HoKua Place
Section 343-5e HRS
Final Environmental Impact Statement (FEIS)
Volume II-A
Exhibits 1 & A to H

Prepared for:
Accepting Authority
State of Hawaiʻi Land Use Commission
&
Petitioner
HG Kauaʻi Joint Venture LLC

Prepared by:

Agor Jehn Architects, LLC
119 Merchant Street, Suite 605A
Honolulu, Hawai`i 96815
(808) 947-2467
ron@agorjehnarch.com

November 2019

Volume II-A Contents

`

HG Kauai Joint Venture, LLC

November 2, 2017

To whom it may concern:

We hereby authorize Ron Agor Architect of Agor Jehn Architects LLC to prepare and submit the Final Environment Impact Statement (FEIS) for the HoKua Place. (TMK: (4) 4-3-003:001) We further authorize the use of information and data provided by one of our consultants, Ho'okuleana, LLC, for their submittal of the DEIS.

Please do not hesitate to contact me with any questions at: 435.272.3709.

Jacob Bracken
Manager

5662 W. Clubhouse Dr., Hurricane, UT 84747

HoKua Place FEIS

Exhibits

&

Responses to DEIS Comments

Exhibit A

Kapa'a Housing Market Study (DEIS) for HoKua Place (Formerly Kapa'a Highlands II)

I. INTRODUCTION

The Data@Work is a market research firm that specializes in analyzing residential real estate markets for developers and lenders. We have been retained to perform a study analyzing the market for proposed master planned community on the island of Kauai, called Kapaa Highlands.

This study focuses on the historical and projected market conditions and trends in accessing the ability of the project to be successful in selling its residential properties at a price and at a velocity. The study entailed collecting, comparing and analyzing information that has a bearing on the numerous aspects of market demand for the proposed project, including but not limited to publicly available real property, economic and commercial data.

The author makes every effort to verify that all of the information in study and in particular the market description and analysis is accurate, but is aware that 100% accuracy is unlikely. Finally, the analysis and statements herein are based on independent research by the author.

II. PROJECT DESCRIPTION & STUDY OUTLINE

Project

Kapaa Highlands is a master planned project on the Island of Kauai targeting primary housing demand from local and in-migrant families, as well as offshore second home demand for view estate ownership. It sits above the historic town of Kapaa and below the foothills of the mountain chain that forms the island. It is equidistant from the two major resorts on the island (and at the center of the third, the Coconut Coast). Thus, it is at or close to the centers of employment and commercial activity.

As Kapaa is arguably at the center of the island, the target market for this development will be spread across a wide range of households, but mainly appealing to local families looking for reasonably priced housing that is well-located with regard to the centers of employment in the county, as well as to a good range of shopping, recreational and social facilities.

The development contains a portion of the Kapaa bypass road, a major arterial road adjacent to the property. As such, the property is accessible from three sides and is adjacent to already improved county roads. Furthermore, the property has no significant restraints relative to adequate water availability and wastewater. Finally, the Kapaa Middle School is located adjacent to the property and adds to the attractiveness of the site to the local population.

KAPAA HIGHLANDS PRODUCT MIX AND SALES PROJECTION

Product	Units
House Lot Packages, On Large Lots (10,000 sf)	36
House Lot Packages, On Medium Lots (7,500 sf)	50
Multi-Family Dwelling Units (4 Plex, 8 DU/Ac)	500
Affordable Housing Dwelling Units (12 DU/Ac)	183

The units described above include condominiums (Multi-Family pads and Affordable Housing) and single-family homes (House Lot package).

EXHIBIT "A"

[Note that some of the House/Lot package units may be sold as home sites, depending on future demand and market conditions].

The condominium units will be designed in a range of bedroom configurations that will best meet the demand for housing by providing designs that apply to different family types, including starter families, empty nesters, families with children, and households that qualify for affordably priced housing.

The design of the single family units will appeal to some of those in the aforementioned condominium demographic groupings, but will go further by addressing the needs of large families, families wanting to be close to the Middle School, trans-generational families needing adequate (read larger and more defined) living space, and professional families or those with multiple wage-earners.

The design of the condominiums could include stacked flats and townhomes, both of which have cost and livability advantages. They will located in multi-unit buildings (four and six-plex, etc.) and laid out in a way that will be taking advantage of the site's benefits: including those of the ocean views, the cooling winds, the warming sunlight, etc. Their density would range from 8 to 12 units per acre.

The single-family units will be designed to take advantage of the area topography, as well as wind and sun direction and views. By having two different lot sizes allows for the land plan to address two demographics: the smaller lot size units would be most appropriate to starter families, and larger lot size units would be appropriate for larger families and multigenerational households.

It is worth being mindful that, generally speaking, the high cost of housing production in Hawaii, and Kauai in particular, often pushes housing prices beyond what local families, particularly workforce families, can afford. To counter that, often Kauai home purchasers include a number of income earners into the purchase, both family members and non-family members. It is this market demand segment that the larger lot size and house size units will address.

