundations of the proposed structures (office, metals processing, household hazardous waste, warehouse, vehicle maintenance) may be preliminarily designed as discussed below.

Bearing Capacity: The proposed structures may be supported on isolated and continuous shallow spread footings or mat foundations bearing upon engineered fill. An allowable bearing capacity of 2,500 pounds per square foot (psf) may be used for design. This value may be increased by 200 psf for every additional foot of depth to a maximum of 3,000 psf.

For transient load applications, such as wind or seismic loads, allowable foundation bearing pressures may be increased by one-third. Where footings are adjacent to below-grade walls or underground utilities, the footing should extend below a 45-degree plane projected upward from the backside of the wall footing or bottom of the underground utility trench.

Settlements: Shallow foundations designed according to our recommendations are estimated to have total settlements less than ¾ inch, with differential settlements between adjacent columns of less than 1/2 inch. Foundation settlements resulting from building loads are anticipated to occur mostly during and shortly after construction. In addition, seismically-induced settlements are anticipated not to exceed approximately ¼ inch.

Resistance to Lateral Loads:
Lateral loads can be resisted by passive soil pressures and by friction between concrete and foundation soils. Lateral loads can be resisted by an allowable passive soil pressure of 250 pounds per square foot per foot of depth (psf/ft). The upper 1 foot of passive resistance should be neglected unless the soil is confined by pavement or slab. The allowable passive pressure includes a safety factor equal to 1.5 for relatively large deformations. In addition, a friction coefficient between the mass concrete and compacted fill can be used in combination with passive earth pressures to resist lateral loads. Assuming the engineered fill pads are composed of predominantly granular (sandy/gravelly) material, an allowable base coefficient of 0.45 is estimated. The allowable friction coefficient includes a factor of safety of 1.5. The coefficient of friction should be applied to net dead normal loads only.

Slabs on Grade:
Concrete slabs on grade should be underlain by a minimum thickness of 3 feet of select non-expansive granular engineered fill. This mat may be constructed by removing existing clayey near-surface soils and replacing them with granular structural fill, compacted to at least 95 percent relative compaction (per ASTM D1557). For slabs-on-grade in storage areas, and in areas where heavy vehicular traffic or forklift work is anticipated, the upper 24 inches of the 3 feet of prescribed engineered fill will be constructed of clean gravel or crushed rock (containing no more than 3 percent fines). This layer will help distribute the heavy floor loads more evenly to the foundation soils. Elsewhere, slabs on grade will be underlain by 3 feet of engineered fill with the upper layer composed of compacted clean rock or sand, not less than 4 inches in thickness.

Moisture vapor will tend to migrate through floor slabs. To reduce vapor migration in areas where moisture condensation on the floor is undesirable, consideration should be given to placing a plastic membrane of at least 6 mil thickness over the compacted structural fill layer. All plastic membrane joints should have a minimum overlap of 2 feet and joints should be taped. It is also recommended to lay vapor retarder over footings or to seal foundation walls, or both, and seal around penetrations such as utilities and columns in order to create a monolithic membrane between slab and moisture sources below the slab and at the slab perimeter in accordance with ASTM standard practice E1643 ("Installation of Water Vapor Retarders in Contact with Earth or Granular Fill under Concrete Slabs"). The plastic membrane should be covered with a minimum

of 6 inches of gravel as a capillary moisture retarder. This layer may also be considered as a portion of the recommended 24 inches of select non-expansive fill.

Pavements:

Pavement thickness depends on the strength of construction materials as well as on the loading and repetition of truck traffic. It is recommended that subgrade below pavements, within clayey soil areas, be over excavated a minimum of one foot and be replaced by non-expansive granular engineered fill, compacted to 95 percent relative compaction (per ASTM D1557).

Based on the design procedures in the Highway Design Manual, and using an assumed design R-Value of 10 for subgrade soils and 78 for aggregate base course, the following flexible pavement sections are recommended for various traffic indices (TI):

TI = 7.0 (Truck traffic, fire lanes and major traffic areas): 3 inches of asphaltic concrete over 16 inches of crushed aggregate base.

TI = 5.0 (Minimum adopted by most public agencies): 3 inches of asphaltic concrete over 6 inches of crushed aggregate base.

Prior to placement of the one-foot-thick engineered fill, the existing subgrade soils shall be processed (scarified) to a minimum depth of 6 inches, moisture-conditioned as necessary and recompacted to a minimum of 90 percent relative compaction (Modified Proctor, per ASTM D1557).

In fill areas, soil should be compacted to at least 90 percent relative compaction, but the upper 12 inches of fill soils should be compacted to at least 95 percent relative compaction and moisture-conditioned to at least 0 to 3 percent above optimum moisture content (ASTM D1557).

R-Value or California Bearing Ratio (CBR) tests should be performed on actual subgrade materials during construction to verify the selected resistance value used for design. All base materials should meet the applicable gradation and quality requirements of County of Maui Department of Public Works specifications. Field inspections and periodic testing, as needed during preparation of subgrade and placement of base course materials, shall be undertaken to ensure that the requirements of these specifications are fulfilled.

For the delivery pads areas, we recommend 6 inches of Portland Cement Concrete (PCC) over 6 inches of crushed aggregate base. The PCC sections should be provided with appropriate steel reinforcement and crack-control joints.

6.0 SITE DRAINAGE

The proposed grading plan for the Project results in the surface sloping at an average of 2% to 2.2%. Runoff from the Project area is generally of shallow-channel flow type, to be collected in perimeter asphaltic concrete (AC) paved road drainage ditches with adjacent AC berms, and discharged into the two proposed infiltration basins located as shown in Figure 2B.

The Project area next to Pulehu Road (approximately 28 acres) is graded to drain towards the north/northeast to the AC drainage ditch (approximately 12 inches deep) and berm (approximately 8 inches high) adjacent to the internal access road next to the Project property line (See Figure 2B, Detail 2). The AC drainage ditch will collect surface runoff and flow northwest to an open top concrete culvert crossing under the access road and discharge into Infiltration Basin "A". The concrete culvert will have a traffic-rated cattle crossing-style grate, matching the adjacent road grade, which will bridge over the open top culvert. Infiltration Basin "A" will include an emergency spillway (weir type, 400 feet long) along the north side in case design peak flows are exceeded during the life of this structure. A rip-rap revetment will provide erosion control over the outer slope of this emergency spillway, as shown in Detail 1, Figure 2B.

The Project area abutting the northern property line of the CML (approximately 11 acres) is graded to the northeast. Stormwater will sheet flow over the surfaced operational areas to the graded inlet of Infiltration Basin "B" (elevation 226 ft MSL). Drainage features such as curbs and contoured pavement will be added to this area during final design of the roads and paved operational areas to further define stormwater flow to the basin inlet.

Infiltration Basins "A" and "B" have net capacities (after deducting the one-foot freeboard) of approximately 11,600 and 15,000 cubic yards (cy), or about 7.2 and 9.4 acre-foot, respectively. Stormwater collected in the proposed basins will discharge primarily by infiltration through the fractured bedrock in which these basins are constructed.

Infiltration Basin "B" is proposed to be connected to the adjacent existing 11,000 cy CML Phase IV stormwater basin, as shown on Figure 2B. If the design capacity is exceeded in the event of a major storm, overflow of the combined basins will be conveyed into the adjacent Kalialinui Gulch from the existing Phase IV basin spillway.

The drainage features are sized based on the results of a preliminary hydrology study evaluating them in relation to the design storm (50-year, 1-hour design storm event) specified in County of Maui Department of Public Works regulations (Title MC-15, Subtitle 1, Chapter 4 "Rules for the Design of Storm Drainage Facilities in the County of Maui"). A copy of the preliminary hydrology study is located in Attachment 1.

In addition to the Project infiltration basins being sized to hold and infiltrate 100% of the stormwater run-off associated with design storm, the completed Project will incorporate structural and operational Best Management Practices (BMPs) designed to minimize impacts to stormwater quality as a result of the Project activities.

Structural BMPs will include covered or enclosed areas for activities with a high potential to impact stormwater to prevent their exposure to rainfall. The Metals Processing Area, Vehicle Maintenance Area, the HHW Area, and Warehouse are all covered or enclosed areas providing shelter for activities that could otherwise adversely impact stormwater. Storage of vehicle fluids, solvents, fuels, etc. will be within these covered areas when possible; if outdoor storage is necessary, these areas will be equipped with the applicable secondary containment structures to prevent run-off. Additional structural BMPs will include use of diversion berms and swales to direct run-off around and away from steeply sloped areas and areas with activities that could contribute to stormwater degradation.

Operational BMPs include development and effective implementation of operational practices and procedures which will reduce potential for pollutants to impact stormwater. These will include work practices and procedures for each Project activity that limits pollutant exposure to stormwater, good housekeeping practices, and regular inspections/observations to verify the efficacy of the operational practices.

Operational practices and procedures are prescribed methods of executing work to minimize pollutant exposure to stormwater. Examples include a policy that vehicle fluid changes and maintenance activities involving fluids will only be conducted inside the covered maintenance area, or scrap vehicles leaking fluids when delivered to the Metals Processing Area will only be stored under the canopy and not outdoors. In the case of the C&D Material Recovery Area, an example is to minimize storage of fine-grain soils to reduce potential for erosion of stockpiles and high suspended solids in stormwater.

Good housekeeping will include practices and procedures that maintain the Project facilities and areas in a neat and orderly fashion that prevents exposure of pollutants to stormwater. Regular use of a street sweeper on paved areas to minimize build-up of dirt and oils on the road that would otherwise impact stormwater is an example. Regular cleaning and upkeep of the exposed operational areas is another example.

Finally, the implementation of regular inspections and observations of the Project areas to ensure structural BMPs are in good working order, to verify the adequacy of the operational BMPs, and to identify and correct deficiencies before storms will ensure minimal impact to stormwater.

7.0 SITE ACCESS AND INTERNAL TRAFFIC CIRCULATION

Access to the Project site will be provided by two new driveways located on Pulehu Road (Figure 2B). The southernmost driveway (Entrance 2) is the primary entrance/exit and provides full access, while the northernmost driveway (Entrance 1) is secondary and provides for right in/right out only for traffic traveling north on Pulehu Road.

Access to the Project site from the CML will be by connecting the Project internal access roads to existing internal CML access roads. One connection between CML and the Project access roads will be located to the south of Infiltration Basin "B" where the Project access road located near the Refuse Collection Office, Truck Parking, and Maintenance Area will connect to the CML roads. A second connection is the Project access road located between the Household Hazardous Waste and Electronic Waste Collection and Storage Area, and the Warehouse and Storage Area which will connect to the CML internal access road located approximately 300 feet northeast of the self-haul waste drop off area. See Figure 2B for location of the two access road connections between CML and the Project.

Project driveways will be designed to meet all American Association of State Highway and Transportation Officials (AASHTO) standards as well as County of Maui Department of Public Works standards for intersection design. Separate entrances for the Project site and the landfill should reduce the risk of conflicts between landfill traffic and vehicles accessing the Project site.

The site provides maneuverability for a WB-40 tractor semi-trailer as defined by the American Association of State Highway and Transportation Officials (AASHTO). All Project-related equipment and vehicles should be able to maneuver throughout the site. All Project roads are asphalt, a minimum width of 24 feet, and will accommodate 2-way traffic.

Signage will be installed at the entrances off Pulehu Road, on internal access roads connecting with the CML internal access roads, and at all internal access road intersections indicating the directions to the various Project facilities. Signage identifying each operational area will be placed at its entrance.

Internal traffic control will be achieved with standard traffic signage, primarily 4-way stop signs at intersections requiring traffic from all directions to stop prior to proceeding through the intersection.

Pedestrian traffic will be limited to only those areas next to the Project structures. To ensure safety of the public attending the periodic abandoned vehicle auctions at the Office, a pedestrian path from the Office to the Abandoned Vehicles Area is planned. This will include pedestrian crossing signage and a painted cross walk across the road extending from Entrance 2 off Pulehu Road. Similarly, signage and a walkway and cross walk is also planned across the road running between the Refuse Collection Office, Truck Parking, and Maintenance Area and

the adjacent automobile parking lot. Movement of personnel and customers to and between the other Project facilities should be by vehicle rather than walking to ensure maximum safety.

Customers seeking to access the Office, Abandoned Vehicles Area, or the Household Hazardous Waste and Electronic Waste Collection and Storage Area will enter the Project area from Pulehu Road using Entrance 2 and will follow the paved roads to the desired location.

Customers seeking to drop materials at the Metals Processing Area or the Construction and Demolition (C&D) Material Recovery Area will enter the CML entrance off Pulehu Road and proceed to the truck scales to be weighed and ticketed and will then proceed to their destination in the Project area using the access road located between the Household Hazardous Waste and Electronic Waste Collection and Storage Area and the Warehouse and Storage Area. Customers, after dumping their loads, requiring to return to the scales to be weighed for their empty weight will return using the same route. Customers not returning to the scales will exit the Project area using Entrance 2.

Refuse vehicles, operating from the truck parking area at the Refuse Collection Office, Truck Parking, and Maintenance Area, in the morning at the beginning of their route, will travel the internal access roads to Entrance 2 and exit the site onto Pulehu Road. When they return with a payload of waste, they will enter the CML entrance off Pulehu Road, be weighed and ticketed at the scales, and proceed to the landfill. They will exit the landfill, to continue their daily routes, following the same route in reverse. After dumping their last load of the day at the landfill, the refuse vehicles will return to the truck parking area via CML roads that connect to the Project access road.

Trucks transporting outbound materials, such as processed scrap metal, processed C&D, or hazardous waste/electronic waste will follow the internal access roads to the CML scales to be weighed and the loads documented. After processing at the scales, the trucks will exit the site via the CML internal roads and entrance on Pulehu Road. Processed C&D materials, while some portion may be transported off-site occasionally, will more typically be utilized at the CML as landfill cover (dirt) and as road base (concrete, asphalt, rock, etc.). Wood recovered at the C&D Area is to be transported to the EKO Systems composting facility located on the CML property. Wood loads transported to EKO will follow the same previously described route to the CML scales, travel to EKO via the CML access roads, and return to the C&D Area via the access road located between the Household Hazardous Waste and Electronic Waste Collection and Storage Area and the Warehouse and Storage Area.

Employees will normally access the Project area from Pulehu Road by way of Entrance 1 or 2, but may on occasion enter through the CML entrance off Pulehu Road and travel to the Project area via the CML internal access roads.

8.0 LANDSCAPING

Given the remote location of the Project, the industrial nature of the adjacent land uses (rock quarry, rock processing, paving company yard, precast concrete products plant, and landfill) and the zeroscape landscape approach utilized at the adjacent CML, the County proposes to continue with the zeroscape landscape approach for the Project area as well. The Pulehu Road frontage of the CML is not landscaped. Plant growth in this frontage area is cut and maintained in a neat and orderly fashion. The Project frontage on Pulehu Road is proposed to be maintained in a similar fashion. The additional benefit of this approach is reduced water demand and reduced water extraction from the underlying groundwater aquifer which is planned be the Project water supply source.

9.0 AREA DESCRIPTIONS AND DESIGN CRITERIA

9.1 General

The areas and related structures to be developed as part the Project are listed as follows:

a. Office;
b. Metals Processing Area;
c. Household Hazardous Waste and Electronic Waste Collection and Storage Area;
d. Refuse Collection Office, Truck Parking, and Maintenance Area;
e. Warehouse and Storage Area;
f. Abandoned Vehicles Area; and
g. Construction and Demolition (C&D) Material Recovery Area

The Project and the associated structures will be developed for expanded solid waste and diversion services for the citizens of the County.

The County plans to incorporate into the Project sustainable construction materials and construction practices, energy and water efficient systems, and a healthy indoor environment in an effort to achieve LEED Certification. In an effort to achieve LEED Certification, the project will incorporate the following features into the Project:

- Water Conservation Measures
  - EPA WaterSense labeled plumbing fixtures
  - Flow reducers and faucet aerators in all domestic plumbing fixtures
  - High-efficiency toilets
  - Xeroscape landscaping
  - Paved internal roads to minimize need for dust control water

- Energy Conservation Measures
  - High-Efficiency HVAC systems with programmable controllers
  - EPA EnergyStar appliances/office equipment
  - Energy efficient lighting systems (LED and/or Fluorescent) with multi-zone control
  - Incorporate skylights and locate windows in a strategy to maximize natural lighting
  - Cool roof materials

The current County of Maui Building Code is the 2006 Edition of the International Building Code that will apply to all Project Structures.

9.2 Office

9.2.1 Description and Design Considerations

The Office will house personnel associated with the operation of the Abandoned Vehicles Program, Construction and Demolition (C&D) Material Recovery Area, and the Metals Processing Area.

The exterior dimensions of the Office structure are 80 ft. by 100 ft. At the front of the structure, within the 8,000 square foot (sf) footprint, a 30 ft. by 40 ft. (1,200 sf) open-sided canopy cover is planned to accommodate persons participating in the periodically conducted abandoned vehicle auctions. Within the enclosed portion, approximately 3,000 sf of the interior will house a combination of offices, workstations, and sanitary facilities (mens and womens restrooms and locker rooms) that will accommodate the following: 1) personnel associated with the Abandoned Vehicles Program; 2) personnel operating the Construction and Demolition (C&D) Material Recovery Area; and 3) personnel operating the Metals Processing Area. The remaining portion of the interior will be for storage.

9.2.2 Parking, Circulation, and Access

Parking is proposed in the area immediately around the structure and will accommodate automobile or light-duty utility vehicles. This parking capacity is adequate to accommodate personnel regularly housed in the structure as well as the public attending the periodic abandoned vehicle auctions. The parking lot will be asphalt and access is from the internal access road. The parking lot encircles the structure and enables vehicles to enter off the internal access road, drive around the entire structure, and exit back onto the access road. Personnel working in the Office will park in the surrounding lot, as will attendees of the abandoned vehicle auctions, with access to the structure via several exterior doors.

9.3 Metals Processing Area

9.3.1 Description and Design Considerations

The Metals Processing Area structure will house activities associated with the receipt, management, storage, and outgoing transportation of recycled metals generated through the management of junked vehicles, white goods, and other scrap metal. The structure will house systems for the draining and management of fluids and freon from junked vehicles and white goods. Collected fluids and freon will be stored before transport off-site. After removal of fluids and freon, vehicles and white goods will be size reduced as necessary, before being crushed/baled. After being crushed/baled, scrap will be stored inside until being loaded for transport off-site.

The exterior dimensions of the structure are 100 ft. by 400 ft. (40,000 sf). The structure is open-sided on all four sides with a full canopy roof. To accommodate operation of heavy equipment consisting of excavators, wheel loaders, forklifts, and crushers/balers, the structure will be clear span and have a minimum internal clearance of 35 ft. (floor to roof structure). The floor is steel reinforced concrete (8" minimum). The layout includes a loading area next to the baled product storage area. See Figure 5 for conceptual illustration of the floor plan and elevations. The structure will likely be equipped with steel reinforced concrete pushwalls (8 to 10 ft. in height) in areas where scrap metal will be stored prior to crushing/baling to facilitate efficient storage and ease of handling with a wheel loader.

Equipment for the draining and management of fluids and freon is electrically powered. All mobile equipment is to be either gasoline or diesel powered. The crusher/baler, depending on the equipment selected by the County, is to be either diesel powered or electrically powered.

Restroom facilities for the operating personnel are proposed to be located within the structure footprint.

9.3.2 Parking, Circulation, and Access

Parking will be provided in the area along the Pulehu Road frontage. The Metals Processing Area is an 8.2-acre portion of the Project site which provides staging area for vehicles to be processed.

The area surrounding the structure will be asphalt pavement, compacted crushed rock, or compacted recycled asphalt/concrete base material to ensure all weather access from the paved internal access road to the structure, provide traffic circulation around the structure, provide access to the interior, facilitate loading of trucks for transportation of scrap metal to off-site buyers or end-users, and the loading of trucks for transportation of recovered automotive fluid and freon to permitted off-site processors.

Vehicles loaded with white goods, scrap metal, and scrap vehicles will enter the area via the paved internal access road after being weighed at the CML scales. The vehicles will park parallel to the northern end of the structure for off-loading. Off-loading will be done with a forklift or wheel loader equipped with forks or a grapple attachment, and items not suitable for storage or staging outside are to be staged inside the structure to await further processing for removal of fluids and freon, if necessary, prior to being dismantled, crushed/baled, and prepared for off-site transport.

9.4 Household Hazardous Waste and Electronic Waste Area

9.4.1 Description and Design Considerations

The Household Hazardous Waste and Electronic Waste Area structure will house activities associated with the receipt, management, storage, and outgoing transportation of household hazardous waste and electronic waste collected from County residents. The structure will house a drive-through area to receive wastes from County residents, an area to handle and package wastes as necessary, areas to store different types of waste, a loading area to facilitate loading outbound materials for off-site transportation, and an office area to accommodate the operational personnel.