In keeping with the county's affordable housing requirement, the requisite number of units will be produced and priced according to the existing income guidelines when marketed. The current affordable requirement is 30%, and the fulfillment of that will be a benefit to the local families seeking better housing or a more convenient location.

Additionally, while the market homes will be priced to the market, and done so at the time of the start of construction, they will also be more affordably priced, relative to much of the new construction on the island. This is because the large size of the overall development (750+ units) is conducive to achieving construction economies of scale, both for infrastructure and vertical construction - which can be passed on to the consumer.

Further, these homes and condos will also be designed with the needs of local families in mind, as opposed to the offshore buyer market. This will thus 'lessen' the overall demand for them, resulting in a more moderate price point. This stands in contrast to many other new home construction projects and developments on the island and in the state, which seek to address the needs of the offshore buyer (and are priced accordingly higher).

Finally, it is important to note that this development will benefit those in the community who will not be purchasing here, but who nonetheless are in the market for affordable housing. This is because this, or any, provision of new housing acts to soften the pressures that push housing prices higher – national and local studies and data has shown that the supply of new housing into an existing market place results in a moderating trend in prices.

Study Outline

In an effort to evaluate the proposed project, the study will begin by describing the area, the housing stock and the economy. It will take account of the economic factors and trends that affect housing relative to the county and to the proposed project. Thereafter, it will describe the housing market in general, and in particular to this project. In doing so, it will describe and analyze the factors and trends behind the general and specific supply and demand for housing. And it will summarize the findings and finish with some concluding remarks and expectations.

III. OVERVIEW of COUNTY and MARKET

Subject Property's Community

Kauai County is the fourth largest county in the state, as ranked by population and economic activity, behind the City & County of Honolulu (Oahu), Maui County and the Big Island of Hawaii.

The majority of the island's roughly 52,000 residents lives and works in the coastal areas leaving the interior of Kauai natural and pristine. Kauai's weather is near perfect year round with daytime temperatures ranging from the mid 70's to the mid 80's, slightly warmer in the summer. The northeast trade winds average about 15 mph for most of the year, and provide refreshing breezes. Rain showers usually fall in the evening and early morning hours, predominantly over the mountain ranges. The temperature of the ocean ranges from 68 to 80 degrees Fahrenheit.

It has one of the strongest brands in the global visitor industry, as well as arguably the most diversified visitor industry of any of the islands, combining large resort master planned communities, cruise ship visitations, time share developments and small-scale bed and breakfasts.

The breadth and depth of this economic base, like the rest of the state, rests on the county's economy's unique comparative advantage relative to the other visitor destinations world-wide: it has a very high quality of life, a function of a naturally beautiful setting, with a benign environment and near perfect climate. Indeed, the proof of its attractiveness can be found in the quality of the number of 'rich and famous' who have bought in Hawaii, starting with Lawrence Rockefeller in 1960 (followed by John Wayne, George Harrison, Peter Gruber, Charles Schwab, Michael Dell, Ben Stiller, Oprah Winfrey, Akio Morita, Michael Creighton, etc.)

Kauai has three major resort destinations:

- **Princeville**, a 45-minute drive from the Airport, is a resort that runs across a large plateau overlooking one of the largest deep-water bays in Hawaii. The view of the sunset, looking west, is extraordinarily beautiful.

- **Poipu**, also a 45-minute drive from the airport, sits above the south shore, with numerous bays and beaches safe for swimming. It has the largest concentration of hotels and golf courses on the island. .

- **Coconut Coast**, a 20 minute drive from the airport, this area was the favored area of Hawaiian royalty and the original site of resort development on the island and, save for Waikiki, the state. It today hosts one of the largest percentage of accommodations, shops, recreation, restaurants and historical sites on the island.

The majority of the primary housing development is located within the Kapaa and Lihue urban zones, with secondary sources located areas in and around Poipu, Kilauea/Hanalei, and Hanapepe and Waimea. Second home development is located within and around the three major resort communities, as well as in locations that are close to the coastline and/or in westward facing locales).

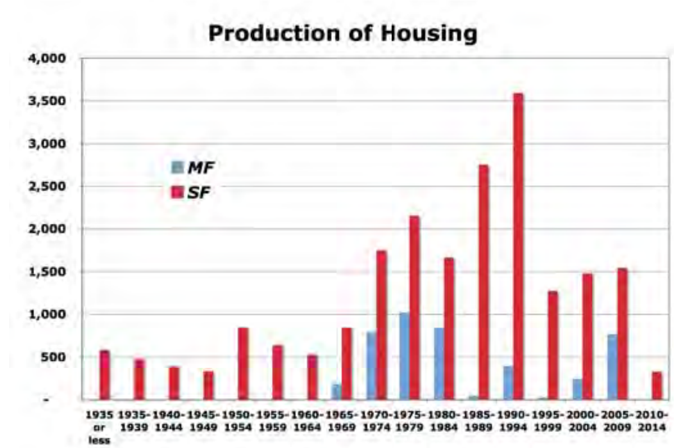
Subject Property's Housing Stock

Most of the primary housing inventory and on-going development is located within the Kapaa and Lihue urban zones. Primary housing is also concentrated, but to a lesser degree, in and around the communities of Poipu, Kilauea/Hanalei, and Hanapepe and Waimea.