The exterior dimensions of the structure are 100 ft. by 200 ft. (20,000 sf). Within the 20,000 sf footprint, there will be a 40 ft. wide x 200 ft. long covered drive-thru with 2 parallel lanes. The drive-thru will be open on each end to permit traffic flow and on the exterior wall for ventilation, with a canopy cover. The remaining portion will measure 60 ft. wide by 200 ft. long and provide an enclosed area to house the operations office and the waste handling and storage areas. Roll-up doors will permit forklifts to move materials from the drive-thru to the structure interior. On the side of the structure opposite the drive-thru, a loading area for loading outbound materials into transport vehicles is proposed. Figure 6 provides a conceptual illustration of the floor plan and elevations.

9.4.2 Parking, Circulation, and Access

Parking will be provided in the area immediately around the structure and will accommodate automobile or light-duty utility vehicles. This parking capacity is adequate to accommodate the operational personnel and provide several stalls for limited customer parking. The drive-thru design will eliminate the need for customer parking as customers will not have to park to unload their vehicles.

The area surrounding the structure will be asphalt pavement to ensure all weather access. Customers seeking to deliver HHW and e-waste will enter the area off the internal access road and will drive counter clockwise around the northerly end of the structure and proceed to the southerly end to the drive-thru lanes and proceed under the canopy cover. Operational personnel will direct them to the appropriate location and assist in the off-loading of waste materials. After all waste has been unloaded, the customer will exit out of the northerly end of the structure and exit the area onto the internal access road and proceed to exit the Project area via Entrance 1 or 2.

A load out area is located on the southwesterly side of the structure, the side opposite the drive-thru, for loading HHW and e-waste materials onto transport trucks, with forklifts, for transport off-site. Wastes being loaded are to be palletized or packed in drums, and are weighed prior to loading to permit accurate manifesting of outbound loads. The transport trucks will access the area via the same entrance off the internal access road that is used by customers and once loaded

will travel around the structure and exit back onto the internal access road and proceed to exit the Project area via Entrance 2. Loading of outbound materials will, as a rule, be scheduled on days the operation is not receiving wastes from customers.

9.5 Refuse Collection Office, Truck Parking, and Maintenance Area

9.5.1 Description and Design Considerations

The Refuse Collection Office, Truck Parking, and Maintenance Area will house personnel and activities associated with the operation and maintenance of the County refuse collection vehicle fleet, and some administrative personnel associated with operation of the landfill. This structure and the associated truck parking area, located immediately adjacent, will accommodate the Upcountry and Central/Wailuku refuse collection operations presently operating in two separate locations. The area has been sized to permit the County to also accommodate the Westside collection operation in the future.

The conceptual design provides for a 2-story office area, 3 bays for vehicle repair and maintenance, and a canopy covered vehicle wash bay. See Figure 7 for the floor plan and Figure 8 for the elevations. The dimensions are 80 ft. wide x 150 ft. long (12,000 sf footprint). The office portion of the footprint measures 80 ft. wide x 50 ft. long and is 2 stories tall; area is 4,000 SF per floor (8,000 sf total). The vehicle maintenance area accommodates 3 enclosed, drive-thru repair/maintenance bays (each bay measuring 80 ft. long x 25 ft. wide) with roll-up doors; total area for 3 bays is 6,000 sf. The canopy covered wash pad measures 80 ft. long x 25 ft. wide; total area is 2,000 sf, and will abut the structure on one side and be open-sided on the remaining 3 sides.

The vehicle maintenance areas and wash bay floors will be surfaced with steel reinforced concrete (8" minimum). The maintenance bays and wash bay floor will drain to a grated collection trench in the floor, through a clarifier to separate oils/grease and solids from the water before it is conveyed to a waste water storage tank. The County may elect to utilize a wash water recycling system which will reduce the need for off-site water disposal, but a waste water storage tank will be necessary. Waste water will likely be transported to one of the County-owned treatment plants for final disposal.

The maintenance and repair of refuse collection vehicles includes vehicle fluid products (lubricating oils, hydraulic fluids, antifreeze, etc.) and generation of waste versions of these fluids. The area design will incorporate storage areas for these fluids and wastes. Typically, these fluids are stored in tanks located outside, but immediately adjacent to the structure, to facilitate access by bulk delivery trucks (and waste removal trucks). The tanks will be equipped with secondary containment structures. Certain fluid types, used in smaller quantities, may be purchased in 55-gallon drums, or smaller containers, and may be stored inside the structure.

The facility will include a station for fueling the refuse collection truck operating out of the yard. The station will consist of one or more above ground diesel storage tanks, with a total capacity of 4,000 to 5,000 gallons, and a pump and nozzle for dispensing fuel to the trucks.

The ground floor of the office area will house offices required for refuse collection operations management, administrative, and maintenance personnel, as well as office space for landfill administrative positions. The second floor will initially be used only to house storage for non-flammable vehicle maintenance supplies, and possibly a driver training room. The balance of the second floor area is proposed to be reserved for development of additional office space if needed in the future.

9.5.2 Parking, Circulation, and Access

Employee vehicle parking will be provided in a parking lot located immediately to the north of the structure. This parking capacity will accommodate initial employee headcount as well as the additional personnel if the Westside yard is consolidated into this area, and potential growth in the office staff. The parking lot is proposed to be surfaced with asphalt pavement. Employees parking in the lot will access the structure via a cross walk across the internal access road.

The refuse collection and fleet support vehicles, when not operating, are to be parked in the 2-acre truck parking area located immediately to the south and east of the structure, which can easily accommodate 50 refuse collection vehicles (current fleet size for all 3 current operating base yards is 24 collection trucks). The parking area and its ingress and egress points to the internal access road will be asphalt pavement.

9.6 Warehouse and Storage Area

9.6.1 Description and Design Considerations

The Warehouse and Storage Area will be used for storage of operating supplies and materials for the facilities and activities located within the Project area as well as for the adjacent operations. Materials anticipated to be stored are metal and plastic such as heavy equipment parts, refuse collection carts, metal drainage pipe, plastic drainage pipe, landfill tarps, etc.

The exterior dimensions of the structure is proposed to be 100 ft. by 200 ft. (20,000 sf). The structure is proposed to be fully enclosed with access via 4 roll-up doors (16 ft. wide x 18 ft. high) and pedestrian doors. The floor is steel reinforced concrete (8" minimum). To maximize usable floor space and facilitate movement of materials, the structure is recommended to be clear span with a minimum floor to ceiling clearance of 18 ft.

See Figure 9 for conceptual illustration of the floor plan and elevations.

9.6.2 Parking, Circulation, and Access

Parking will be available around the structure perimeter. As this structure will not normally be staffed on a regular basis, parking space requirements are very limited. The area surrounding the structure will be surfaced with compacted crushed rock or compacted recycled asphalt/concrete base material to ensure all weather access from the paved internal access road. Vehicles accessing the structure will enter the area via the paved internal access road. The yard is large enough to permit trucks to maneuver and back up to the roll-up doors of the structure, or pull along the side if a flat-bed trailer is used. Loading and off-loading will be done with a forklift.

9.7 Abandoned Vehicles Area

The Abandoned Vehicles Area will function as a storage area to accommodate vehicles that are taken into custody by the County of Maui. Abandoned vehicles will be stored until such time the means of their final disposition is determined. Periodically the program will conduct public auctions of abandoned vehicles as a means to put the vehicles to productive use and prevent their disposal as scrap. The auctions will be held in the canopy covered meeting area of the adjacent office structure. The public attending the auctions will be, prior to the auctions, permitted to observe the vehicles to be auctioned that are to be stored in the yard. Vehicles that are not purchased at auction will be recycled either through a 3rd party scrap metal processor or through the adjacent Metals Processing Area.

9.7.1 Description and Design Considerations

The Abandoned Vehicle Area will be a 2-acre area located southeast of the office structure and immediately to the northwest of the Metals Processing Area. The area will be surfaced with compacted crushed rock or compacted recycled asphalt/concrete base material to provide an all-weather operating surface and access to the paved internal road. Crossing the area, parallel to Pulehu Road, is a 50 foot wide electric transmission line easement which is restricted from use for parking or storing vehicles. The portion of the area located to the northeast of the easement will receive and store primarily automobiles and light duty utility vehicles with 25 foot traffic lanes between each row of parking stalls. The area to the southwest of the easement is proposed to be used for the storage of large vehicles and vessels. To provide security and control access, the area will be enclosed with a 6 foot high chain link fence and locking gate.

9.7.2 Parking, Circulation, and Access

Parking for staff personal vehicles will be provided in the parking lot at adjacent the office. Staff will access the area from the office via a walkway and painted cross walk across the internal access road extending from Entrance 2 off Pulehu Road. Vehicle access to the area is via the internal access road through the gated yard entry. The parking stalls for vehicles delivered to the site are arranged in rows with 25 foot wide drive lanes between the rows to provide adequate

room for tow trucks delivering the vehicles to maneuver. The area between the portion of the property adjacent to the Pulehu Road frontage and the 50 foot wide electric transmission line easement is available for storage of larger vehicles or vessels, but can also be used to accommodate automobiles and light duty utility vehicles.

9.8 Construction and Demolition (C&D) Material Recovery Area

The Construction and Demolition (C&D) Material Recovery Area will be a 4-acre area located southeast of the Metals Processing Area and to the southwest of the Household Hazardous Waste and Electronic Waste Collection and Storage Area. The area will accommodate the receipt, processing, and storage of recyclable materials from C&D wastes generated on the island of Maui. Processing utilize heavy equipment to separate and segregate bulky materials and feed non-bulky items into sorting equipment that may include manual sort lines and mechanical screens. Large items of concrete, asphalt, and rock (inerts) will be stockpiled and periodically crushed to permit re-use.

The intent of the C&D processing activity is to minimize quantities discharged into the landfill as trash and recover recyclable materials including metals, wood, inerts, and soils. Metals recovered are planned to be recycled either through a 3rd party scrap metal processor or through the adjacent Metals Processing Area. Wood (including woody vegetative materials) recovered is planned to be directed to the EKO Compost facility located in the adjacent CML facility for processing into compost and soil amendments. Soils recovered are to be utilized as cover at the CML landfill. Inerts recovered are to be utilized as road base at the CML landfill.

9.8.1 Description and Design Considerations

The C&D Material Recovery Area is proposed to be located on 4 acres. The areas used for vehicle access and material stockpiling will to be covered with compacted crushed rock or compacted recycled asphalt/concrete base material to provide an all-weather operating surface and access to the paved internal access road. The central portion of the area where the material handling and processing activities will occur is a 40,000 sf open concrete slab. Due to the heavy-duty service associated with C&D processing, concrete slabs are typically 10 to 12 inches thick and reinforced with steel rebar.

9.8.2 Parking, Circulation, and Access

Parking for staff personal vehicles will be provided at the office. Personnel movement between the office and the C&D area will be done using County work vehicles. C&D waste delivery vehicles will first enter off Pulehu Road through the CML entrance, proceed through the scales to be weighed and ticketed, and then proceed to the C&D area via internal CML and Project access roads. As the waste vehicles travel from the entry driveway and approach the 40,000 sf concrete operating pad they will drive around the pad in a counter clockwise direction and will be directed

by staff to the appropriate location to dump the load, based on the material composition of the load.

After materials are separated and processed, they are to be stockpiled in the areas near the entry or along the graded slope running parallel to Pulehu Road. When materials are to be loaded out, transport trucks will park alongside the various storage areas and be loaded with a wheel loader using a bucket attachment. Outbound materials will typically be directed to on-site destinations with scrap metal being transported to the Metals Processing Area, soil and crushed inert materials being transported to the landfill for re-use as road base, wood materials being transported to the EKO Systems compost facility, and refuse being transported to the landfill for final disposal. All outbound material loads are to be weighed at the landfill scales to document quantities of diverted and landfilled materials; vehicles traveling to the scales will exit the area through the driveway and travel the internal access roads to the scales.

10.0 WATER SYSTEM

10.1 Existing Conditions

There is no water system at the Project site. The County of Maui water system has not been extended to the site, nor is such an extension planned. The landfill operation utilizes an on-site well (State Well No. 5125-07) as its primary source of water. Use of this well was initiated in May 1, 2016. The landfill operation has an average daily water usage of approximately 19,000 gallons per operating day. The landfill offices/entrance facility domestic and fire control water is supplied via a dedicated 100,000 gallon storage tank, water pump, and on-site piping distribution system. Water supply to this tank is currently trucked in from an off-site source by County Highways. Domestic water consumption at landfill offices/entrance facility averages approximately 14,000 gallons/week (approximately 2,500 gallons per day).

The County plans to interconnect the 100,000 gallon tank and the on-site well in order to eliminate the need to truck water. The on-site well is capable of supplying up to 145,000 gallons per day. When the well becomes the supply source for the landfill offices/entrance facility, the average daily water demand will be approximately 21,500 gallons; therefore, the excess supply capacity of the well will be approximately 123,500 gallons per day. This equates to a weekly excess capacity of 886,000 gallons, when accounting for no water usage on Sundays when CML is closed.

10.2 Water System Schematic Design

The proposed Project water system shall conform to County of Maui Department of Water System Standards (2002) and shall meet the requirements of the State of Hawaii Department of Health.

The Project will be serviced by a water tank connected to a pump that will provide adequate pressure for domestic use and fire flow. A distribution network consisting of 8-inch main lines, 6-inch fire hydrant laterals, and 2-inch laterals to the structures should be adequate for the Project. The tank will have a capacity of 0.6 million gallons. See calculations below.

10.3 Water Demand Calculations

The Project area is 40 acres in total. A portion of the total Project area is occupied by light industrial uses with the balance of the area occupied by non-water demand uses of infiltration basins, roads, parking areas, utility easements, etc. The following table summarizes the land uses and the areas associated with each.

Table - 1

Light Industrial Use Areas	Area (sf)	Area (acres)	Use Area Total (acres)
Refuse Collection Office and Maintenance Area	131,000	3.0	
Household Hazardous Waste Area	103,000	2.4	
Metals Recovery Area	358,000	8.2	
Warehouse & Storage Area	63,000	1.4	
C&D Material Recovery Area	176,000	4.0	19.1
Parking Areas, Roads, and Un-Used Areas	**Area (sf)**	**Area (acres)**	**Use Area Total (acres)**
Basins A & B	128,000	2.9	
Office & Parking Area	63,000	1.4	
Abandoned Vehicle Area	96,000	2.2	
Refuse Truck Parking Area	26,000	0.6	
Roads	152,000	3.5	
Undeveloped/Unused Areas (slopes, easements, etc)	446,400	10.2	20.9
Total Project Area			40

The following domestic and fire flow requirements are based on guidance provided in the County of Maui Department of Water System Standards (2002):

Domestic and Light Industrial Flow Requirement

Domestic flow requirement, associated with water uses inside the various Project office areas and non-industrial activities, is assumed to be equivalent to 100% of the waste water flows calculated for these areas (See Section 11.0 for calculations). The flow requirement associated with the light industrial activities is based on the 6,000 gallons/acre/day prescribed in the County of Maui Department of Water System Standards (2002).

Domestic Flow = (100% of domestic waste water flow)	1,828 gallons/day; round up to 2,000 gpd
Light Industrial Land Use Area	19.1 acres
Average daily demand for water consumption for light industrial use =	6,000 gallons/acre/day
Light Industrial Average Daily Demand =	6,000 gallons/acre/day x 19.1 acres 115,000 gallons/day

Domestic + Light Industrial
Daily Demand = 2,000 + 115,000
117,000 gallons/day

Maximum Daily Demand = 1.5 x Average Daily Demand
1.5 x 117,000 gallons/day
175,500gallons/day
Roundup to 176,000 gallons/day

Peak Hour Flow = 3 x Average Daily Demand
3 x 117,000 gallons/day
351,000 gals/day

Fire Flow Requirement

The following table summarizes the Project structures, their total floor area, and the NFPA (National Fire Protection Association) Construction Type assumed for each structure. NFPA 1, Fire Code, Table 18.4.5.1.2 prescribes a minimum fire flow and flow duration for a structure based on the type of construction (defined in NFPA 220, Standards on Types of Building Construction) employed.

Table - 2

Structure	Total Floor Area (sf)	NFPA Construction Type	Required Fire Flow (GPM)	Required Flow Duration (hours)
Office	8,000	III (200)	2,000	2
Metals Processing Area	40,000	I	2,250	2
Household Hazardous Waste Area	20,000	III (211)	2,000	2
Refuse Collection Office and Maintenance Area	16,000	III (211)	1,750	2
Warehouse	20,000	I	1,500	2

The required fire flow and fire water supply storage capacity is based on the single Project structure with highest fire flow requirement which represents the worst-case scenario for fire protection water supply. The Metals Processing structure is the largest proposed structure at 40,000 SF and, based on the previously referenced NFPA criteria, requires a fire flow of 2,250 gallons per minute (GPM) for a duration of 2 hours. The other Project structures combined floor area and construction type result in lower required fire flows, and therefore are not used for calculating required fire water supply storage capacity. Based on the fire flow and duration applicable to the metals processing structure, the fire flow is calculated as follows:

Required Fire Flow =	2250 gpm
Flow Duration (hours) =	2
Flow Requirements(gallons/day) =	2250 gpm x 2 hours x 60, minutes 270,000 gallons

Water Storage Tank Sizing

The County of Maui Department of Water System Standards (2002) require storage capacity to satisfy the following criteria:

1. Meet maximum day consumption. Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.
2. Meet 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.
3. Minimum size reservoir shall be 0.1 MG.

Maximum Daily Demand (gallons) =	176,000
Fire Flow (gallons) =	270,000
Total Demand (Maximum Daily + Fire Flow) = (assumes reservoir is ¾ full)	446,000
Required Reservoir Capacity (100% full) =	595,000
Reservoir (Tank) Capacity (million gallons) =	0.6

10.4 Developed Condition

The combined water demand of the existing landfill operation (21, 500 gallons/day average) plus the estimated demand of the Project (117,000 gallons/day) results in a daily water demand of 138,500 gallons for each day the facilities operate. Assuming 6 operational days per week, the projected weekly water demand is estimated to be 831,000 gallons. The production well is planned to be the source of water for both the existing demand and the Project demand and is capable of supplying up to 145,000 gallons per day. Therefore, with a daily production capacity of 145,000 gallons and a daily water demand of 138,500 gallons, the production well capacity has a daily excess capacity of 6,500 gallons. On a weekly basis, the production well capacity is 1,015,000 gallons and the operational demand is estimated to be 831,000 gallons. Therefore, the production well capacity will exceed the weekly water demand by approximately 184,000

gallons. In reality, the operational water use on Saturdays, due to reduced operational activity as compared to Monday through Friday, is typically 50% to 75% of the average operational weekday. Therefore, the excess capacity of the production well is likely closer to approximately 250,000 gallons per week.

11.0 Wastewater System

11.1 Existing Conditions

Currently, there is no existing wastewater system in the vicinity of the Project site and there are no plans to service the site. The landfill operation utilizes a septic system and leach field to meet the wastewater demands of the offices at the CML.

11.2 Wastewater System Schematic Design

Wastewater generated by the proposed Project will to be treated with septic systems consisting of septic tanks and leach fields designed to the standards of the State of Hawaii Department of Health.

The tanks and leach fields are sized to accommodate the anticipated occupants for each of the areas. The septic tanks and leach fields are located where traffic is not expected.

Septic systems are not allowed within 1,000 feet of potable water wells. The landfill production well is located at the corner of the Project property; adjacent landfill property near Pulehu Road. Additionally, septic systems are not allowed within 50 feet of any surface body of water. These siting restrictions apply to the Project as a result of the on-site production well and the infiltration basins being considered bodies of water for the purposes of the restrictions.

The Warehouse structure will not have bathroom facilities. The Warehouse will not be staffed on any regular basis and will only be accessed from time to time when materials are placed in or removed from the structure.

The Household Hazardous Waste and Electronic Waste Collection and Storage Area and the Metals Processing Area structures are both located within the required 1,000 foot offset from the production well, therefore domestic wastewater generated at these structures are proposed to be managed in the septic system that also services the Office. The Office septic system, consisting of a septic tank, distributor box, and leach field, are to be sized to accommodate the waste water flows for it, the HHW structure, and the Metals Processing structure. This septic system is to be offset at least 50 feet from the new Infiltration Basin "A".

The Refuse Collection Office, Truck Parking and Maintenance Area septic system is to be offset at least 50 feet from the new Infiltration Basin "B" located to the east of the area. This septic system, consisting of a septic tank, distributor box, and leach field, will serve only the Refuse Collection Office, Truck Parking, and Maintenance Area. See Figure 10 for proposed location of septic leach fields and conceptual layout of septic piping.

11.3 Wastewater System Design Calculations

Table 3 presents the calculations and associated assumptions for the sizing of the septic system for the Refuse Collection Office, Truck Parking, and Maintenance Area domestic waste water, and the system that will service the combined domestic waste water flows from the Office, the Metals Processing Area, and the Household Hazardous Waste and Electronic Waste Collection and Storage Area. In both systems, the sizing is based on maximum anticipated occupant loading.

The calculations are compliant with design requirements of HRS Chapter 11-62 – Waste Water Systems.

As presented in Table 3, both systems flows at maximum anticipated loading are below 1,100 GPD. Each system will utilize the largest septic tank size permitted, 1,250 gallons. Based on the percolation rate observed at the landfill leach field, each system leach field is required to be at least 1,913 sf. With dimensions of 65 ft. x 30 ft., each field will provide the required absorption area.

Table 3 - Waste Water Volume & Septic System Sizing Calculations

Structure	Occupant Description	Headcount		Average Daily Waste Water Generation Rate/Occupant (GPD) (2)	Daily Waste Water Volume (3)		Proposed Septic Tank Size (gallons) (4)	Leach Field Sizing			Leach Field Dimensions	
		Initial	Maximum Future (1)		Initial	Future		Percolation Rate (minutes/inch) (5)	Required Absorption Area per 200 Gallons (6)	Required Absorption Area (SF) (7)	Length (ft) (7)	Width (ft)
Refuse Collection & Maintenance	Office Staff	5	40	20	100	800						
	Mechanics	2	3	55	110	165						
	Drivers/Helpers	37	45	20	93	113						
					303	1078	1,250	48	306	1913	65	30
Office, Metals Recovery, & HHW Areas	Abandoned Vehicle Staff	3	3	20	60	60						
	C&D Operation Staff	3	9	20	60	180						
	Metals Processing Staff	3	9	20	60	180						
	HHW Staff	4	6	55	220	330						
					400	750	1,250	48	306	1913	65	30
Totals					703	1828						

Notes: 1. Maximum headcount based on the following asumptions:

a. Refuse Collection Vehicle Maintenance Shop

Maximum office personnel is based on an assumed 200 sf/per person. First and second floor space availabe for office area is 4,000 sf/floor (total = 8,000 sf).
Potential for future consolidation of West Side Base Yard operations into this facility, therefore, increase mechanics by 1, and drivers/helpers by 8 positions

b. Office

Abandoned Vehicle Program not anticipated to grow beyond initial staffing levels
C&D Operations Staff - staff could increase by factor of 4X if intensive processing systems implemented
Metals Processing Operations Staff - staff could increase by factor of 4X if intensive processing systems implemented
Maximum future headcount with the planned 3,000 sf of office space developed within the bldg equates to an average area per person housed of 140 sf.

b. HHW

Will only operate 2 to 3 days per week. If higher usage is experienced, staff would not be expected to grow by 50%.

2. Source: HRS Chapter 11-62 Appendix D Table 1

a. All staff positions categorize as "Workers - Day, at schools and offices" with a 20 GPD waste water generation rate.

b. Categorize HHW Contractor Staff & Mechanics as "Factory" which adds 35 GPD for these positions in addition to the "Workers - Day, at schools and offices" contribution of 20 GPD for waste water generation purposes. Daily waste water generation rate per position = 35 gpd for Factory + 20 GPD = 55 GPD.

3. a. Waste water volume generated by Drivers/Helpers uses 1/8 of the total headcount. These employees work off site except for beginning and ending of 8 hour shift. Assumed these employees occupy the building for a maximum of 1 hour of the normal 8 hour shift, therefore 1/8 of total headcount used for waste water volume calculation.

4. Maximum septic tank size permitted is 1,250 gallons.

5. Assumed similar percolation rate as found at adjacent landfill leach field as documented in:
Geotechnical Engineering Exploration Central Maui Landfill Phase IV Expansion and
Facilities Infrastructure Puunene, Maui, Hawaii, August 26, 2002, Geolabs, Inc.

6. Source: HRS Chapter 11-62 Appendix D Table 3

7. Calculated as follows:
(Required Absroption Area/200 Gallons) x Septic Tank Size = Area (SF)
(306/200) x 1,250 = Area (SF)

12.0 ELECTRICAL SYSTEM

12.1 Existing Conditions

Electrical utility service for the Project will originate from the overhead utility lines along the Project side of Pulehu Road. There is an existing 23 KV Maui Electric (MECO) line extension that runs from Pulehu Road between the Project parcel and the landfill property. This line extension services the existing landfill offices near Pulehu Road, and the leachate and landfill gas flare facilities approximately 1,500 feet northeast of Pulehu Road. Some portion of the Project facilities may be powered from this line, depending on available capacity. There is no existing electrical service located within or presently servicing the Project area, and MECO will need to perform a line extension from Pulehu Road.

12.2 Developed Condition

Electrical service to the Project areas and related structures will likely be provided via an overhead electrical extension from Pulehu Road that will likely run along the internal access road. From the overhead line, legs will be extended to each area and structure via underground conduit that will feed pad mounted transformers adjacent to these areas or structures. Electrical service characteristics are 480Y/277V, 3-phase, 4-wire, 400 amperes. Electrical service equipment is comprised of a pullbox, current transformer cabinet, meter socket, and enclosed circuit breaker. Step-down transformers (480V-208Y/120V, 3-phase, 4-wire) and branch circuit panelboards will be located as necessary in each structure or area to further distribute power to wiring devices and miscellaneous loads.

Electrical load for each of the areas and structures will depend directly upon the specific uses, occupant count, and equipment utilized. As the activities and uses are specified by the County, detailed electrical load calculations will be developed which will be used to develop detailed electrical distribution system design as well as detailed electrical system design for each area and structure. The Office, Household Hazardous Waste and Electronic Waste Collection and Storage Area, and Warehouse and Storage Area will have electrical loads primarily driven by lighting, IT infrastructure, and HVAC/ventilation, and can be reasonably estimated at this time. These structures would likely be adequately serviced with a 200 amp distribution panel.

The Refuse Collection Office, Truck Parking, and Maintenance Area, Metals Processing Area, and the Construction and Demolition (C&D) Material Recovery Area electrical loads will be largely defined by the number and type of equipment utilized in each area. If the County elects to shred and/or bale scrap vehicles using electrical powered equipment, the electrical load will be significantly higher than if diesel powered equipment is used. Electrical powered balers and shredders utilize electric motors as large as 300 horsepower. This structure, if diesel powered equipment is utilized, will likely not require much more than a 200 amp service. If electrical powered equipment is utilized, the service could well exceed 1000 amp, depending on motor size and number. Depending on the use of diesel or electrical powered C&D screening and crushing equipment will define the electrical load at the Construction and Demolition (C&D) Material

Recovery Area. If diesel equipment is utilized, the electric load of the operation will likely be limited to exterior lighting and the load will be very small. Whereas if electric powered equipment is used, the service could well exceed 1000 amp, depending on motor size and the specific equipment utilized. Similarly, the maintenance activities and equipment used in the Refuse Collection Office, Truck Parking, and Maintenance Area will significantly impact the overall electrical load. Typical refuse maintenance facilities of the size proposed for the Project would require electrical service of about 600 amps.

Project design is at a conceptual level at this point in time and electrical load calculations are to be viewed as preliminary.

Electrical load can be moderated and reduced through the use of high efficiency lighting systems (LED and fluorescent), use of skylights to take advantage of natural lighting, and high efficiency HVAC systems. Architectural design and selection of building materials can also positively impact electrical consumption. Exterior walls and roof construction materials of a light color or reflective nature that absorb less heat will reduce HVAC costs, as will strategic use of landscaping to provide shade to the structures.

12.3 Developed Condition

Incorporation of renewable energy systems into the Project will reduce the amount of electricity purchased from MECO to operate the Project areas and activities. Renewable energy options available for consideration are photovoltaic (solar), wind turbines, and LFG to energy (utilizing landfill gas (LFG) from the CML to generate electricity).

The size and scope of a renewable energy generating system is based on the anticipated electrical load of the Project. Given the conceptual level of the electrical load, the specific sizing of an electrical generating system is not appropriate at this time, but a general strategy for sizing the system is discussed in the following.

Once the electrical demand of the Project is reasonably estimated, the capacity of the energy generating system can be defined. Under the current circumstances, sales of excess power to MECO from an on-site generating system are limited with revenue of power sales being extremely low to zero revenue. As the Project moves forward, the terms and conditions of MECO's various interconnect agreements, power purchase programs, and the Public Utilities Commission (PUC) tariff programs should be evaluated to determine if opportunities develop that would incentivize the County to generate excess power for sale and export to the utility.

Until such time that revenue associated with the sale of excess power improves, the strategy for an energy generating system would be to size the capacity of such a system to match the electrical power needs of the Project and minimize the purchase of power from MECO for the Project. Under the current programs available and assuming a system rated generating capacity of greater than 100 kW, this would likely be a standard interconnect agreement with MECO which would ensure the County's ability to purchase power as needed but provide no revenue for

excess power exported to the grid. Currently, a MECO program exists (Customer Grid Supply) for systems with rated capacity of less than 100 kW that provides for customers generating excess power to receive credits that offset the cost of power they purchase from MECO. However, this program is limited by capacity caps on total program generating capacity set by the PUC, and was previously closed to new projects until additional capacity was recently added. It is uncertain how long this or similar programs will be available in the future.

Additionally, the PUC has placed a limit on MECO distribution circuits of 15% of peak circuit demand on the total aggregate capacity of non-MECO generating systems on each circuit. Presently, the circuit serving the Project is well below the 15% saturation limit, so for the near term such a limitation should not be a concern.

Assuming solar (photovoltaic) power to be the likely electrical generating technology to be used, the following provides some concept of possible power generating capacity if solar systems were deployed on portions of the roof area provided by the Project structures.

Total roof area for the Project structures is 80,000 sf. Assuming 50% of this area is aligned in a southerly direction to optimize power generation, then 40,000 sf of solar panels could be deployed. Assuming a nominal area of 10,000 sf is required for a 100 kW system, the roof space of 40,000 sf could accommodate a generating capacity of 400 kW. This would be the rated capacity and the true generating efficiency will be affected by the degree to which alignment of panels with the sun is optimized, inclination of the panels, and maintaining the panels in a clean condition.

Additional generating capacity could be realized by placing panels on the portions of the roof area that do not have the optimum southern exposure, which would result in a lower power output per panel. Utilization of additional structures such as parking lot canopies that are designed with optimum alignment to the south and panel inclination would increase generating capacity but would require additional capital costs associated with these structures.

As with all capital projects, a cost benefit analysis will be necessary to determine the appropriate level of development of power generating capacity that will maximize the benefit to the County for the minimum required investment.

13.0 SITE SECURITY

Upon development of the Project, the site will be secured to prevent unauthorized access during non-operational hours. The perimeter of the property will be enclosed by a 6 foot high chain link fence. In areas where there is a graded slope, the fence will be located at or near the crest of the slope. The fence will tie-in to the existing CML security fencing along Pulehu Road. Locking gates are proposed to be installed at Entrance 1 and 2.

To provide further security at the Abandoned Vehicles Area, the area will be enclosed with a 6 foot high chain link fence with a locking gate.

Project areas will be equipped with security and alarms systems monitor and alert the County of unauthorized entry during non-operating hours.

Video surveillance and recording systems may be installed to monitor the Project entrances off Pulehu Road and the structure exteriors 24-hours per day, 365 days per year.

14.0 SOLID WASTE

The development of the proposed solid waste management facilities in the Project will be beneficial to the County and its residents by providing more and improved waste diversion services and will increase operational efficiency of the refuse collection system by consolidating at least two base yards and reducing non-productive drive time to and from the landfill.

Currently the County residents have limited C&D recycling options with most facilities only accepting a source separated portion of the C&D waste stream. With the development of the Construction and Demolition (C&D) Material Recovery Area, residents and businesses generating C&D waste will have a permanent and centrally located facility that will be able to accept and process mixed C&D waste. In late 2016, Maui Demolition and Construction Landfill, the destination for most C&D wastes on Maui, ceased operation. The average annual volume of C&D wastes discharged in the previous 5 years at Maui Demolition and Construction Landfill is estimated at approximately 36,000 tons per year (100 to 150 tons/day). Since its closure, most C&D waste is now being received by CML with a portion of the waste being processed for use. With the development of the Construction and Demolition (C&D) Material Recovery Area in the Project, most of the C&D waste being delivered to CML will be processed for recovery and re-use. Depending on the specific processing methods applied, diversion rates for this operation can be reasonably expected to range between 50% and 80%.

The Metals Processing Area will provide an additional option for the recovery of scrap metal. Currently only one scrap metal processor capable of dismantling and preparing scrap metal for off-island recyclers is operating on Maui. If this facility were to close, there would be no remaining service provider to manage scrap metal generated on the island. Therefore, the County intends to develop the Metals Processing Area to ensure there is a reliable means of management for scrap metal.

Household Hazardous Waste and Electronic Waste Collection and Storage Area will provide the County a permanent collection facility for these wastes. Currently, the County conducts periodic collection events at different temporary locations around the island. With the establishment of a permanent facility, the County will be able to have regularly scheduled collection events at a fixed facility which will improve participation rates of the public and reduce quantities of these materials now being abandoned or illegally disposed of.

The relocation of the Abandoned Vehicles Area from its current temporary location on the corner of Pulehu Road and Hansen Road will provide a larger, more secure, and permanent location to receive, store, and auction abandoned vehicles. Abandoned vehicles are a significant problem on the island and establishment of a permanent and adequately sized management area will complement the current and ongoing efforts to manage this problem.

FIGURES



CML Vicinity Map

GRAPHIC SCALE 1"=400'

0 400 800 1200

N

Kalialinui Gulch

Haiku Ditch

CML Facilities Site
(40 Acres)

Phase III
Stormwater Basin

Ameron Aggregate
Process and Storage Area

GP-10R

MW-2

GP-2R

GP-3.1

GP-3.2

Manhole 4
Leachate Sump

MW-4

Phase I & II
Closed Landfill

GP-4

MW-1

EKO Systems
Composting

Phase III
Future
Landfill

Phase IV
Stormwater Basin

GP-1R

Kalialinui Gulch

Phase I and II
Stormwater Basin

MW-5

MW-3

GP-7

Phase IV-B
Leachate Manhole

GP-8

Phase IV-A
Sump

Kalialinui Gulch

Kalialinui Gulch

GP-5

Kalialinui Gulch

Proposed Phase V-B
Extension Sump

Phase IV-B
Sump

GP-6R

Permitted Central
Maui Landfill

MW-6

1923 Topography
2015 Topography

Electric Transmission
Line Easement

GP-9

GP-11

Water Line
Easement

Production well

CML Entrance

Pulehu Road

Pulehu Road

Proposed CML Facilities

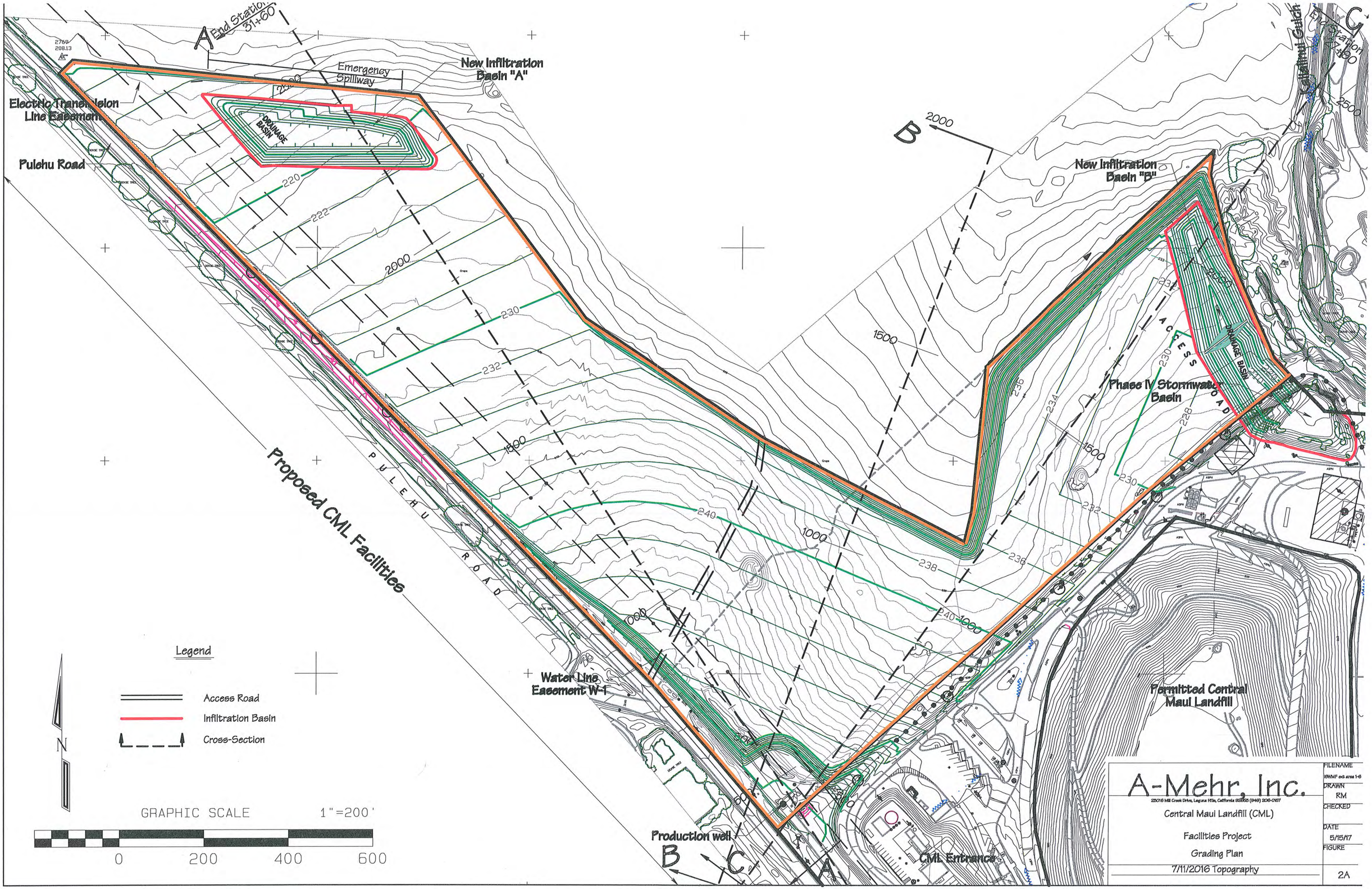
Currently Permitted Central Maui Landfill

Village Rd

Reservoir

200 210 220 230 200 210 200 210 250 300

A-Mehr, Inc.	FILENAME: ISWMF est area 1-7
23016 Mill Creek Drive, Laguna Hills, California 92653 (949) 206-0127	DRAWN: RM
Central Maui Landfill (CML)	CHECKED
Facilities Project	DATE: 11/29/17
Location and Vicinity Map	FIGURE
7/11/2016 Topography	1



A
End Station 31+60
Emergency Spillway
New Infiltration Basin "A"
Electric Transmission Line Easement
Pulehu Road
DRAINAGE BASIN
220
222
2000
230
232
1500
240
1000
238
236
234
228
B
New Infiltration Basin "B"
Phase IV Stormwater Basin
ACCESS ROAD
DRAINAGE BASIN
Proposed CML Facilities
PULEHU ROAD
Water Line Easement W-1
Permitted Central Maui Landfill
Production well
CML Entrance
C
Legend
Access Road
Infiltration Basin
Cross-Section
N
GRAPHIC SCALE 1"=200'
0 200 400 600
A-Mehr, Inc.
Central Maui Landfill (CML)
Facilities Project
Grading Plan
7/11/2016 Topography
FILENAME
DRAWN RM
CHECKED
DATE 5/15/17
FIGURE 2A

Electric Tranemision Line Easement

Emergency Spillway

Cattle Crossing Grate

Entrance 1

New Infiltration Basin "A"

Crosswalk & Walkway

Abandoned Vehicles Area (2 AC.)

Metals Processing Area (8.2 AC.)

Entrance 2

Large Vehicle/ Vessel Parking

Proposed CML Facilities

CONSTRUCTION & DEMOLITION (C & D) MATERIAL RECOVERY AREA 4 AC.

Water Line Easement W-1

Proposed Water Storage Tank

Production well

TANK

CML Entrance

REFUSE COLLECTION OFFICE, TRUCK PARKING, AND MAINTENANCE AREA (3 AC)

CROSSWALK & WALKWAY

PASSENGER CAR PARKING AREA

WAREHOUSE AND STORAGE AREA (1.4 AC.)

HOUSEHOLD HAZARDOUS WASTE AND ELECTRONIC WASTE COLLECTION AND STORAGE AREA 2.4 AC.

TRUCK PARKING AREA (2 AC)

New Infiltration Basin "B"

Phase IV Stormwater Basin

Permitted Central Maui Landfill

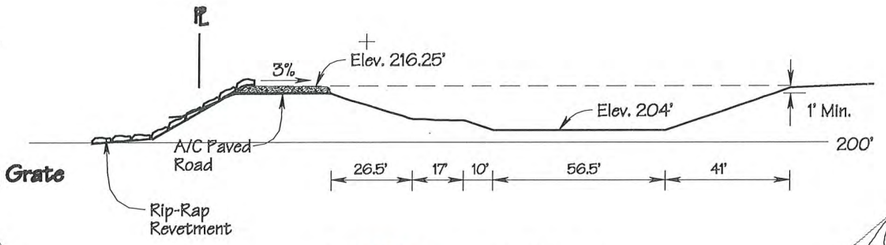
Legend

- Parking and Landscaping
- Access Road
- Infiltration Basin
- Facilities

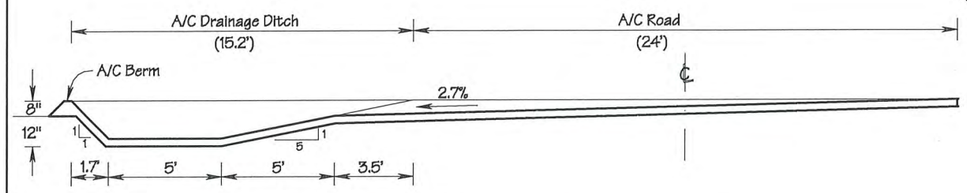
N

GRAPHIC SCALE 1"=200'

0 200 400 600



Detail (1) - Emergency Spillway



Detail (2) - Perimeter A/C Road, Ditch and Berm

A-Mehr, Inc.