Since the 1990s, Kauai's housing stock has grown faster than the population, as measured by the average annual growth rate for dwellings: it grew by 3.5% p.a. between 1990 and 2000, the highest in the State. The growth rate dropped to around 1.7% over the 2000-2010 period. Many of these new units have been targeted for the visitor or second home industry.

For instance, in 1990, the percentage of occupied housing units was about 92.5% of the county's total housing stock. By 2006, according to the Hawaii Housing Study, that dropped to 76.2 percent, the greatest rate of change among the four counties. Since 2006, however, there has been a reversal of that trend, with the percent of housing stock being build for primary homeownership has increased to 89.6%.

By way of context, housing development and construction was most active on Kauai during the time when the major resorts were developed in the 1970 and 1980s. Thereafter, primary housing production reached only half that level, save for periods of housing reconstruction that followed a major hurricane event.



In the years after the establishment of the resorts, there was a boom in condominium production, but many of these projects that were developed targeted the offshore buyer market. TMK records

show that over 70% of the condo units and 12% of the single-family homes are owned by out of state residents.

Census records have shown that a quarter of the County's housing stock did not house residents in 2000. Thus, while the Census categorizes these units as "vacant," they may be actually rented to vacationers, reserved by owners as a second home, or both. Demand in the housing market hence comes from residents, investors, and non-residents.

As a result, the average prices for housing units are skewed upwards and do not necessarily reflect residents' ability to pay for housing. Kauai housing stock is 78% owner occupied and 22% vacant, per their definition (it includes seasonal or recreational use, which itself constitutes 64% of all vacant units, with rental units constituting 20% of that total).

Indeed, housing inventory shows that about 3,000 of the 4,000 condominium units in the county, or 73%, are owned out-of-state. This would account for the high prices of condos in the county, the second highest in the state. Median resale price this May 2013 for a condo on Kauai is $323,000.

HOUSING CHARACTERISTICS OF THE MARKET

Kauai County	Units
Occupied housing units	23,051
Owner-occupied housing units	13,968
Renter-occupied housing units	9,272
Vacant housing units	6,553
For rent	1,312
Rented, not occupied	61
For sale only	251
Sold, not occupied	51
For seasonal, recreational use	4,172
All other vacant units	706
Homeowner vacancy rate (percent)	1.8%
Rental vacancy rate (percent)	12.3%

Note that the homeowner vacancy rate is low but the rental vacancy rate is high. This is indicative of a community that has high priced houses – therefore the homeowner vacancy rates are low. Additionally, as it is a very desirable place to live, there are a lot of rental units for vacation rental – and therefore the rental vacancy rate is high.

HOUSING CHARACTERISTICS OF THE MARKET, BY AREA

	Waimea	Koloa	Lihue	Kawaihau	Hanalei	Total
Detached Home	2,270	4,843	4,706	5,212	2,013	19,044
Townhouse	57	128	142	36	113	484
Condominium	0	195	326	190	366	1,082
Duplex/multiplex	85	201	24	142	22	484
Apartment	328	139	564	202	185	1,428
Co-op	0	67	107	0	0	184
Other/Not	0	179	65	148	52	345
	2,739	5,752	5,935	5,930	2,751	23,051

Note that the area of the proposed development is Kawaihau, highlighted in blue, and that area has very few dwellings that are attached units (condo, townhouse, etc.).

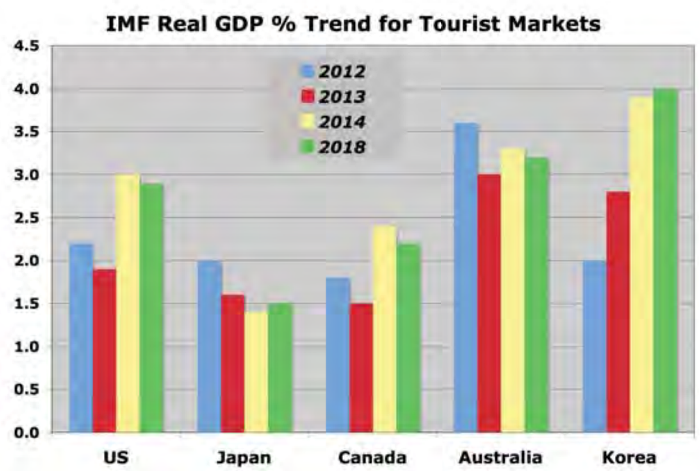
IV. THE ECONOMY

Simply put, residential for-sale and rental values move closely in synch with an area's economic growth, and economic growth is determined in the short run by the balance of trade between the area and it's major trading partners. And the mechanism by which this growth in values occurs is via rising incomes and higher job counts. We start by looking at the economic outlook for the state and the county. As the major industry is tourism, the county's significant visitor sources would be the US, Canada and Asia

As such, we look at the economic trends in all three sources.