25016 Mill Creek Drive, Laguna Hills, California 92653 (949) 206-0257

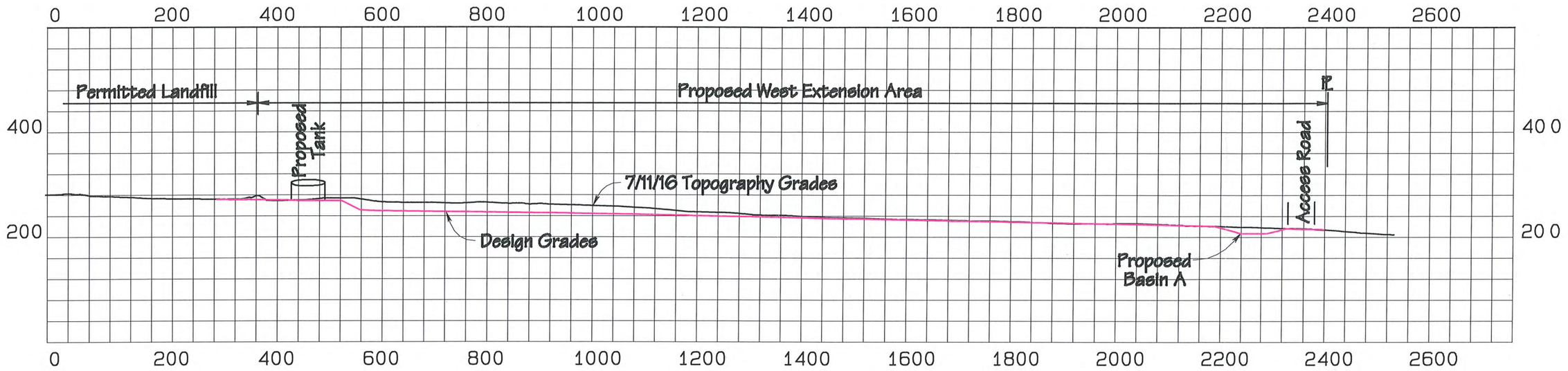
Central Maui Landfill (CML)

Facilities Project

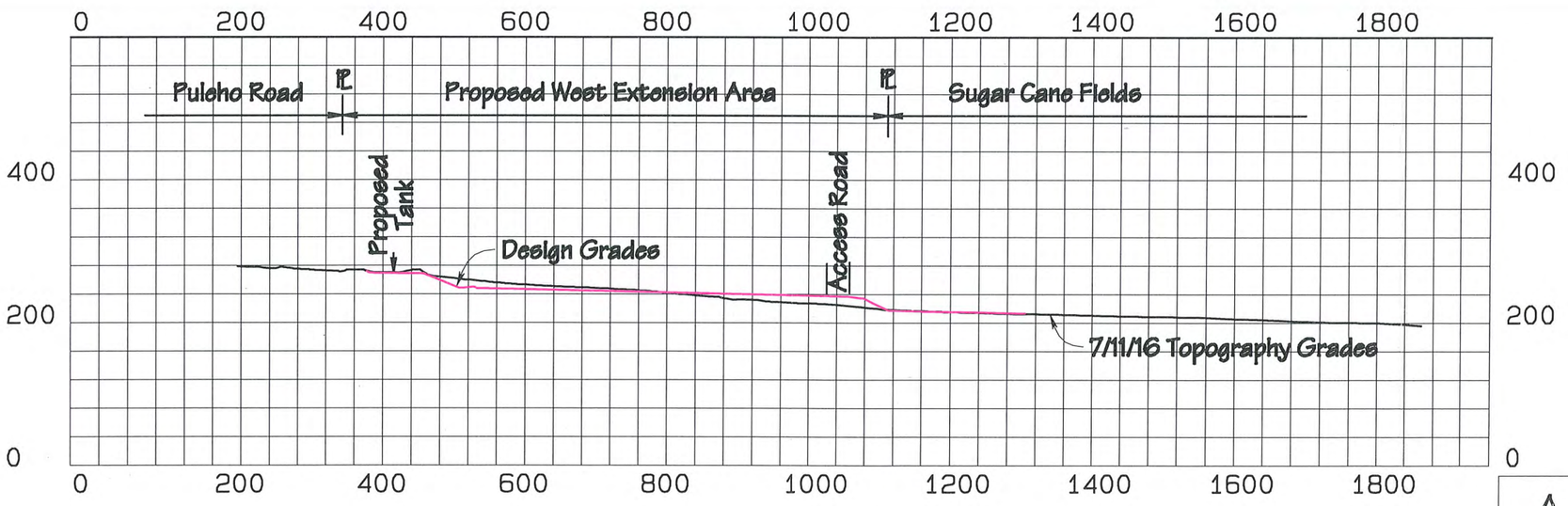
Drainage Plan

7/11/2016 Topography

FILENAME	SWMP exh area 1-6
DRAWN	RM
CHECKED	
DATE	12/8/16
FIGURE	2B



Cross-Section A-A



Cross-Section B-B

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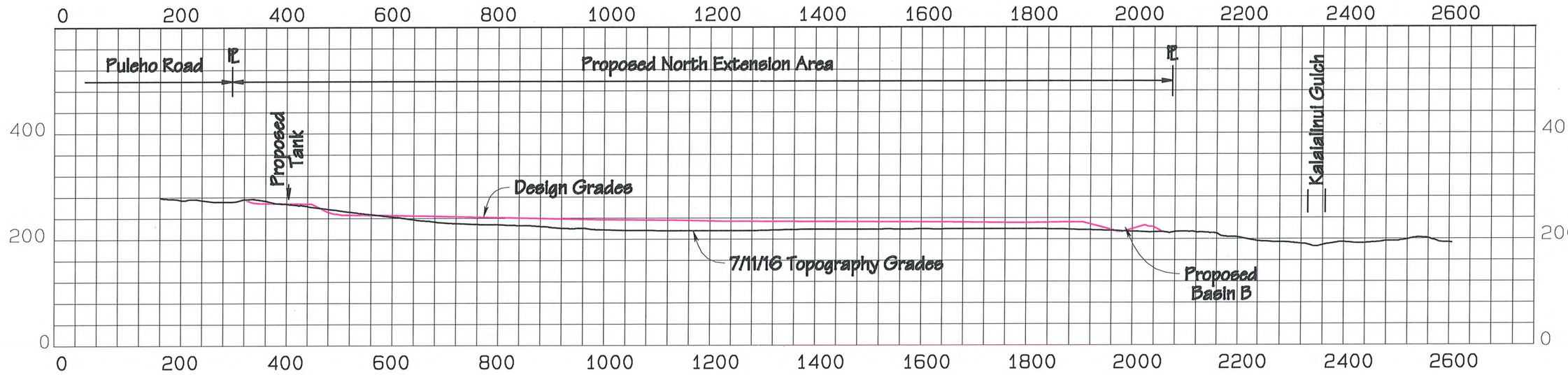
Central Maui Landfill (CML)

Facilities Project

Cross-Section A-A' and B-B'

FILENAME	15WMF ed. area 1-6
DRAWN	RM
CHECKED	
DATE	12/5/16
FIGURE	2C



Cross-Section C-C

A-Mehr, Inc.	FILENAME: 19WMF ext area 1-6
23016 Mill Creek Drive, Laguna Hills, California 92653 (949) 206-0157	DRAWN: RM
Central Maui Landfill (CML)	CHECKED
Facilities Project	DATE: 12/5/16
Cross-Section C-C'	FIGURE: 2D

1929 Topography
2015 Topography

Electric Transmission Line Easement

CML Facilities Site (40 Acres)

Kalialinui Gulch

Phase IV Stormwater Basin

Pulehu Road

Proposed CML Facilities

Water Line Easement

Permitted Central Maui Landfill

Production well

CML Entrance

210

200

210

250

N

GRAPHIC SCALE 1"=200'

0 200 400 600

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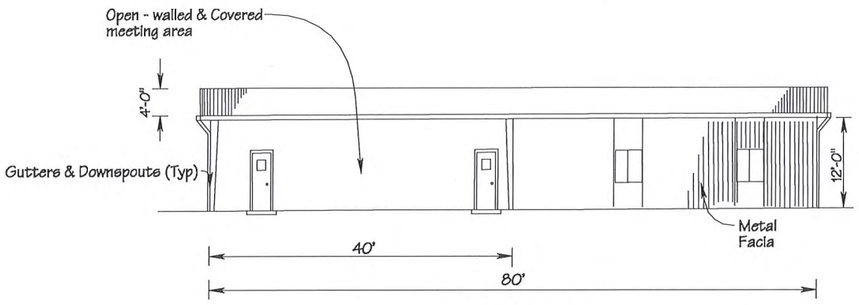
Central Maui Landfill (CML)

Facilities Project

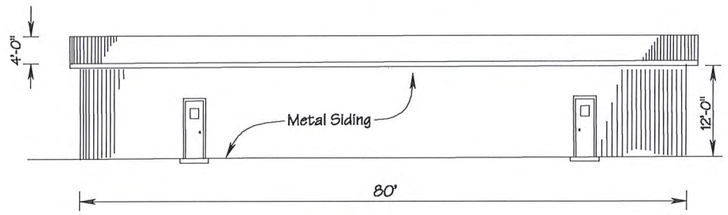
Existing Topography

7/11/2016 Topography

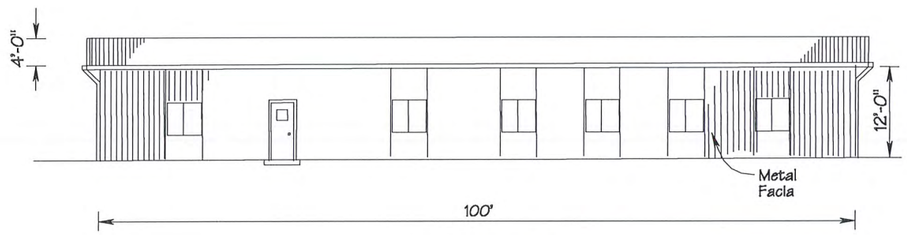
FILENAME	SWMP sub area 1-6
DRAWN	RM
CHECKED	
DATE	5/15/17
FIGURE	3



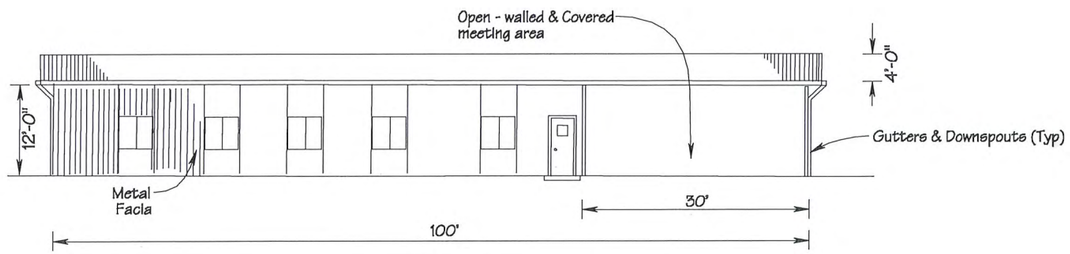
Front Elevation



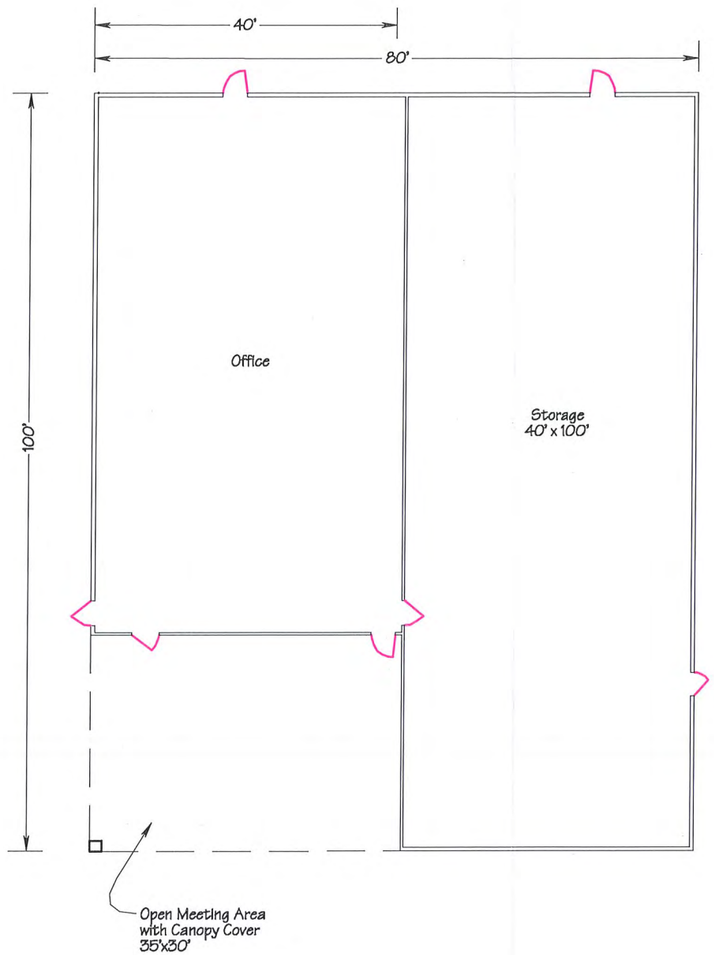
Rear Elevation



Right Side Elevation



Left Side Elevation



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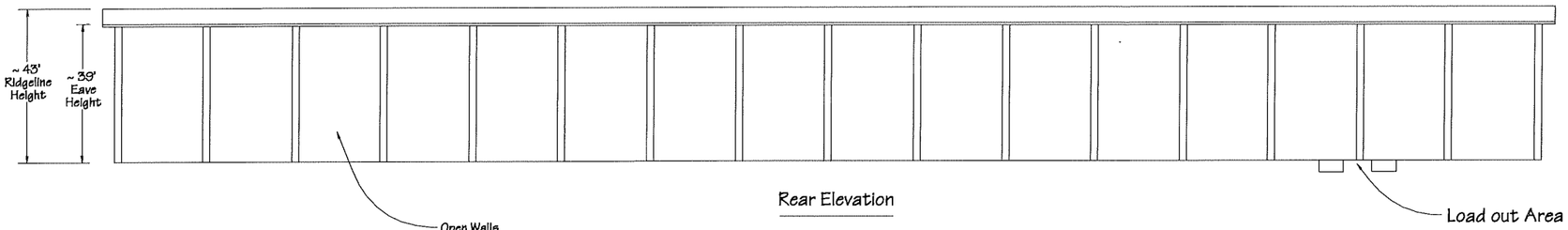
Central Maui Landfill (CML)

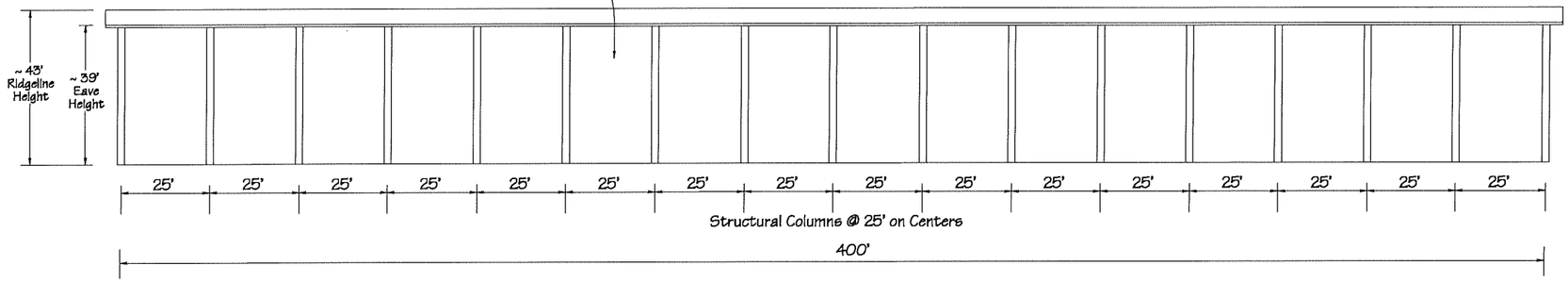
Facilities Project

Office Structure

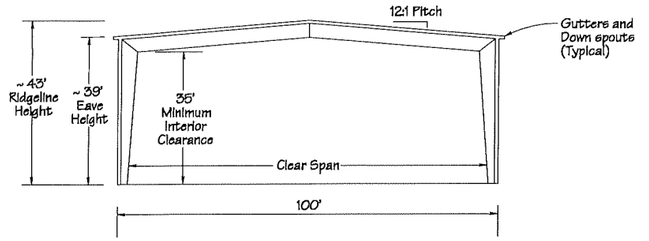
FILENAME	ISWMF ext area
DRAWN	RM
CHECKED	
DATE	5/17/17
FIGURE	4



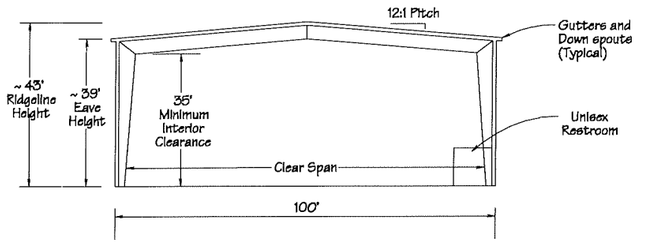
Rear Elevation



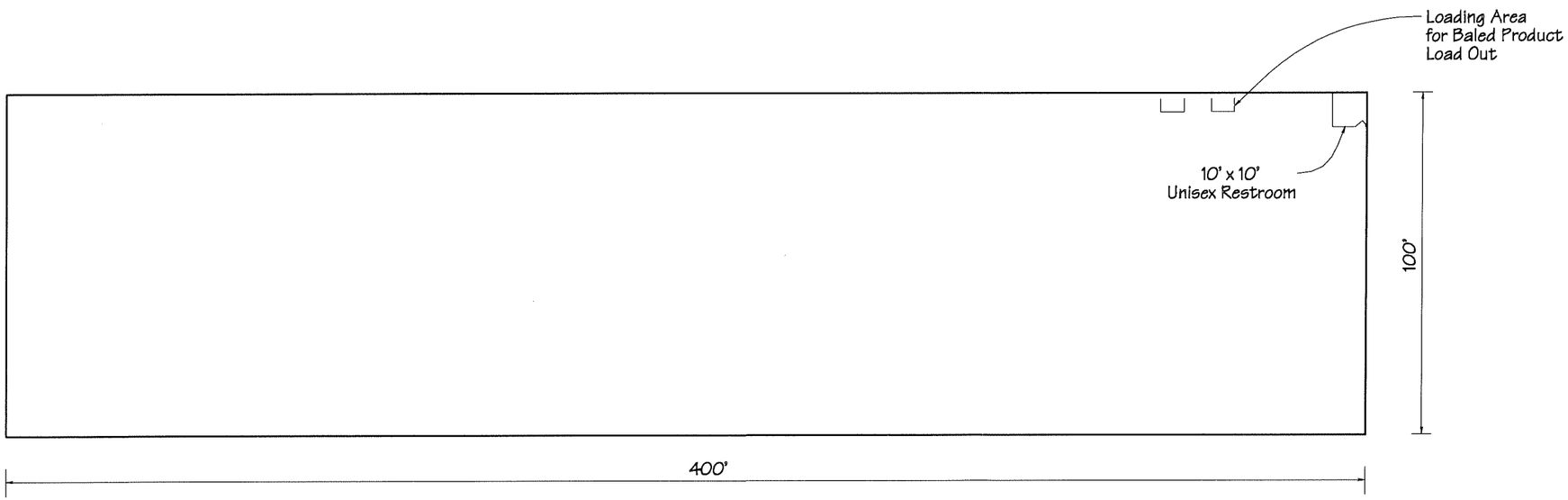
Front Elevation



Left Elevation



Right Elevation



Floor Plan

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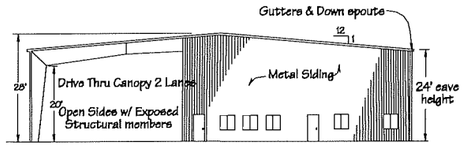
Central Maui Landfill (CML)

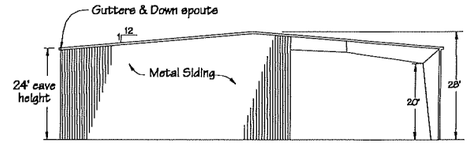
Facilities Project

Metals Processing Structure

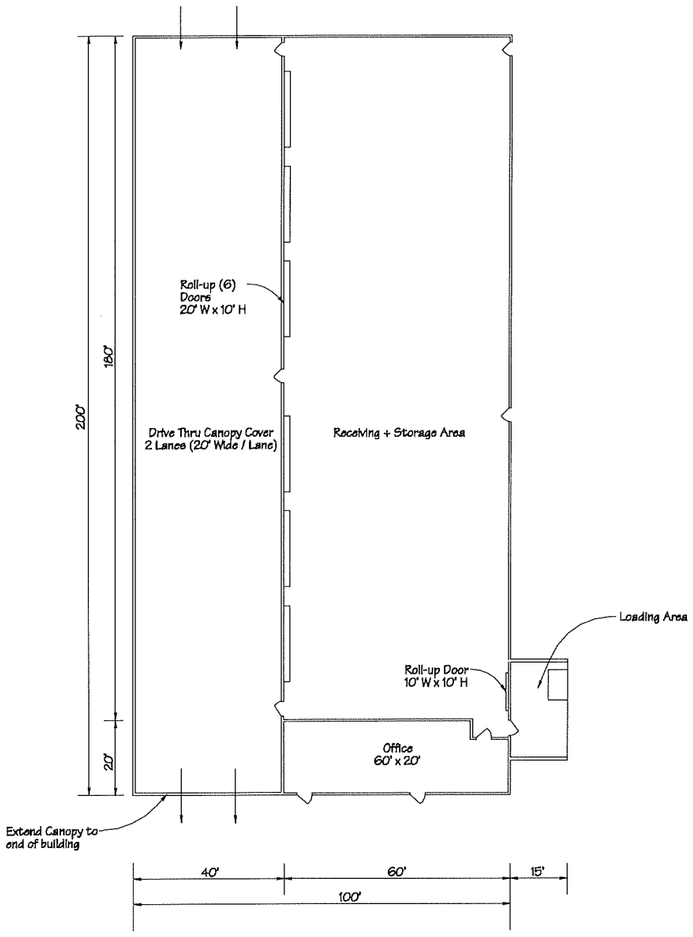
FILENAME	16WMF ext area
DRAWN	RM
CHECKED	
DATE	5/17/17
FIGURE	5



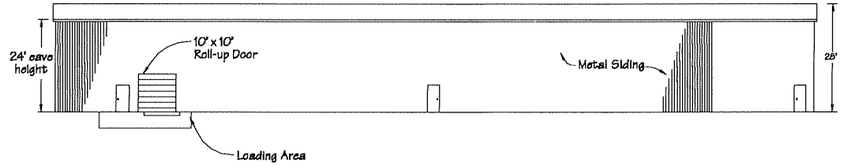
Front Elevation



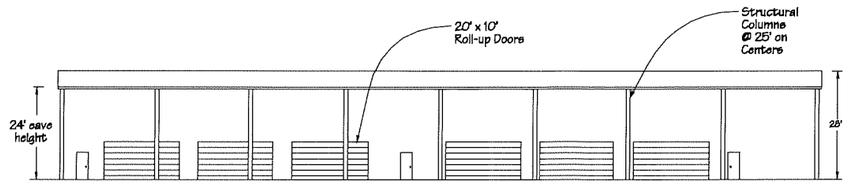
Rear Elevation



Floor Plan



Right Elevation



Left Elevation

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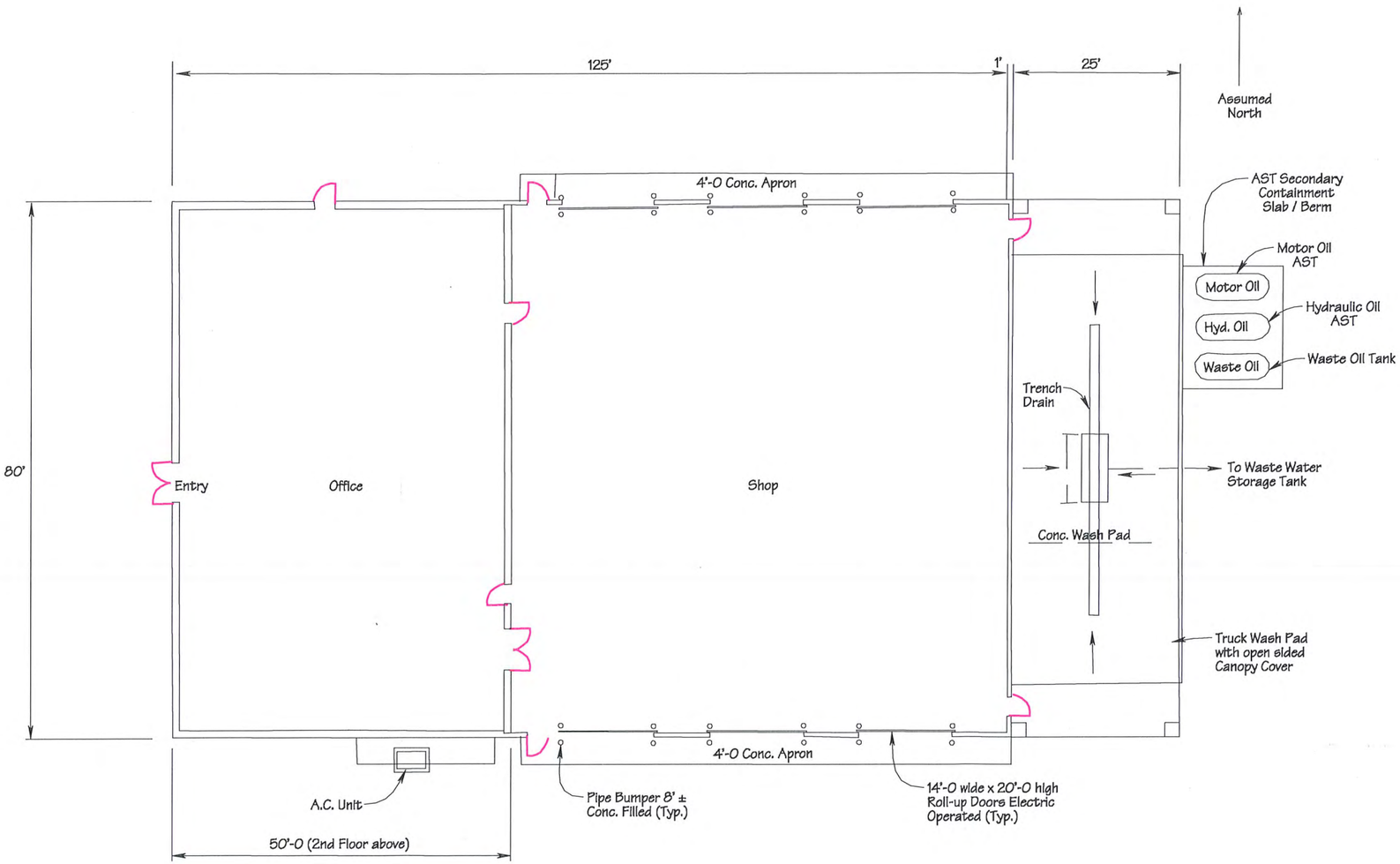
Central Maui Landfill (CML)

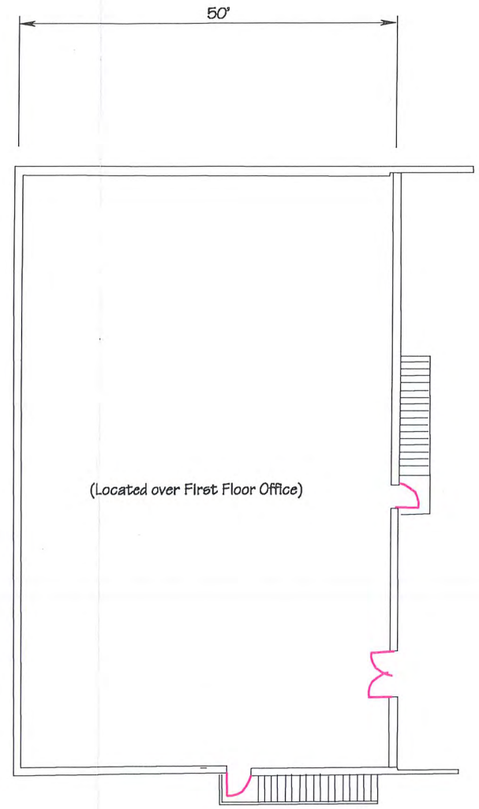
Facilities Project

Household Hazardous Waste and Electronic Waste Structure

FILENAME	LSWMF ext. area
DRAWN	RM
CHECKED	
DATE	5/17/17
FIGURE	6



1st Floor Plan



2nd Floor Plan

A-Mehr, Inc.

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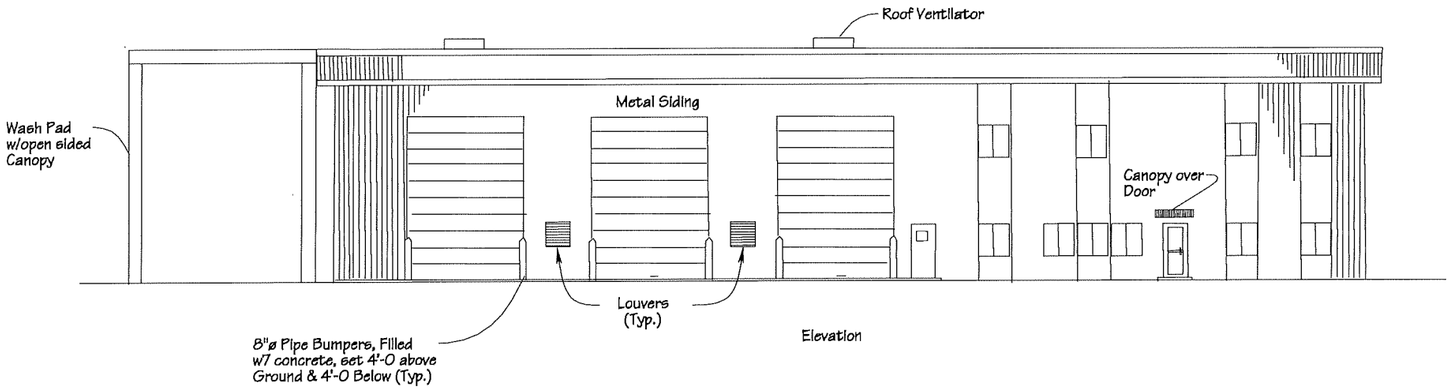
Central Maui Landfill (CML)

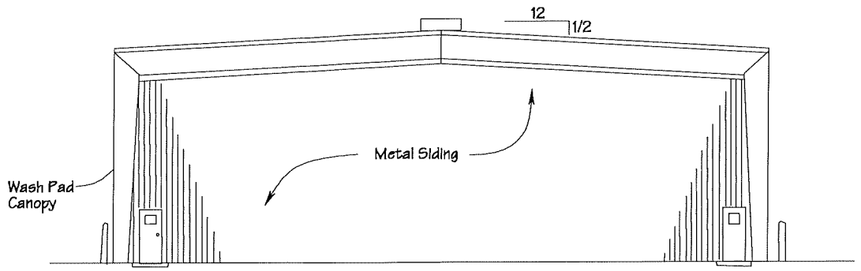
Facilities Project

Refuse Collection Office and Maintenance Structure Floor Plan

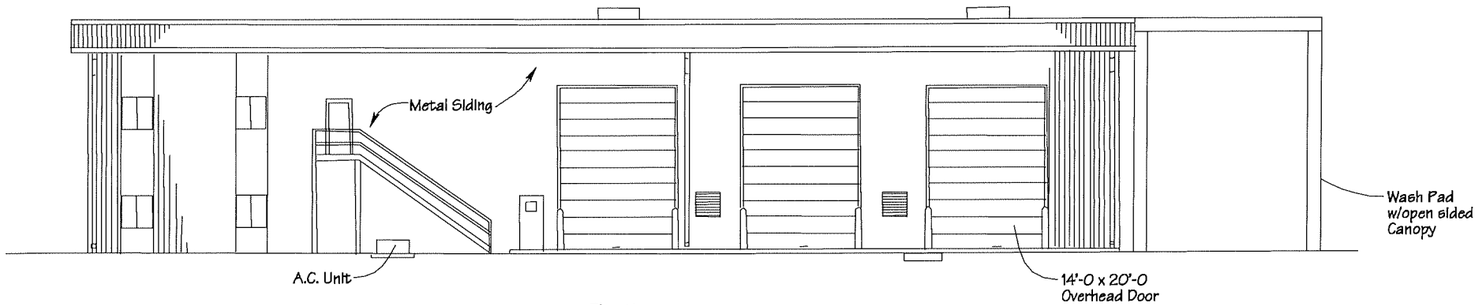
FILENAME	16WMF ext area
DRAWN	RM
CHECKED	
DATE	5/17/17
FIGURE	7



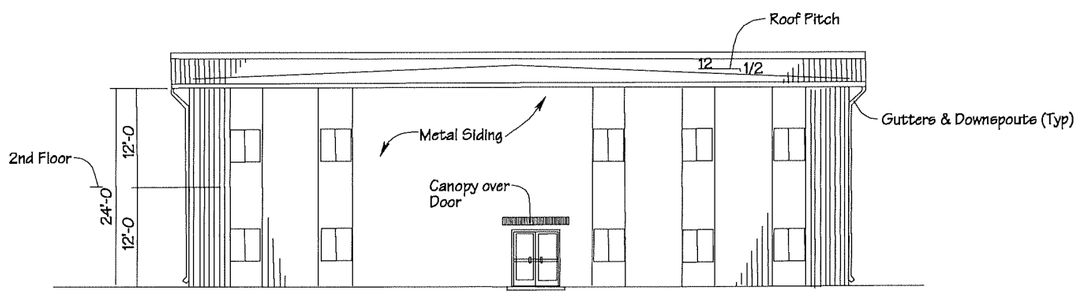
Elevation



Elevation



Elevation



Elevation

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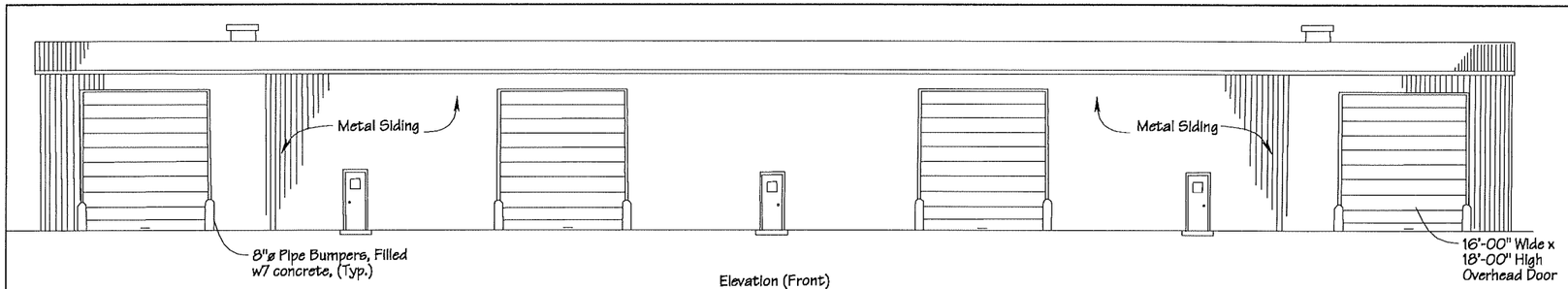
Central Maui Landfill (CML)

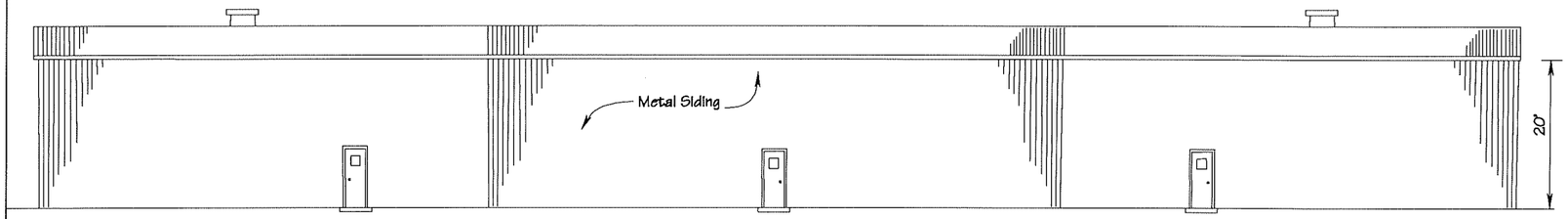
Facilities Project

Refuse Collection Office and Maintenance Structure Elevations

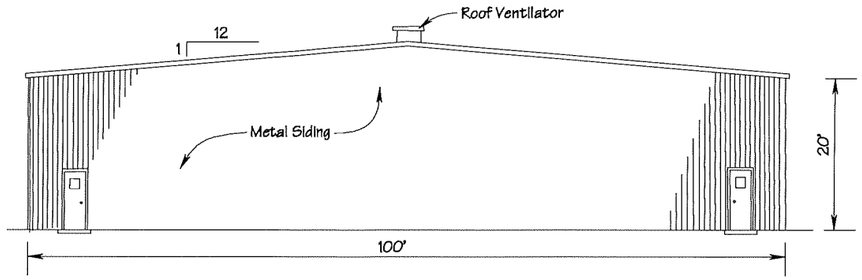
FILENAME	L5WMF ext. area
DRAWN	RM
CHECKED	
DATE	5/17/17
FIGURE	8



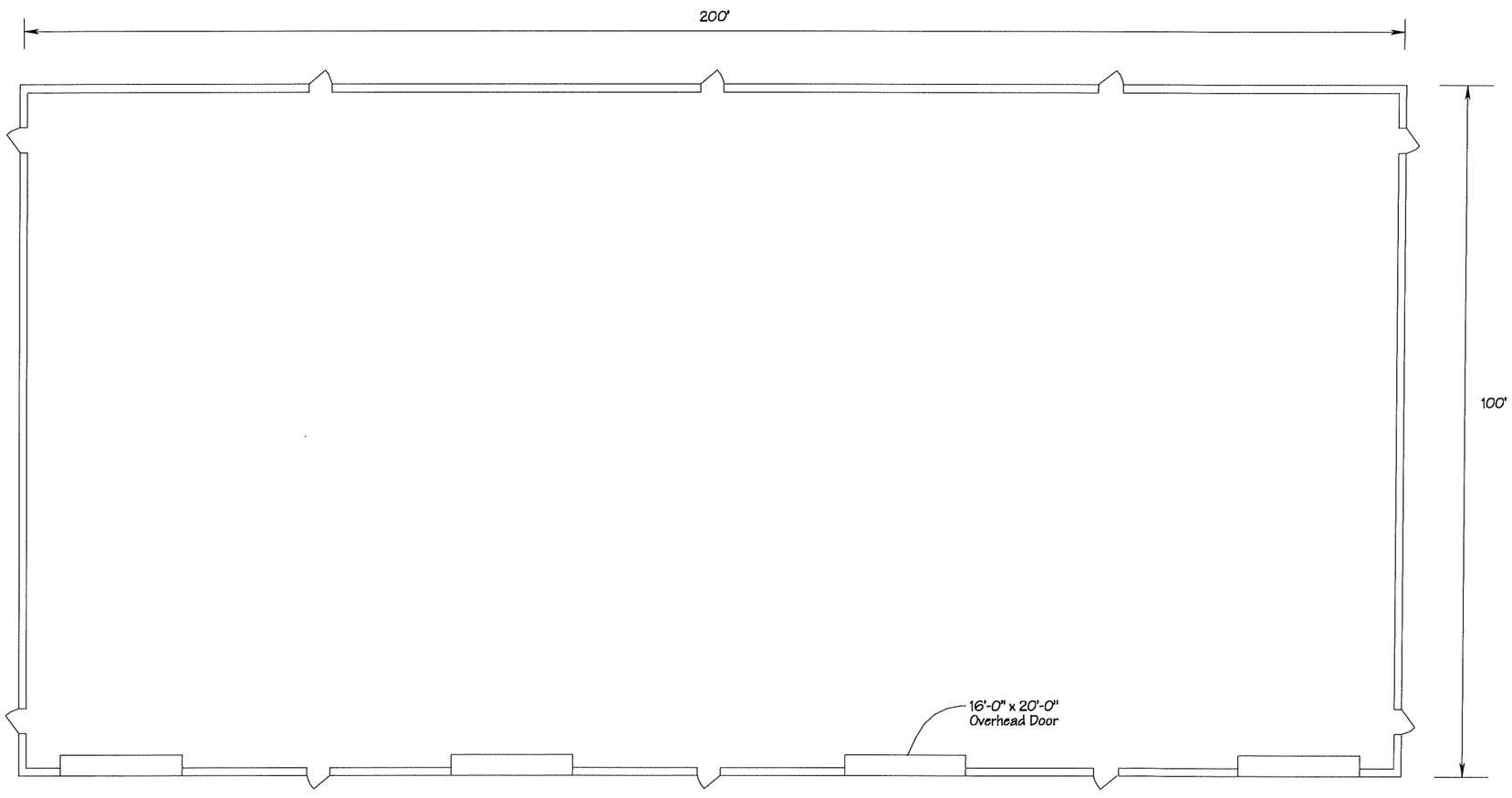
Elevation (Front)



Elevation (Rear)



Elevation (Both Ends)



Floor Plan

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Central Maui Landfill (CML)

Facilities Project

Warehouse Structure

FILENAME	ISWMF adc area
DRAWN	RM
CHECKED	
DATE	5/17/17
FIGURE	9

Electric Tranemielon Line Easement

2769
208.13

Emergency Spillway

Cattle Crossing Grate

New Infiltration Basin "A"

DRAINAGE BASIN

Entrance 1

CROSSWALK & WALKWAY

Abandoned Vehicles Area (2 AC.)