GLOBAL ECONOMY:

The overall global economic forecast by the IMF earlier this year noted that the recovery had solidified, but the unemployment remained high. It said global financial risks have shrunk, including the chance of a fallback in economic activity (a double dip).

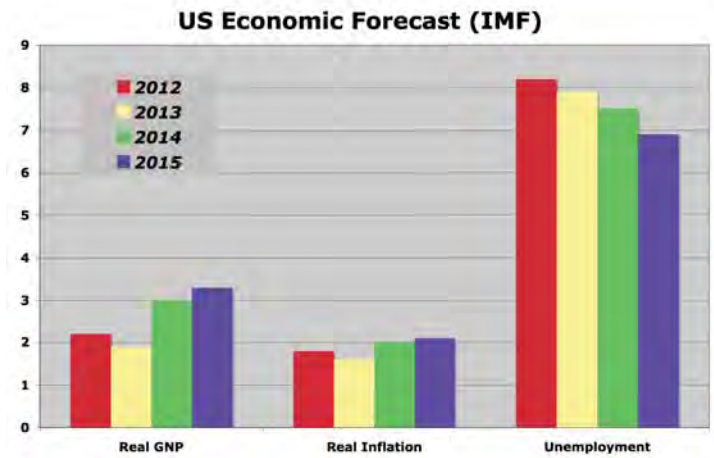


If the advanced economies continue to repair their public and financial balance sheets, and stimulate employment, and if emerging markets do not overheat their economies, global financial markets and property markets will stabilize and grow.

UNITES STATES:

The US economy is projected to grow by 3 percent in 2014, as firmer private final demand takes the burden to stimulate the economy off of federal fiscal policy. More and more, the risks to the economic outlook are abating: the recovery in housing prices and the slight growth in the job

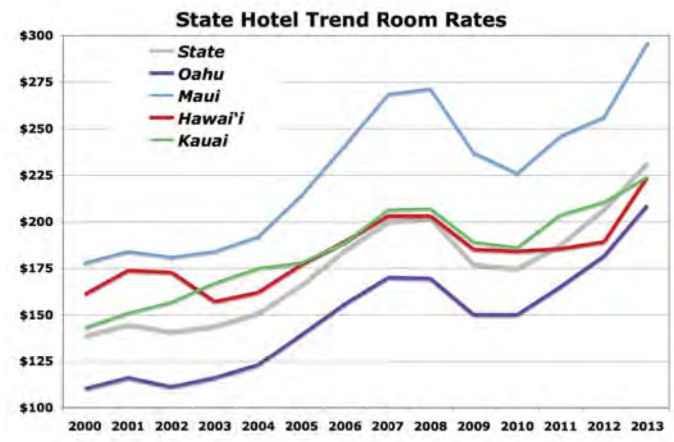
market are big positives looking ahead. Given the slack in the economy, inflation is expected to remain subdued, but with a rise in the interest rates in the cards.



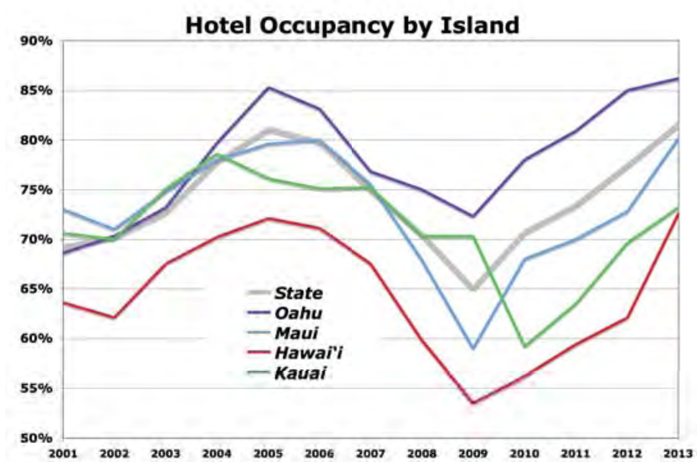
Looking ahead, the US economy will be on the rise. That, plus the perception of a growing economy, should be sufficient to grow the Hawaii state and the Oahu county economies. As an improved US economy is manifested in terms of higher visitor industry revenues, this commensurate growth in state economic activity will then put pressure on housing, via higher job counts (immigration) and incomes.

HAWAII STATE:

According to the state economic forecasters, Hawaii's economy continues to grow strongly in 2013 at an accelerating rate. The state has very low unemployment relative to the rest of the nation, thanks to a resurgent demand in the visitor industry, which is the major engine of economic growth in the county and the state (as seen below).

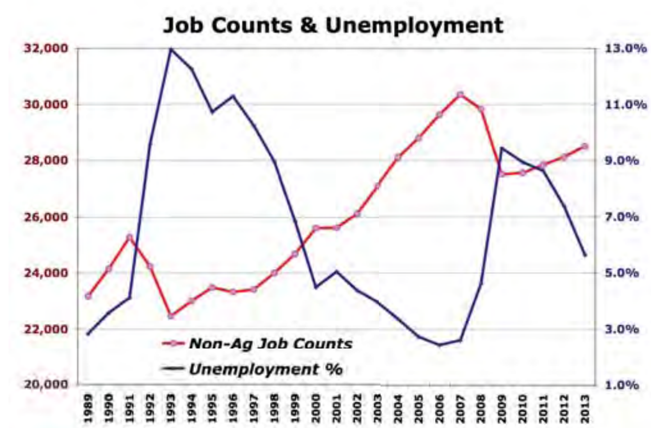


Historically, Hawaii's economy follows those of the Pacific Rim countries, which bodes well for the future.



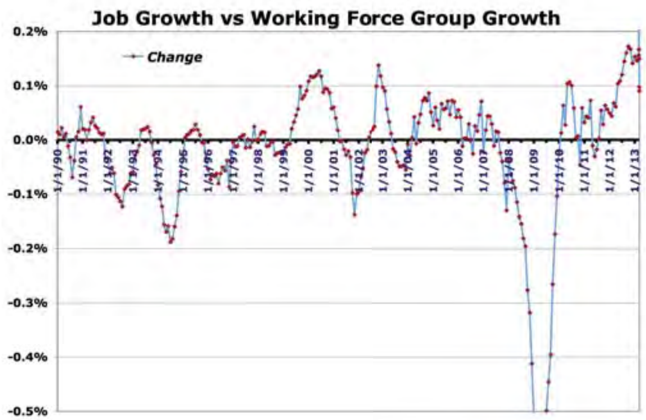
KAUAI:

Kauai is enjoying economy growth again, thanks to a resurgent demand in the visitor industry, which is the major engine of economic growth in the county and the state (as seen in job counts rising and unemployment rates falling).

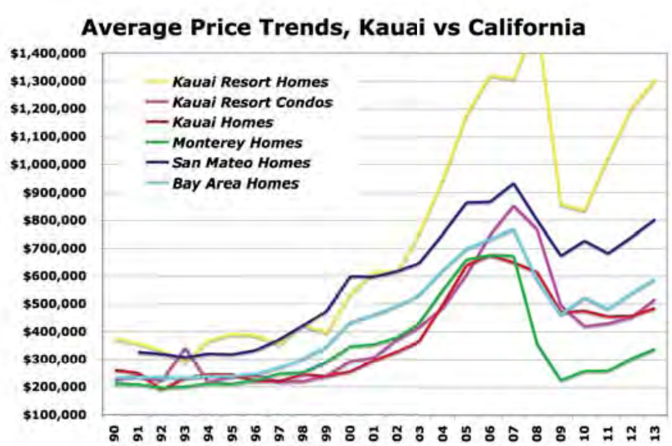


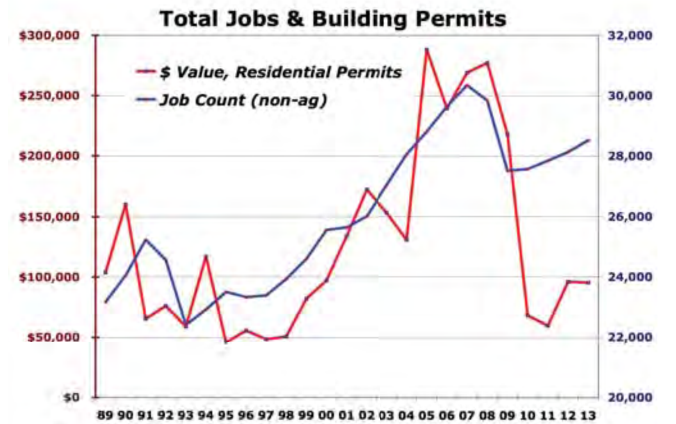
Going forward, Kauai will begin to experience tight labor conditions, with immigration occurring in order to meet rising job growth. Indeed, this is happening already, as seen next.

This chart shows that the recent growth in jobs is outpacing the natural growth in the workforce, i.e., population growth. Thus, in-migration will occur (which leads to increased housing demand).