Septic Drain Line to Leach Field

Required 50' Offset from Basin

OFFICE STRUCTURE 3,000 S.F.

ROAD

Access Road

Office, HHW, & Metals Buildings Combined Septic Leach Field

Metals Processing Area (8.2 AC)

1000' RADIUS (FROM PRODUCTION WELL)

Truck Parking Stalls

ACCESS

Large Vehicle/Vessel Parking

Entrance 2

HOUSEHOLD HAZARDOUS WASTE AND ELECTRONIC WASTE COLLECTION AND STORAGE AREA (2.4 AC.)

ROOFED STRUCTURE 40,000 S.F.

Proposed CML Facilities

P U L E H U

R O A D

CONSTRUCTION & DEMOLITION (C & D) MATERIAL RECOVERY AREA 4 AC.

OPEN PROCESSING AREA 40,000 S.F.

Water Line Easement W-1

Proposed Water Storage Tank

Production well

TANK

CML Entrance

Kailua Gulch

Required 50' Offset from basin

REFUSE COLLECTION OFFICE, TRUCK PARKING, AND MAINTENANCE AREA (3 AC)

Maintenance Building Septic Leach Field

New Infiltration Basin "B"

CROSSWALK & WALKWAY

PASSENGER CAR PARKING AREA

WAREHOUSE AND STORAGE AREA (1.4 AC.)

ACCESS

OFFICE & MAINTENANCE STRUCTURE (12,000 S.F.)

DRAINAGE BASIN

ROAD

Phase IV Stormwater Basin

TRUCK PARKING AREA (2 AC)

WAREHOUSE 20,000 S.F.

ROOFED STRUCTURE 20,000 S.F.

Access Road

Permitted Central Maui Landfill

Legend

- Parking and Landscaping
- Access Road
- Infiltration Basin
- Facilities
- Septic Drain Line from Building to Leach Field

N

GRAPHIC SCALE 1"=200'

0 200 400 600

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Central Maui Landfill (CML)

Facilities Project

Wastewater Septic Systems

7/11/2016 Topography

FILENAME	IWMF ovs area 1-7
DRAWN	RM
CHECKED	
DATE	5/17/17
FIGURE	10

ATTACHMENT 1

HYDROLOGY REPORT

A-Mehr Inc.

Professional Engineers and Scientists Specializing in Landfills

23016 Mill Creek Drive
Laguna Hills, CA 92653

Phone(949) 206-0157
Fax (949) 206-9157

HYDROLOGY REPORT

Central Maui Landfill
Facilities Project
May 2, 2016,
Revised July 1, 2017

Scope

This report presents an analysis of surface water management features and provisions for drainage at the proposed Central Maui Landfill Facilities Project site. The analytical methods and content meet or exceed requirements of applicable County of Maui Department of Public Works regulations set forth Title MC-15, Subtitle 1, Chapter 4, "Rules for the Design of Storm Drainage Facilities in the County of Maui", dated July 14, 1995.

Project Description and Background

Existing and proposed development conditions are depicted in Figures 1, 2A, 2B, 2C, 2D and 3 of the CML Facilities Project, Preliminary Engineering Report, July 2017 (attached). The project is described in the following paragraphs with a more detailed description in the attached Preliminary Engineering Report.

Figure 1 provides a vicinity map and an overall site plan of the existing permitted CML as well as the 40-acre site of the CML Facilities Project. Figure 2A illustrates the proposed grading of the CML Facilities Project site. Figure 2B illustrates the proposed buildings and facilities areas of the CML Facilities Project and the project drainage plan.

The proposed 40-acre "L-shaped" Project site will include two wings, herein designated as the "West" and "North" Extension areas, respectively. These areas were part of former agricultural fields 7201 and 7202 of a Hawaiian Commercial and Sugar Company (Lot 2-A-1, owned by Alexander and Baldwin, Inc.). Figures 2C and 2D display cross-sections A-A' and B-B' through the West Extension Area and section C-C' through the North Extension area for existing and proposed development conditions. Cross sections locations are shown on Figure 2A. Site surface and drainage conditions and proposed developed conditions at the site are summarized in the following paragraphs.

Existing Site Drainage Conditions: The proposed CML Facilities Project site is adjacent to the existing CML landfill and located between Kalialinui Gulch to the northeast and Pulehu Road (an existing 40-foot-wide right of way) to the southwest; the West Extension area is crossed by a 50-foot-wide electrical utility line easement near-parallel to, and approximately 120 feet northeast of, Pulehu Road, and a water easement line (W-1) heading from Pulehu Road towards the Haiku ditch in the north-northwest direction.

Regional natural drainage: is directed to the northwest, primarily along or near parallel to Kalialinui Gulch, at average gradients on the order of 2.5 $\pm$ 0.5 percent over a distance of 5 miles

roughly centered at the CML site. Additional regional drainage within the Wailiku District is provided by the southwest-northeast trending Waihee, Haiku and Lowrie ditches, of which the Haiku Ditch is the closest to the CML extension site, namely, less than about one half mile north of both proposed West and North Extension areas. Figure A1 (Appendix A of this Report) provides an aerial photograph of the site and regional drainage features to the north (Haiku Ditch) and to the east (Kalialinui Gulch).

Existing Site Drainage: As shown in Figure A2 (Appendix A), the highest ground surface elevations currently range from approximate 270 feet above mean sea level (MSL), decreasing to approximately 205 feet to the northwest (West Extension), and to 196 feet to the north and northeast (North Extension), with maximum overland flow length of nearly 1720', 1200' and 770' towards the northwest, north and northeast, respectively. The northern portion of the North Extension Area is adjacent to the Kalialinui Gulch, which drains to the northwest.

Natural Slope Gradients: are locally no steeper than about 16 percent around the site's highest elevations, gradually decreasing towards the northwest, north and northeast, with corresponding natural drainage flow directions mostly towards Haiku Ditch. The northern portion of the North Extension Area is adjacent to the Kalialinui Gulch, a natural drainage feature that in turn drains to the northwest.

Three current drainage sub-areas are defined, which are listed as "West, Center and North", respectively, in Summary Table 1 of this report and Figure A2 (Appendix A). Drainage is mostly of shallow-channel type, with average drainage subarea gradients of 3.8, 5.5 and 5.7% for the west, central and northern portion of the CML Facilities Project site, respectively. Maximum lengths of overland flow, elevations, and average gradients are included in Summary Table 1 (Part 1 – Existing Conditions) of this report, and are also approximately depicted in Cross Sections A-A', B-B' and C-C', respectively.

Current Land Use: Sugar cane roads/trails cross the site and adjacent areas extending to the north up to the Haiku Ditch, and to the northwest towards Kalialinui Gulch as shown in site aerial photograph in Figure A1 (Appendix A). Drainage of the West and North Extension Areas is mostly of shallow-channel type, as shown on Figure A2 (Appendix A).

Current Watershed Characteristics and Run-off Conditions: Based on County of Maui Rules for the design of storm drainage facilities, we estimate: a) Infiltration to be "slow"; b) Relief to be "flat" to "rolling"; c) vegetative cover to be "poor" (<10%); and d) existing development type to be "agricultural" for these drainage sub-areas, as listed in Summary Table 1 (Part 1 – Existing Conditions).

Proposed Development:

The proposed West Extension Area will include several new facilities, located as shown on Figure A3, (Appendix A), which are listed below:

- An infiltration basin (Basin A) with a "net" storage capacity (i.e., after deducting a 1 foot freeboard) of approximately 11,581 cubic yards, or about 7.18 acre-foot;
- Abandoned Vehicles Area (2 acres);
- Office Structure: 8,000 square feet (sf);

- Construction and Demolition (C&D) Material Recovery Area: 4 acres, including a 40,000 sf open processing area;
- Metals Processing and Recovery Facility: 8.2 acres, including a 40,000 sf roofed processing facility building;
- Household Hazardous Waste (HHW) and Electronic Waste Collection and Storage Area: 2.4 acres, including a 20,000 sf roofed building;
- Water tank at the highest (southernmost) site location; and
- Access roads and parking stalls for truck-type vehicles, with site Entrances 1 and 2 from Pulehu Road, as shown on Figure A3, (Appendix A).

The North Extension Area will include the proposed new facilities:

- Infiltration basin (Basin B): with a net storage capacity of nearly 15,109 cy, or about 9.37 acre-foot;
- Maintenance Facilities: 3 acres, including a 12,000 sf shop and office building and refuse collection truck parking area;
- Passenger car parking area; and
- Warehouse and Storage Area: 1.4 acres, with a 20,000 sf warehouse building.

Earthwork: The earthwork for the entire site (West and North Extension areas) to accommodate the proposed development as shown on Figure A3 (Appendix A), will be essentially balanced with excavation quantity of 198,000 cy (plus approximately 2,000 of road base and footing excavation) and fill quantity of 200,000 cy.

Proposed West and North Extension Drainage Facilities: Runoff from the proposed CML Facilities Project West and North Extension areas is generally of shallow-channel flow type, to be collected in perimeter asphaltic concrete (AC) paved road, drainage ditches and adjacent AC berms and discharged into the two proposed basins (Basin "A" and Basin "B") located as shown in Figure A3 (Appendix A).

Within the West Extension Area, the AC drainage ditch and berm at this perimeter road is to collect and convey surface runoff water to culvert crossing under the road and then into Infiltration Basin "A". In addition, Infiltration Basin "A" will include an emergency spillway (weir type, 400 feet long) along its outer side (towards the north) in case design peak flows were exceeded during the life of this structure. A rip-rap revetment will be used for erosion control over the outer slope of this emergency spillway, as shown in Detail 1 of Figure 2B (Preliminary Engineering Report). The drainage ditch will be about 12 inches deep, and the AC berm about 8 inches high, as shown in Detail 2 of Figure 2B.

Basins "A" and "B" have net capacities (after deducting their one-foot freeboard) of approximately 11,581 and 15,109 cubic yards (cy), or about 7.18 and 9.37 acre-foot, respectively. Stormwater collected in the proposed basins is to discharge primarily by infiltration through the fractured bedrock in which these basins are constructed.

Within the North Extension area, the proposed Basin "B" will be connected to the adjacent existing CML Phase IV basin, as shown on Figure 2B. Stormwater collected in the existing CML Phase IV basin is discharged primarily by infiltration through the fractured bedrock in which the basin is constructed. It is anticipated that the proposed Basin "B" will function similarly and infiltrate into the bedrock as a primary means of discharge. In turn, if the Basin "B" design storage capacity were exceeded in the event of a major storm, overflow of the combined Basin "B" and Phase IV basin would be conveyed into the adjacent Kalialinui Gulch from the existing Phase IV basin spillway.

Proposed Development Watershed Characteristics and Run-off Conditions: Based on County of Maui Rules for the design of storm drainage facilities, we estimate: a) Infiltration to be "negligible"; b) Relief to be "flat"; c) vegetal cover to be "poor"; and d) proposed development type to be "industrial" to business, for two drainage sub-areas, as also listed in the lower half of Summary Table 1 (Part 2 – Developed Conditions).

HYDROLOGIC RUNOFF COMPUTATIONS

Consistent with the County drainage regulations, the design runoff quantity (peak flow rate, Q) is based on the rational method formula:

Q = CIA where
- Q: flow, cubic feet/second (cfs)
- C: runoff coefficient, dimensionless
- I: rainfall intensity, inches per hour
- A: drainage area

The rational method formula variables are evaluated as follows.

Drainage Area

For existing conditions: This proposed CML Facilities Project site was subdivided into three drainage subareas, named West, Central and North, with 18.01, 14.32 and 6.47 acres, respectively, as shown in Figure A2 (Appendix A),

For developed conditions: This area was subdivided into two drainage subareas, named West and North, with 28.19 and 10.64 acres, respectively, as shown in Figure A3 (Appendix A).

Design Storm

For existing conditions: a design storm of 1 hour duration and a recurrence interval of 10 years; from County of Maui (CM) Plate 4 in Appendix A, the applicable one-hour rainfall amount for the Puunene area is 2.0 inches; and

For developed conditions: a design storm of 1 hour duration and a recurrence interval of 50 years; From CM Plate 7 in Appendix A, the applicable one-hour rainfall amount for the Puunene area is 2.5 inches.

Run-off Coefficient (C)

For existing conditions: This area was subdivided into three drainage subareas, named West, Central and West, as indicated in Summary Table 1, and Figure A2 (Appendix A) of this report. From CM Tables 1 and 2, the following watershed and drainage area characteristics were selected in estimating run-off coefficients.

- Infiltration: 0.14 (slow);
- Slopes: 0.02 (flat to rolling);
- Vegetal Cover: 0.05 (poor); and
- Development type: 0.15 (agricultural)
- *Runoff coefficient*: C = 0.36, based on the sum of the four above-listed watershed factors.

For developed conditions: This area was subdivided into two drainage subareas, named West and North, as indicated in Summary Table 1, and Figure A3 (Appendix A) of this report.

- Infiltration: 0.20 (negligible);
- Slopes: 0.00 (flat);
- Vegetal Cover: 0.05 (poor); and
- Development type: 0.55 (industrial, business)
- *Runoff coefficient*: C = 0.80, based on the sum of these four watershed factors.

Time of concentration (T_c)

Based on a conservative analysis of existing conditions at the site, using CM Plate 1 (built-up areas), and CM Plate 3 (small agricultural areas) in Appendix A.

For existing conditions: conservatively assuming poor-grass surfaces, for runoff directed to the west, northwest (center) and north, the time of concentration for runoff to reach the perimeters of the site is calculated using CM Plate 1 in Appendix A. Based on flow lengths of 1,718', 1,200', and 770', and average slopes of 3.8%, 5.5% and 5.7%, respectively, the resulting T_c values are as follows:

- West Drainage Subarea ≈ 25 minutes
- Central Drainage Subarea ≈ 19 minutes; and
- North Drainage Subarea ≈ 17.5 minutes;

For developed conditions: assuming bare-soil surfaces, for runoff directed to the west, and north, the time of concentration for runoff to reach the Basins "A" and "B", is calculated using Plate 1 in Appendix A. Based on flow lengths on the order of 500' and 1,313', and average slopes of 2.4% and 2.5%, respectively, the resulting T_c values are as follows:

- West Drainage Subarea ≈ 17 minutes; and
- North Drainage Subareas ≈ 25 minutes (central and west sub-areas).

Rainfall Intensity (I): Based on CM Plate 2 in Appendix A.

For existing conditions: Based on the 1-hour rainfall of 2.0 inches and T_c value of 25, 19, and 17.5 minutes, the charted intensity is 3.0, 3.4 and 3.7 inches per hour, for the existing west, center and north drainage sub-areas, respectively.

For developed conditions: Based on the 1-hour rainfall of 2.5 inches and T_c value of 17 and 25 minutes, the charted intensity is 4.3 and 3.7 inches per hour, for the developed west and north site drainage sub-areas, respectively.

Design Peak Flows, Q: Based on the above-listed values they are conservatively calculated as:

For existing conditions:
$C \approx 0.36$
$I \approx 3.0$ to 3.7 inches/hour $= 8.5 \times 10^{-5}$ ft/sec
$A \approx 39$ acres $= 1.70 \times 10^6$ ft^2
$Q \approx CIA \approx C\ (I_1 \times A_1 + I_2 \times A_2 + I_3 \times A_3) \approx 19.6 + 18.2 + 8.9 \approx 46.7$ cfs, as shown in Summary Table 1 (Part 1 – Existing Conditions) of this report.

For developed conditions:
$C \approx 0.80$
$I \approx 3.7$ to 4.3 inches/hour $= 8.5$ to 9.3×10^{-5} ft/sec
$A \approx 39$ acres $= 1.70 \times 10^6$ ft^2
$Q \approx CIA \approx C\ (I_1 \times A_1 + I_2 \times A_2) \approx 97.8 + 32.9 \approx 130.7$ cfs, as shown in Summary Table 1 (Part 2 – Developed Conditions) of this report.

Perimeter AC Road/Ditches

The majority of runoff for the developed condition of the West Extension Area will reach the perimeter road/drainage ditch along the north side, which slopes from approximate elevation 238 to 216 feet toward the infiltration basin "A" at longitudinal gradients ranging from approximately 0.5 to 1.8 percent, increasing to the northwest. A trapezoidal shape, AC ditch with a bottom width of 5 feet and a depth of 12 inches below adjacent ground, combined with an 8-inch high AC berm, can convey the maximum expected runoff to the West Basin at approximate elevation 216 feet.

Gradient, i (%)	Velocity, V (feet/s)	Flow Rate, Q (cfs)
0.5	4.2	76.4
1.0	5.9	108
1.5	7.2	132
2.0	8.4	152

Infiltration Basin Storage Capacity Verification – Developed Conditions

Calculations of required basin capacity were made assuming approximate near-parabolic hydrograph peaks. The average storage capacities needed, $C \approx 2/3\ Q \times \Delta t$, are summarized below:

Infiltration Basin "A" (1-hour rainfall, 50-year return period)
Peak Run-off Flow Rate, $Q \approx 97.8$ cfs;
$C \approx 2/3 \times 97.8\ ft^3/s \times 3{,}600s \approx 235{,}000\ ft^3$, or
$C \approx 8{,}737$ cy; and
Available Net Storage Volume $\approx 11{,}581$ c.y. $> 8{,}737$ c.y. (satisfactory)

Infiltration Basin "B" (1-hour rainfall, 50-year return period)
Peak Run-off Flow Rate, $Q \approx 32.9$ cfs;
$C \approx 2/3 \times 32.9\ ft^3/s \times 3{,}600s \approx 78{,}881\ ft^3$, or
$C \approx 2{,}921$ cy; and
Available Net Storage Volume $\approx 15{,}109$ c.y. $> 2{,}921$ c.y. (satisfactory).

It should be noted that the calculated basin net storage capacities already exclude the minimum 1-foot freeboard required by the County of Maui Rules. In addition, Basins "A" and "B" will include a 400-foot- and a 120-foot-long spillway (weir type), respectively. The Basin "A" weir spilling over to the north to adjacent sugar cane fields, and the Basin "B" towards the existing adjacent CML Phase IV stormwater basin, which in turn spills over to the Kulialinui Gulch to the north (if its design capacity were exceeded). Therefore, silts will be retained, while cleaner water will spill over during the design rainstorm event. Further, these basins are actually "infiltration" ponds, with bottoms excavated in fractured rock, namely, permeable material.

CONCLUSION

The perimeter AC drainage ditches and infiltration basins designed for the proposed West and North Extension areas are adequately sized to manage the peak runoff from the proposed CML Facilities Project at final development.