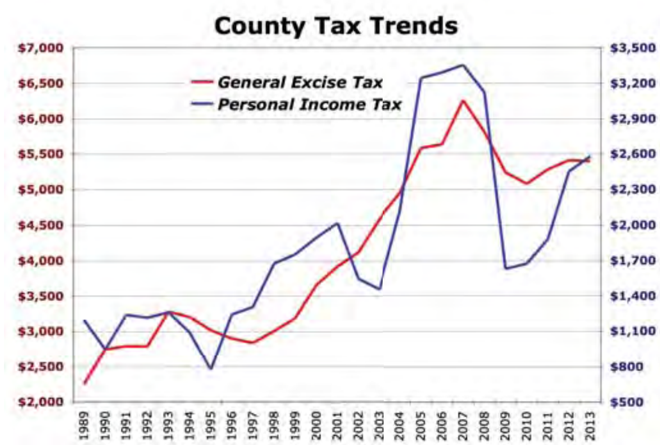


Housing demand will also grow thanks to offshore demand. As seen, when California's residential markets improve, prices (demand) for second homes in Kauai also rises.





Finally, Kauai's economy and real estate market are closely tied, as an increase in one leads to an increase in the activity of the other (per the following chart). In sum, economic indicators look to growth for the island's residential market.



V. HOUSING MARKET

Overview: Much like the state, Kauai's residential real estate supply is inflexible and constrained, but to a greater degree – the cost constraints are even tighter (higher costs of transporting material inputs to a remote locale, plus of sourcing labor in a small community), and the political climate there is generally unfavorable to housing development, particularly at the high end and/or in areas that are highly visible (but decidedly less so, relative to affordable and senior housing, as well as work force housing, which this project is proposing).

At the same time, demand for residential real estate is both flexible and strong, particularly in good economic times and over the long run. It can be, and is currently, constrained to an uncharacteristic degree, thanks to havoc in the financial markets the last few years and the drastic fall off in economic activity globally and nationally.

The first condition, limited supply, arises due to Kauai having a very small landmass, coupled with inadequate infrastructure and challenging geographic conditions (atop the aforementioned political, social and legal impediments).

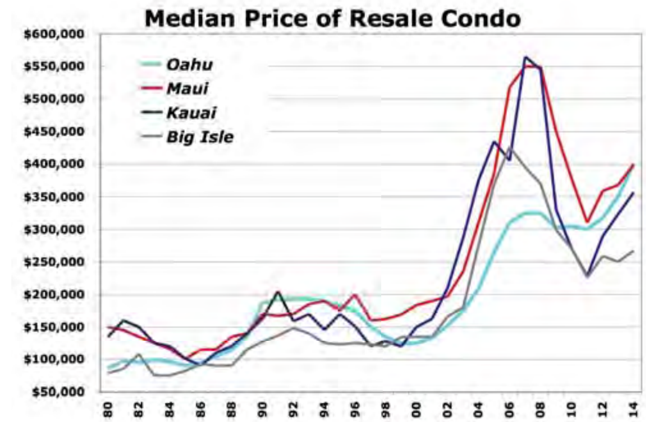
The second starts with the very high quality (defined a high quality of life, in terms of being a place that is environmentally safe, aesthetically pleasing, socially accommodating, politically stable, etc.). This is coupled by a deep and broad appreciation of that lifestyle by very large population accustomed to visiting the island (mainly West Coast and East Asia), which has one of the highest rankings in brand awareness and acceptance.

In combination, this results in a market that can dramatically volatile, up and down, in terms of sales and, to a lesser extent, prices. We note that in the past cycles, prices have been relatively 'sticky' downward, i.e., generally holding on to accumulated values. In this cycle, however, the price appreciation was so extensive and lasted so long, that the ensuing price depreciation during the down cycle has also been extensive.

Currently, Kauai's residential markets are now at the beginning of the up-cycle. The question is, going forward, how long this will last. The rule of thumb for the residential market is that the upswing in the cycle, the up cycle, generally lasts about 6.5 years, and is about twice as long as the down cycles. In addition, the up cycle, through to peak, results a tripling of the number of closings.

For the condo market, the up cycles last about 7 years, almost more than twice as long as the down cycles. In addition, the movement trough to peak of closings can be 300% or 400%, while for prices, it can be 400% or higher (note that this condition is not just particular to Kauai, but to all the neighbor islands).

The following charts illustrate this, starting with price appreciation trends.



For the condo market on Kauai, the one that relates to this project, the up cycles last about 7 years, almost more than twice as long as the down cycles.

Next, we describe the balance between supply and the demand using sales and listings island-wide for condos, as well as the indicator showing the balance between the two, MRI or Months of Remaining Inventory.

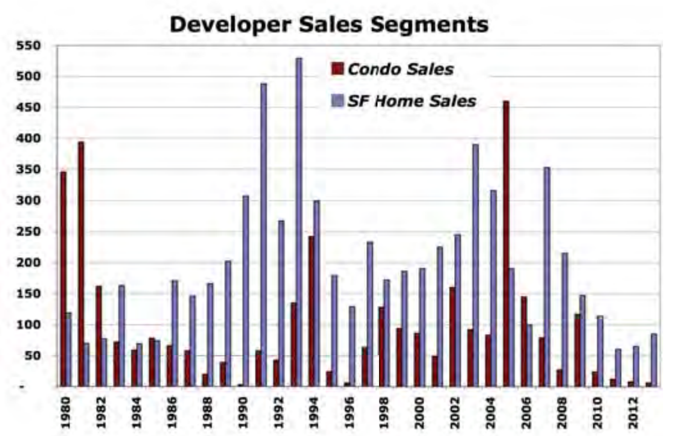
Right now, the MRI trend is declining, per the growth of sales and shrinkage of listings, indicative of a tight market. A normal reading is between 8 and 12 months, with the two balanced.

Looking ahead, we assume that the sales will continue to grow (as a function of low interest rates, plus the spread of the economic recovery in the areas where buyers of Kauai real estate reside (basically on Kauai, plus on the west coast of North America).

In this case, the proper market response to tight supply is for sellers to raise their prices. As seen in other charts, this has already started two years ago, and continues this year as well.

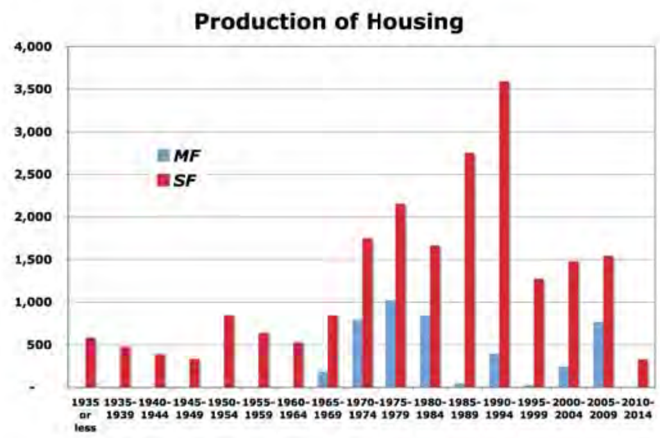
The following chart shows the price trend over the last 32 years for the four basic housing products: single-family resales and developer (newly construct4ed) sales, plus condominium resales and developer sales. As seen, the price trend over the last four years has been down, with the recovery taking hold first with single-family product, followed by condos.

Next, we look at the market for developer sales. As seen in the next chart, the level of new housing production is at a historic low. This is a condition of scarcity and it leads to price movement to the upside.



When that happens, the general public will get a sense that there is a housing shortage, and pressure will be brought politically to increase the supply of affordable housing. In and of itself, that will help to alleviate the demand existing for affordable rental units. That said, it is likely that the demand for reasonably priced housing will vastly outpace the supply.

Another way of seeing this is the long-term production of housing chart. Not only has housing production been low of late, but this also says that the current stock of housing is old, and dated.



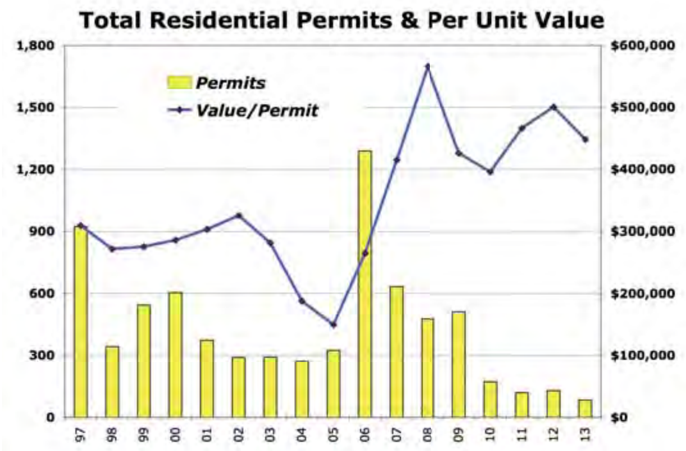
VI. FUTURE KAUAI HOUSING SUPPLY

PERMITS

The easiest way to look ahead to where the housing market is going in the short-term is by examining the activity in permits (where developers apply for permission, and pay their fees, for building residential units). A high level of activity indicates more supply is in the works, which means that more demand will be met, and the potential for prices adjusting downwards. With less supply in the works, prices will feel pressure upwards (and higher prices in the future, when demand recovers).

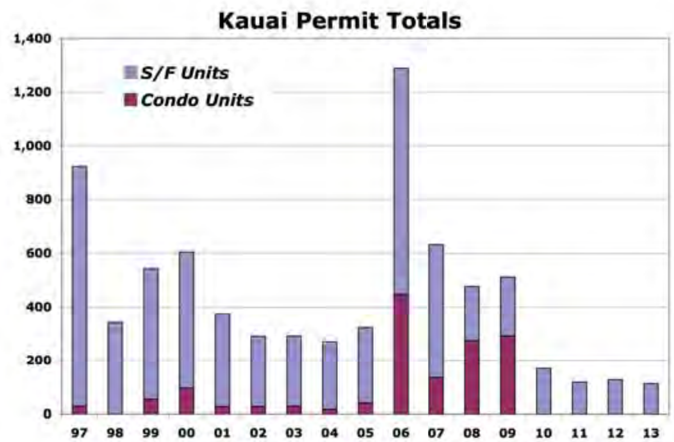
In addition, low levels of per unit value indicate that the units being built are for the lower end of the market (and vice versa). And, this has not been the case overtime on Kauai, indicating that most of the new housing has been targeted on the upper income end of the housing market.