Respectfully Submitted,

M. Ali Mehrazarin, P.E.
Principal Engineer

Summary Table 1: Design of Storm Drainage Facilities
Per County of Maui Department of Public Works and Waste Management Rules

Part 1 - Existing Conditions

Drainage Facilities	West Drainage	Center Drainage	North Drainage	Remarks
On-Site Drainage Area, A_d (sq ft) =	784,561	623,779	281,833	
On-Site Drainage Area, A_d (acres) =	18.01	14.32	6.47	Total Drainage Area = 38.8 acres - From Figures 2 and A1 (Appendix A), this report.
Hydrologic Criteria (§15-04-05)				
1.0 Recurrence Interval, Tm (years)	10	10	10	A_d < 100 acres without sump: Tm = 10 year based on 1-hour storm, per §15-04-05 (a).
1.1 - Run-Off Quantity				Per Rational Method of drainage areas of 100 acres or less, Q = CIA based on accompanying tables and charts.
Watershed/Run-off Coefficient, C				Based on CM Tables 1 or 2, whichever is higher.
Infiltration, C_1	0.14	0.14	0.14	Slow Infiltration
Relief, C_2	0.02	0.03	0.03	Flat to rolling (5 to 6%)
Vegetal Cover, C_3	0.05	0.05	0.05	Poor (<10%)
Development Type, C_4	0.15	0.15	0.15	Agricultural (see aerial photo in Figure 4, this report)
$C = \Sigma$ (C_1 to C_4)	0.36	0.37	0.37	*Built-Up Areas (From CM Table 1)*
Typical for Type of Drainage Area	0.22	0.22	0.22	*Lawns - Heavy soil, average slope 2 to 7% (From CM Table 2)*
Highest Run-Off Coefficient	0.36	0.37	0.37	From CM Tables 1 and 2
Highest Elevation (feet MSL)	270	270	240	From existing ground surface contours (Figures 2 and A1 (Appendix A), this report)
Lowest Elevation (feet MSL)	205	204	196	From existing ground surface contours (Figures 2 and A1 (Appendix A), this report)
Overland Flow Maximum Length, L (feet)	1718	1,199	770	From Figure A1 (Appendix A), this report)
Average Slope Gradient (%)	3.8%	5.5%	5.7%	From Figure A1 (Appendix A), this report)
Average Flow Direction	NW	N	NE	
Time of Concentration, Tc				
a) Grassed areas, Tc (min)	25	19	17.5	Based on CM Plate 1 (overland flow chart)
Value of K	8,832	5,110	3,221	
b) Small agricultural areas, Tc (min)	8.5	5.6	3.9	Based on CM Plate 3, with little or no cover: $Tc = 0.0078*K^{0.77}$, where $K = L/\sqrt{S}$.
10-Year 1-Hour Rainfall (inches)	2.0	2.0	2.0	Based on Plate 4, Island of Maui, 10-Year 1-Hour Rainfall
Rainfall Intensity, I (inches/hour)	3.0	3.4	3.7	Based on Plate 2, for a 2.0" 1-Hour Rainfall and Tc
Flow Rate, Q = C.I.A (cfs)	19.6	18.2	8.9	***Total Q = 46.7 cfs***

Part 2 - Developed Conditions

Drainage Facilities	West Drainage		North Drainage	Remarks
On-Site Drainage Area, A_d (sq ft) =	1,228,118		463,272	
On-Site Drainage Area, A_d (acres) =	28.19		10.64	
Total Infiltration Basin Capacity, without Freeboard (cubic yards)	14,321		24,271	
Infiltration Basin Capacity, with 1' Freeboard (cubic yards)	12,504		22,231	
Infiltration Basin Capacity (acre-foot) =	7.8		13.8	
Hydrologic Criteria (§15-04-05)				
2.0 Recurrence Interval, Tm (years)	50	50	50	Tm = 50 year based on 1-hour storm, per §15-04-05 items b) for drainage areas Ad < 100 acres with sump; d) design of roadway culverts and bridges; and for e) retention and detention basins.
2.1 - Run-Off Quantity				Per Rational Method of drainage areas of 100 acres or less, Q = CIA based on accompanying tables and charts.
Watershed/Run-off Coefficient, C				Based on Tables 1 or 2, whichever is higher.
Watershed Coefficients for On-Site Areas				
Infiltration	0.20		0.20	Negligible
Relief	0.00		0.03	Flat (2 to 2.5%)
Vegetal Cover	0.05		0.05	Poor (<10%)
Development Type	0.55		0.55	Industrial - Business
$C = \Sigma$ (C_1 to C_4)	*0.80*		*0.83*	*Built-Up Areas (From CM Table 1)*
Typical for Type of Drainage Area	*0.80*		*0.80*	*Light Industrial Area (From CM Table 2)*
Highest Run-Off Coefficient	0.80		0.83	From CM Tables 1 and 2
Overland Flow Maximum Length, L (feet)	500		1,313	
Highest Elevation (feet MSL)	250		250	From proposed final ground surface contours (Figures 3 and A2, this report)
Lowest Elevation (feet MSL)	238		217	From proposed final ground surface contours (Figures 3 and A2, this report)
Average Slope Gradient (%)	2.4%		2.5%	
Time of Concentration, Tc				
a) Paved, bare soil & grassed areas, Tc (min)	17		25	Based on CM Plate 1, Overland Flow Chart
Value of K	3,227		8,282	
b) Small agricultural areas, Tc (min)	3.9		8.1	Based on CM Plate 3, Concetration Time of small agricultural areas with little or no cover: $Tc = 0.0078*K^{0.77}$, where $K = L/\sqrt{S}$;
50-Year 1-Hour Rainfall (inches)	2.5		2.5	Based on CM Plate 7, Island of Maui, for 50-Year 1-Hour Rainfall
Rainfall Intensity, I (inches/hour)	4.3		3.7	Based on CM Plate 2, for a 2.5" 1-Hour Rainfall and Tc
Flow Rate, Q = C.I.A (cfs)	97.8		32.9	***Total Q = 130.7 cfs***

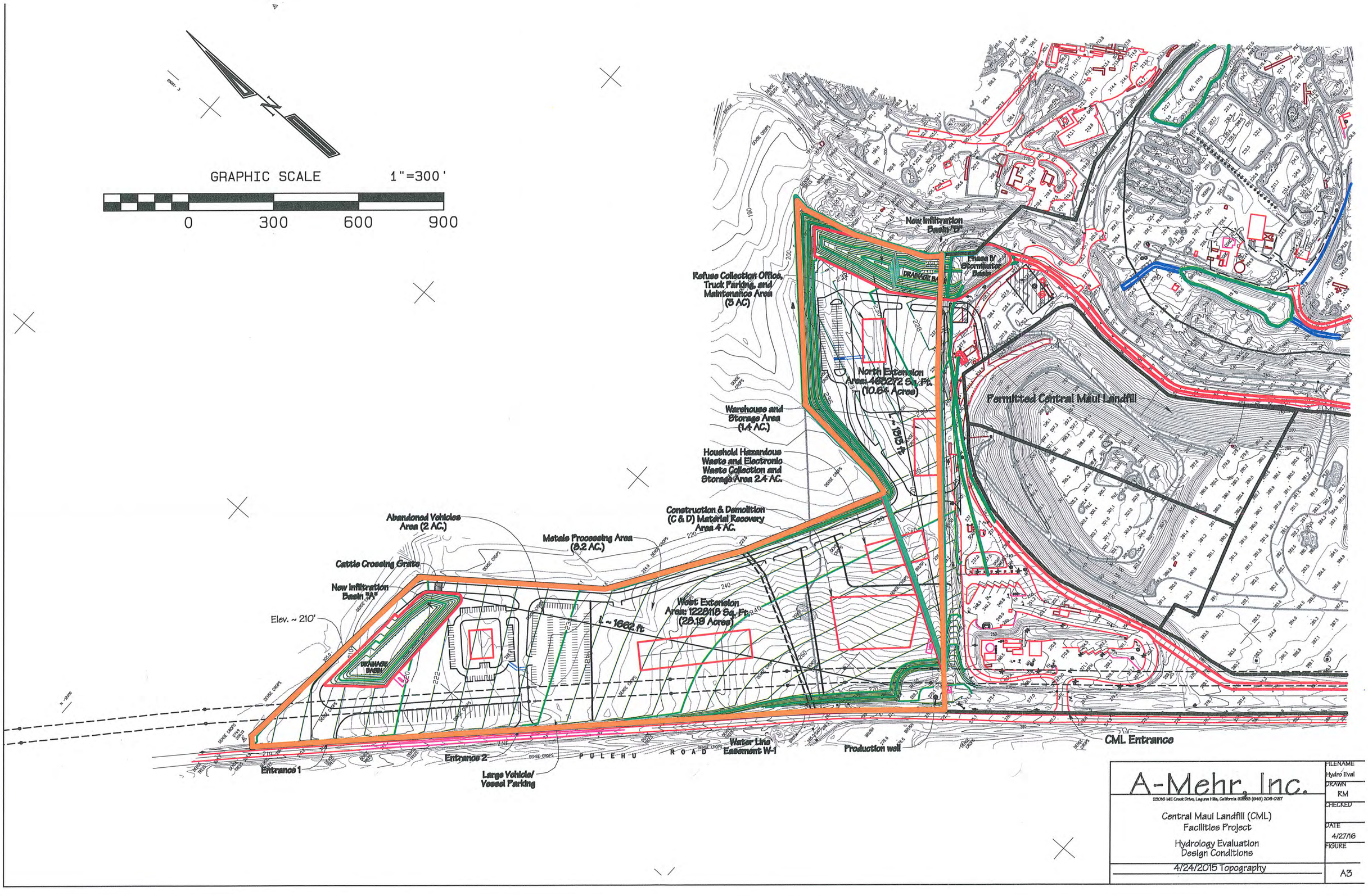


A-Mehr, Inc.

23016 Mill Creek Drive, Laguna Hills, California 92653 (949) 206-0157

Central Maui Landfill (CML)
Facilities Project
Hydrology Evaluation
Site Photograph
Existing Conditions

FILENAME	Hydro Eval
DRAWN	RM
CHECKED	
DATE	3/21/16
FIGURE	A1



A-Mehr, Inc.	FILENAME Hydro Eval
22016 Mill Creek Drive, Laguna Hills, California 92653 (949) 206-0157	DRAWN RM
Central Maui Landfill (CML) Facilities Project	CHECKED
Hydrology Evaluation Design Conditions	DATE 4/27/16
4/24/2015 Topography	FIGURE A3

GRAPHIC SCALE 1"=300'

0 300 600 900

Elev. 196'

Phase IV Stormwater Basin

North Extension Area

Area: 282046.08 Sq. Ft. (6.47 Acres)

L = 770 ft

Elev. 204'

Elev. ~ 240'

L = 417 ft

Elev. 216'

Permitted Central Maul Landfill

West Extension Area

Area: 625699.75 Sq. Ft. (14.32 Acres)

L = 782 ft

Elev. ~ 210'

Area: 784561 Sq. Ft. (18.01 Acres)

L = 1718 ft

Electric Line Easement

Elev. 206'

Elev. 270'

Water Line Easement

CML Entrance

A-Mehr, Inc.

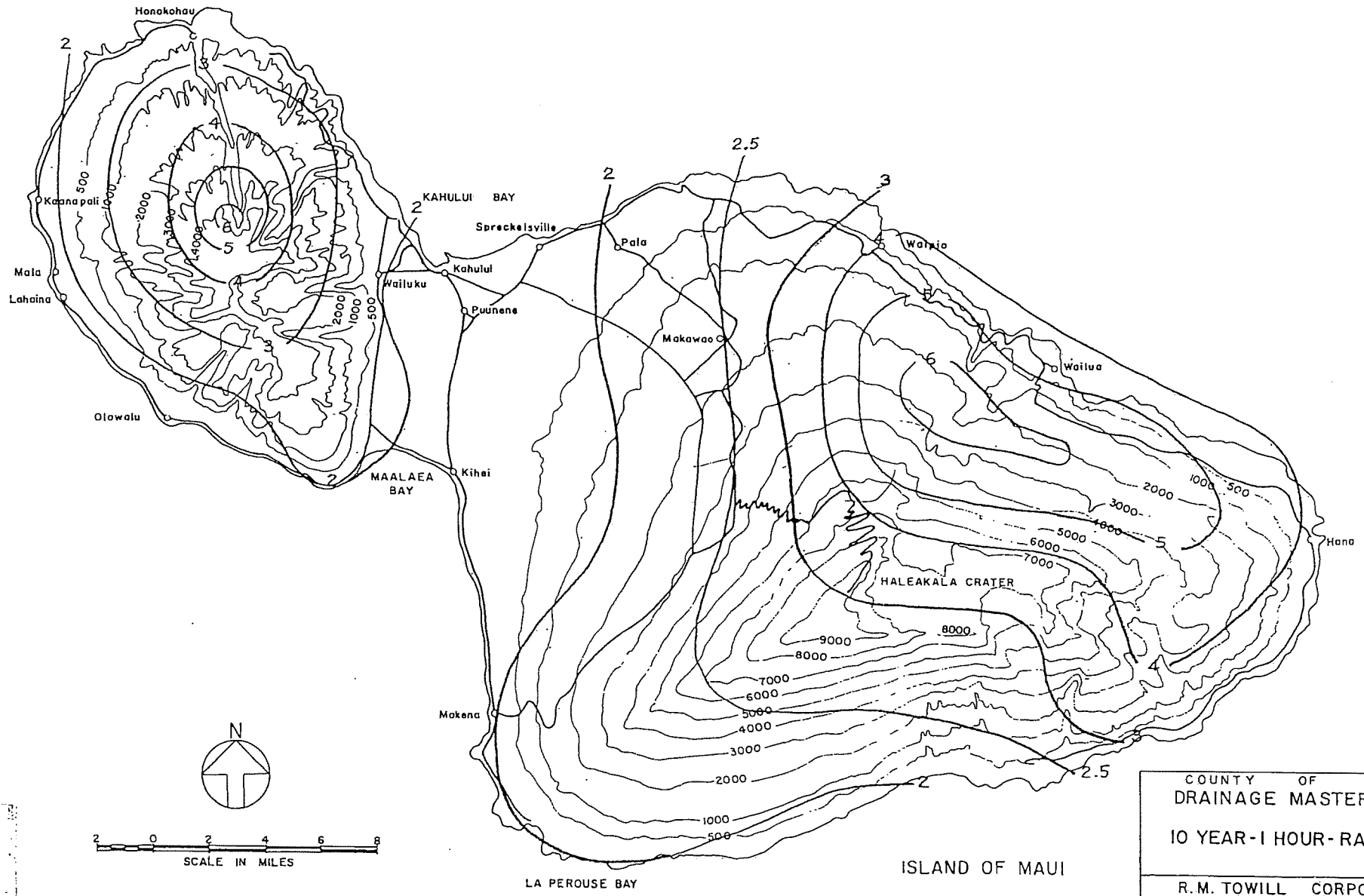
23016 Mill Creek Drive, Laguna Hills, California 92653 (949) 206-0127

Central Maul Landfill (CML)
Facilities Project

Hydrology Evaluation
Existing Conditions

4/24/2015 Topography

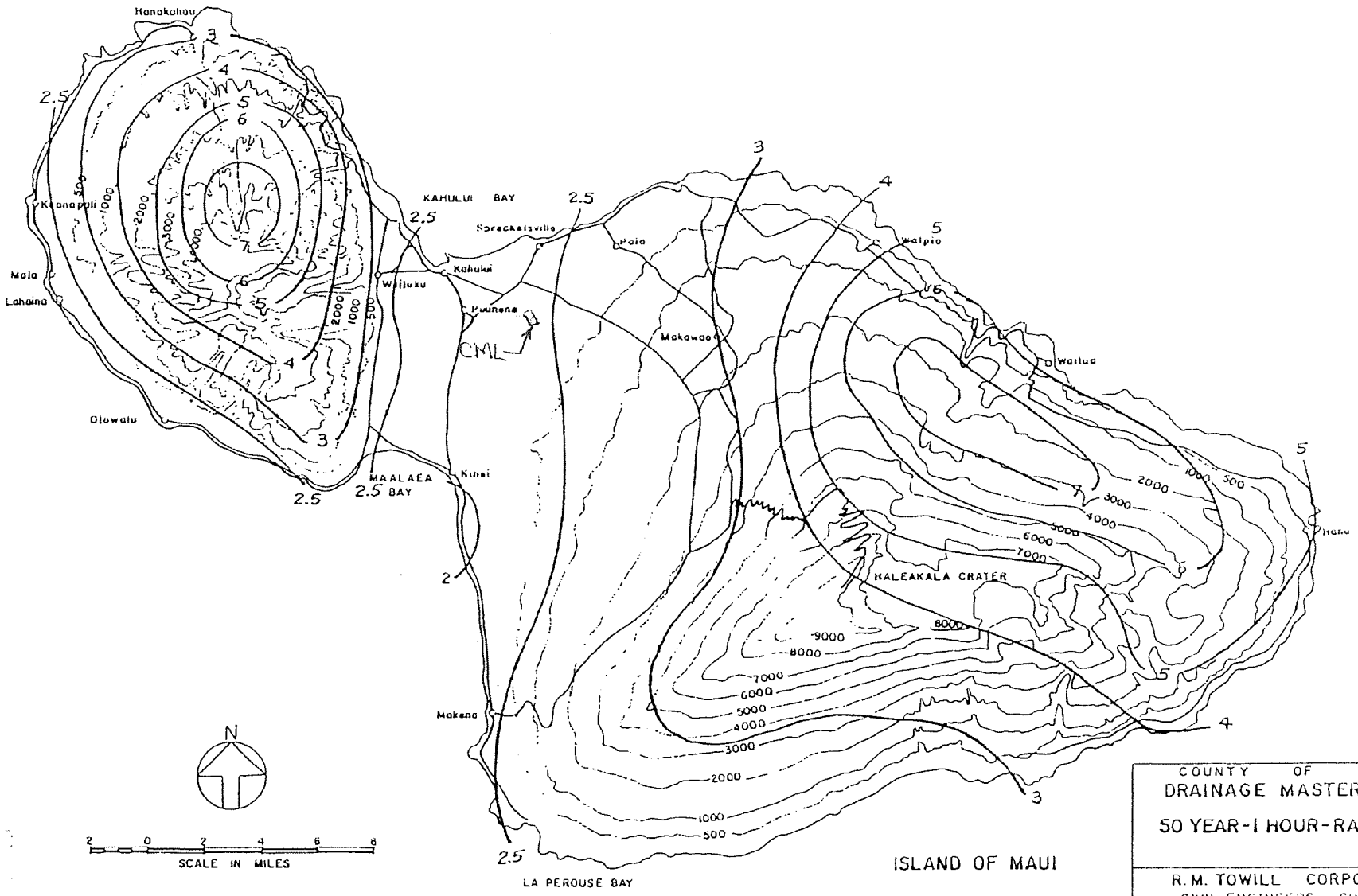
FILENAME	Hydro Eval
DRAWN	RM
CHECKED	
DATE	1/22/16
FIGURE	A2



COUNTY OF MAUI
DRAINAGE MASTER PLAN
10 YEAR-1 HOUR-RAINFALL

R.M. TOWILL CORPORATION
CIVIL ENGINEERS - SURVEYORS

PLATE 4



COUNTY OF MAUI
DRAINAGE MASTER PLAN
50 YEAR-1 HOUR-RAINFALL

R. M. TOWILL CORPORATION
CIVIL ENGINEERS - SURVEYORS

CML → 50-year 1-hr rainfall ≈ 2.5 inches

PLATE 7

Table 1

GUIDE FOR THE DETERMINATION OF RUNOFF COEFFICIENTS FOR BUILT-UP AREAS*

WATERSHED CHARACTERISTICS	EXTREME	HIGH	MODERATE	LOW
INFILTRATION	NEGLIGIBLE 0.20	SLOW 0.14	MEDIUM 0.07	HIGH 0.0
RELIEF	STEEP (> 25%) 0.08	HILLY (15-25%) 0.06	ROLLING (5-15%) 0.03	FLAT (0-5%) 0.0
VEGETAL COVER	NONE 0.07	POOR (< 10%) 0.05	GOOD (10-50%) 0.03	HIGH (50-90%) 0.0
DEVELOPMENT TYPE	INDUSTRIAL & BUSINESS 0.55	HOTEL-APARTMENT 0.45	RESIDENTIAL 0.40	AGRICULTURAL 0.15

**NOTE: The design coefficient "c" must result from a total of the values for all four watershed characteristics of the site.*

Table 2

RUNOFF COEFFICIENTS

Type of Drainage Area	Runoff Coefficient C
Business:	
Downtown areas	0.95
Neighborhood areas	0.70
Residential:	
Single-family areas	0.50
Multi-units, detached	0.60
Multi-units, attached	0.75
Suburban	0.40
Apartment dwelling areas	0.70
Industrial:	
Light areas	0.80
Heavy areas	0.90
Parks, cemeteries	0.25
Playgrounds	0.35
Railroad-yard areas	0.40
Unimproved areas	0.30
Streets:	
Asphaltic	0.95
Concrete	0.95
Brick	0.85
Drive and walks	0.85
Roofs	0.95
Lawns:	
Sandy, soil, flat, 2%	0.10
Sandy, soil, avg., 2-7%	0.15
Sandy, soil, steep, 7%	0.20
Heavy soil, flat, 2%	0.17
Heavy soil, avg., 2-7%	0.22
Heavy soil, steep, 7%	0.35

Central New Mexico Community College (CNM)
Phase II Drainage

Average for East and West Perimeter Channels
L ≈ 475'
S ≈ 33% (3H:1V)

Perimeter Drainage Channel (L ≈ 475')

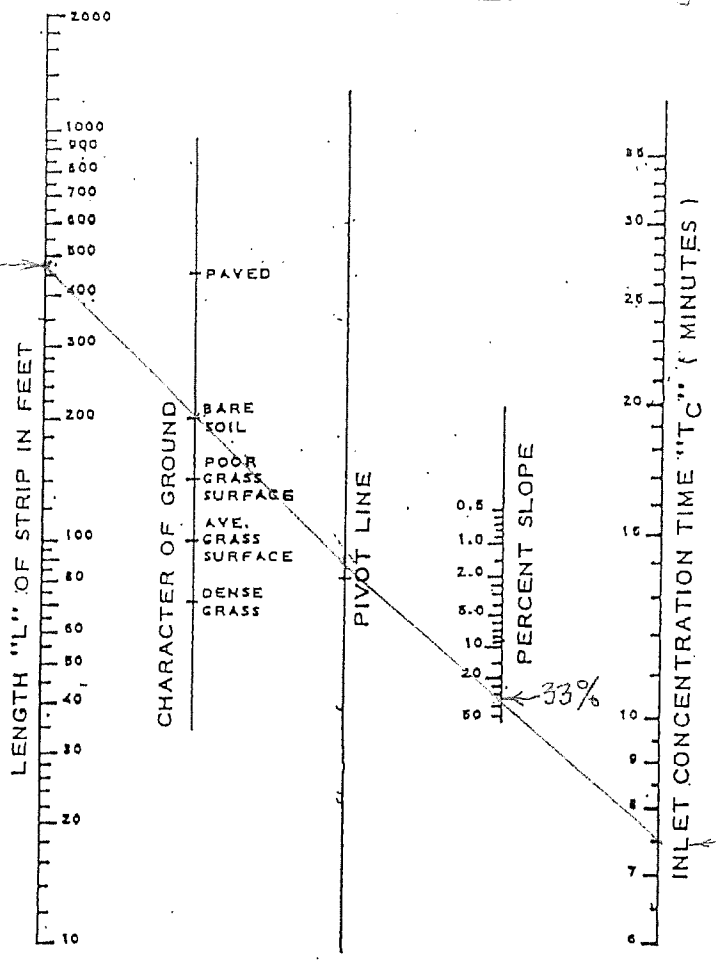
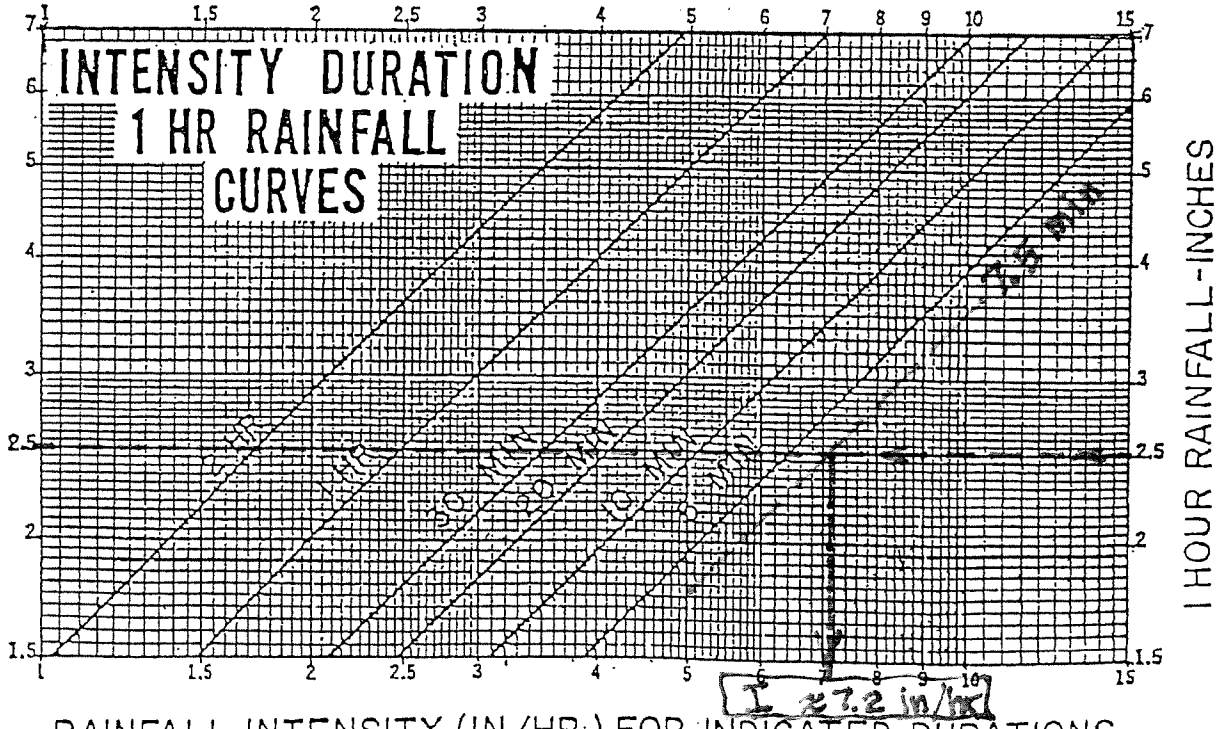


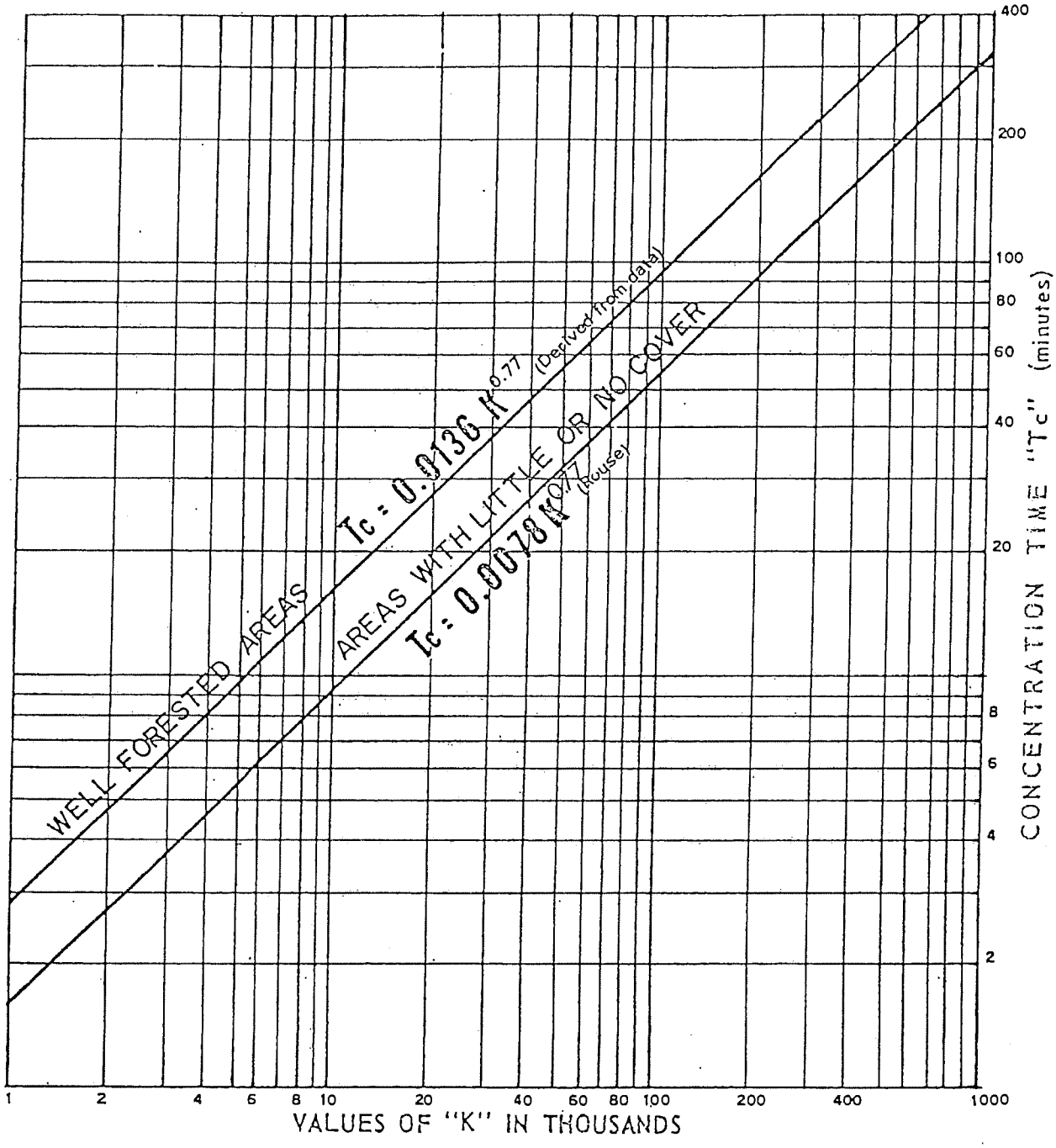
Plate 1

Overland Flow Chart

Plate 2



RAINFALL INTENSITY (IN./HR.) FOR INDICATED DURATIONS



L = Maximum length of travel in feet
H = Difference in elevation between most remote point and outlet in feet.
S = Slope H/L

$$K = \frac{L}{\sqrt{S}} = \sqrt{\frac{L^3}{H}}$$

Use upper curve for well forested areas.
Use lower curve for areas with little or no cover.

SOURCE: CITY PLANNING COMMISSION
Graph from Hunter Rouse "Engineering Hydrauiics"

Plate 3
Time of Concentration
(OF SMALL AGRICULTURAL DRAINAGE BASIN)

EEV

Manning Equation Calculator | Open channel flow software

Manning equation calculation is mobile-device-friendly as of June 27, 2014

West channel

Click to Calculate k = 1.49

Solve for: Velocity and Discharge

Select units: Use feet and seconds units

Area, A (ft^2): 25

Wetted Perimeter, P (ft): 27

Channel Slope, S (ft/ft): 0.0096

Manning n: 0.016

Ave. Phase II Asphalt

Velocity, V (ft/s): 8.6680099 ✓

Discharge, Q (ft^3/s): 216.70025 ✓

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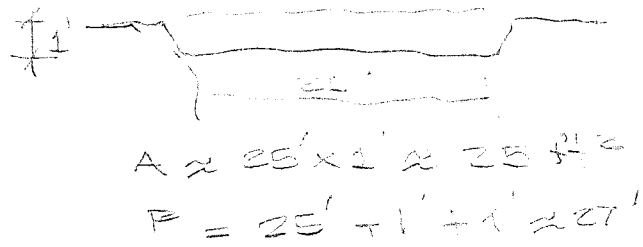
http://www.LMNOeng.com

Units in Manning calculator: ft=foot, m=meter, s=second.

Manning Equation:

$$Q = VA \qquad V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$



k is a unit conversion factor: k=1.49 for English units (feet and seconds). k=1.0 for SI units (meters and seconds).
A=Flow area of the pipe, culvert, or channel.
P=Wetted perimeter which is the portion of the circumference that is in contact with water.
Q=Discharge (flow rate).
S=Downward (longitudinal) slope of the culvert.
V=Average velocity in the pipe, culvert, or channel.

Manning n varies with the roughness of the pipe, culvert, or channel. The higher the n, the rougher the material. Table of Manning n values.

To: LMNO Engineering home page (more calculations)

Related calculations:

Design of Rectangular Channels

Design of Trapezoidal Channels

Circular Culverts using Manning Equation

Culvert Design using Inlet and Outlet Control

Q=VA simple flowrate calculator

CML - Phase VI EEV

Manning Equation Calculator | Open channel flow software

Manning equation calculation is mobile-device-friendly as of June 27, 2014

West Channel

Click to Calculate k = 1.49

Solve for:

Velocity and Discharge

Select units:

Use feet and seconds units

Area, A (ft^2):	25
Wetted Perimeter, P (ft):	27
Channel Slope, S (ft/ft):	.02
Manning n:	0.016
Velocity, V (ft/s):	12.511195 ✓
Discharge, Q (ft^3/s):	312.77987 ✓

average IV, V, VI
Asphalt

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Units in Manning calculator: ft=foot, m=meter, s=second.

Manning Equation:

$$Q = VA \qquad V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$

k is a unit conversion factor: k=1.49 for English units (feet and seconds). k=1.0 for SI units (meters and seconds).
A=Flow area of the pipe, culvert, or channel.
P=Wetted perimeter which is the portion of the circumference that is in contact with water.
Q=Discharge (flow rate).
S=Downward (longitudinal) slope of the culvert.
V=Average velocity in the pipe, culvert, or channel.

Manning n varies with the roughness of the pipe, culvert, or channel. The higher the n, the rougher the material. Table of Manning n values.

To: LMNO Engineering home page (more calculations)

Related calculations:

Design of Rectangular Channels

Design of Trapezoidal Channels

Circular Culverts using Manning Equation

Culvert Design using Inlet and Outlet Control

Q=VA simple flowrate calculator

The Manning Equation is the most commonly used equation to analyze open channel flows. It is a semi-empirical equation for simulating water flows in channels and culverts where the water is open to the atmosphere, i.e. not flowing under pressure, and was first presented in 1889 by Robert Manning. The channel can be any shape - circular, rectangular, triangular, etc. The units in the Manning equation appear to be inconsistent; however, the value k has hidden units in it to make the equation consistent. The Manning Equation was developed for uniform steady state flow (see Discussion and References for Open Channel Flow). S is the slope of the energy grade line and $S=h_f/L$ where h_f is energy (head) loss and L is the length of the channel or reach. For uniform steady flows, the energy grade line = the slope of the water surface = the slope of the bottom of the channel.

The product A/P is also known as the hydraulic radius, R_h.

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LMNO@LMNOeng.com http://www.LMNOeng.com

Manning n values

Unit Conversions

Other information:

Trouble printing?

Register

Discussion and References for Open Channel Flow

Manning's n Coefficients for Open Channel Flow

The fluid mechanics calculations website

Manning n values compiled from the references listed under Discussion and References as well as the references at the bottom of this page. Manning n has no units.

To: LMNO Engineering Home Page (more calculations)
Circular Culverts using Manning Equation Culvert Design using Inlet and Outlet Control
Trapezoidal Channels Rectangular Channels
Manning Equation Calculator Unit Conversions

Material	Manning n	Material	Manning n
Natural Streams		*Excavated Earth Channels*	
Clean and Straight	0.030	Clean	0.022
Major Rivers	0.035	Gravelly	0.025
Sluggish with Deep Pools	0.040	Weedy	0.030
		Stony, Cobbles	0.035
Metals		*Floodplains*	
Brass	0.011	Pasture, Farmland	0.035
Cast Iron	0.013	Light Brush	0.050
Smooth Steel	0.012	Heavy Brush	0.075
Corrugated Metal	0.022	Trees	0.15
Non-Metals			
Glass	0.010	Finished Concrete	0.012
Clay Tile	0.014	Unfinished Concrete	0.014

Brickwork	0.015	Gravel	0.029
Asphalt	0.016	Earth	0.025
Masonry	0.025	Planed Wood	0.012
		Unplaned Wood	0.013
Corrugated Polyethylene (PE) with smooth inner walls [a,b]			0.009-0.015
Corrugated Polyethylene (PE) with corrugated inner walls [c]			0.018-0.025
Polyvinyl Chloride (PVC) with smooth inner walls [d,e]			0.009-0.011

References

Footnotes refer to Manning n table above. All other Manning n values were obtained from the references listed in our Discussion and References page.

[a] Barfuss, Steven and J. Paul Tullis. Friction factor test on high density polyethylene pipe. Hydraulics Report No. 208. Utah Water Research Laboratory, Utah State University. Logan, Utah. 1988.

[c] Barfuss, Steven and J. Paul Tullis. Friction factor test on high density polyethylene pipe. Hydraulics Report No. 208. Utah Water Research Laboratory, Utah State University. Logan, Utah. 1994.

[e] Bishop, R.R. and R.W. Jeppson. Hydraulic characteristics of PVC sewer pipe in sanitary sewers. Utah State University. Logan, Utah. September 1975.

[d] Neale, L.C. and R.E. Price. Flow characteristics of PVC sewer pipe. Journal of the Sanitary Engineering Division, Div. Proc 90SA3, ASCE. pp. 109-129. 1964.

[b] Tullis, J. Paul, R.K. Watkins, and S. L. Barfuss. Innovative new drainage pipe. Proceedings of the International Conference on Pipeline Design and Installation, ASCE. March 25-27, 1990.

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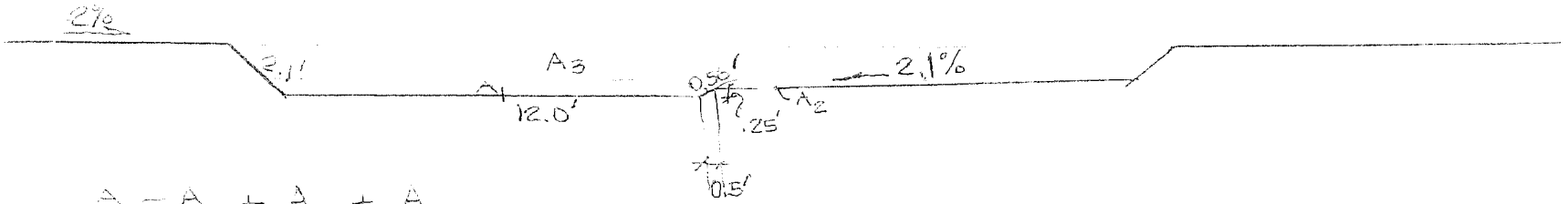

$A = A_1 + A_2 + A_3$

$A_1 = \frac{(12.0' + 12.5')}{2} \times 0.5' \approx 6.12\ ft^2$

$A_2 = \frac{12' \times 0.25'}{2} \approx 1.5\ ft^2$

$A_3 = \left(\frac{27' + 25'}{2}\right) \times 1.0' \approx 26\ ft^2$

$A \approx 6.12 + 1.5 + 26.0\ ft^2 \approx \underline{33.62\ ft^2}$

$P \approx 2.1' + 12.0' + 0.56' + 12.0' + 1.4' \approx 26.7\ ft$

} "high" flow conditions.

$A \approx \frac{12' + 12.5'}{2} \times 0.25' \approx 3.0\ ft^2$

$P \approx 0.4' + 12' + 0.4' \approx 12.8\ ft$

} "Low" flow conditions.

Manning Equation Calculator | Open channel flow software

Manning equation calculation is mobile-device-friendly as of June 27, 2014

Click to Calculate k = 1.49

CML - Phase III East Channel (high flow)

- Average Phase III

Solve for:

Velocity and Discharge

Select units:

Use feet and seconds units

Area, A (ft^2):	33.62
Wetted Perimeter, P (ft):	26.7
Channel Slope, S (ft/ft):	.0296
Manning n:	0.016
Velocity, V (ft/s):	18.682562 ✓
Discharge, Q (ft^3/s):	628.10775 ✓

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Units in Manning calculator: ft=foot, m=meter, s=second.

Manning Equation:

$$Q = VA \qquad V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$

k is a unit conversion factor: k=1.49 for English units (feet and seconds). k=1.0 for SI units (meters and seconds).
A=Flow area of the pipe, culvert, or channel.
P=Wetted perimeter which is the portion of the circumference that is in contact with water.
Q=Discharge (flow rate).
S=Downward (longitudinal) slope of the culvert.
V=Average velocity in the pipe, culvert, or channel.

Manning n varies with the roughness of the pipe, culvert, or channel. The higher the n, the rougher the material. Table of Manning n values.

To: LMNO Engineering home page (more calculations)

Related calculations:

Design of Rectangular Channels

Design of Trapezoidal Channels

Circular Culverts using Manning Equation

Culvert Design using Inlet and Outlet Control

Q=VA simple flowrate calculator

Manning Equation Calculator | Open channel flow software

Manning equation calculation is mobile-device-friendly as of June 27, 2014

CML - Phase II

Click to Calculate k = 1.49

Solve for:

Velocity and Discharge

Select units:

Use feet and seconds units

Area, A (ft^2):	33.62
Wetted Perimeter, P (ft):	26.7
Channel Slope, S (ft/ft):	.022
Manning n:	0.016
Velocity, V (ft/s):	16.106528
Discharge, Q (ft^3/s):	541.50146

- Average (IV, V, VI)

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Units in Manning calculator: ft=foot, m=meter, s=second.

Manning Equation:

$$Q = VA \qquad V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$

k is a unit conversion factor: k=1.49 for English units (feet and seconds). k=1.0 for SI units (meters and seconds).
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CML Phase IX East Channel "Low" Flow

Click to Calculate k = 1.49

Solve for:

Velocity and Discharge

Select units:

Use feet and seconds units

Area, A (ft^2):	3
Wetted Perimeter, P (ft):	12.8
Channel Slope, S (ft/ft):	.022
Manning n:	0.016
Velocity, V (ft/s):	5.2507154 ✓
Discharge, Q (ft^3/s):	15.752146 ✓

Ave. IX, X, XI

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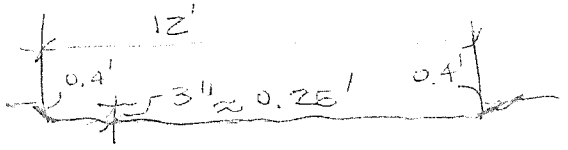
Units in Manning calculator: ft=foot, m=meter, s=second.

Manning Equation:

$$Q = VA \qquad V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$



A = 12' × 0.25' ≈ 3.0 ft²
P ≈ 12' + 0.4' + 0.4' ≈ 12.8'

k is a unit conversion factor: k=1.49 for English units (feet and seconds). k=1.0 for SI units (meters and seconds).
A=Flow area of the pipe, culvert, or channel.
P=Wetted perimeter which is the portion of the circumference that is in contact with water.
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S=Downward (longitudinal) slope of the culvert.
V=Average velocity in the pipe, culvert, or channel.

Manning n varies with the roughness of the pipe, culvert, or channel. The higher the n, the rougher the material. Table of Manning n values.

To:
LMNO Engineering home page (more calculations)

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Manning equation calculation is mobile-device-friendly as of June 27, 2014

Click to Calculate k = 1.49

Solve for:

Velocity and Discharge

Select units:

Use feet and seconds units

Area, A (ft^2):	3
Wetted Perimeter, P (ft):	12.8
Channel Slope, S (ft/ft):	.0296
Manning n:	0.016
Velocity, V (ft/s):	6.0905007
Discharge, Q (ft^3/s):	18.271502

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Units in Manning calculator: ft=foot, m=meter, s=second.

Manning Equation:

$$Q = VA \qquad V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$

k is a unit conversion factor: k=1.49 for English units (feet and seconds). k=1.0 for SI units (meters and seconds).
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