An overview of the TOTAL RESIDENTIAL PERMITS AND VALUES Chart shows that the number of permitted units has sunk so low that it is at an all-time historical low. On the other hand, the value per permitted unit is at a record high.

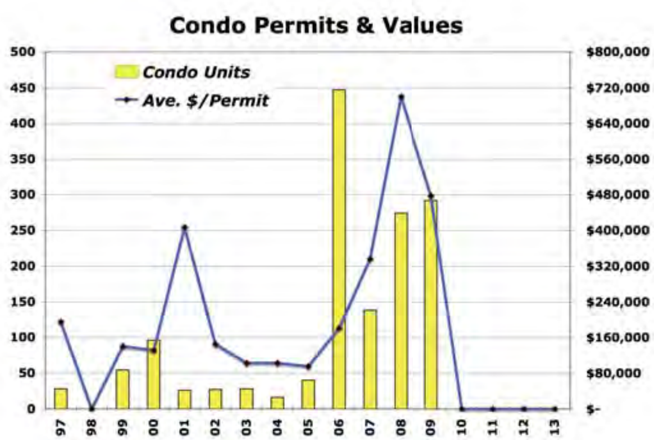


Note that the 2013 data is extrapolated, using actual data through April 2013.

The following chart shows the actual breakdown between condos and single-family homes.

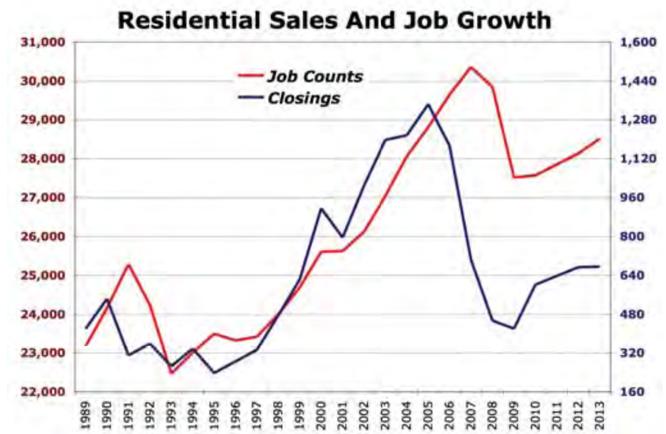


As seen, the number of permits is very low – caused mainly by the condo market.



VII. HOUSING DEMAND

The prime determinant of housing demand is household formation, itself is a function of the economy and demographic and social trends. As noted above, in the short term, residential housing demand is driven by economics – specifically of job creation/income growth, as well as interest rate trends.



Incomes to buy homes, and they drive immigration, which is a prime source of housing demand (sometimes linked to population growth). This linkage is best illustrated in the RESIDENTIAL SALES & JOB GROWTH Chart.

Note how closely the two trends track one another, up until the 2004-2005 period, when high prices prevented many families from buying a house. This then shows how the lack of housing supply on an on-going basis drives prices higher, and thus lowers the sales of homes.

Further note, the gap that has opened up between the two trends starting in 2005. In previous recessions, a similar pattern occurred, with the sales of homes (blue line) picking up during the recovery. This was because a lot of families doubled up (multiple families living in one dwelling) during the recession. Thereafter, they took the economic gains they made in the recovery and invested it in housing. This will be happening in the next few years.

If the subject property were under construction, then this unmet housing demand would turn to this project as a source of housing supply.

VIII. HOUSING DEMAND POTENTIAL & PROJECTION

JOB GROWTH TO HOUSING DEMAND: In the tables below, we describe DBEDT's predictions for wage and salary job creation on Kauai for the next 10-15 years, and derive from that a general expectation for housing demand over the next five to ten years (in other words, we will translate it into housing demand). Note that the model* used here ran from 2007, but was updated in 2009

HOUSING DEMAND, FROM DBEDT'S 2035 JOB FORECAST FOR WAGE & SALARY JOBS

	2007	2015	2020	2025
Total civilian wage and salary jobs	44,077	46,900	49,500	51,900
5 Year Growth		2,823	2,600	2,400
Annual Job Growth		565	520	480
Annual Housing Demand (1.75 Jobs: 1 Home)		332	306	282

*(http://hawaii.gov/dbedt/info/economic/data_reports/2035LongRangeSeries/LRFreport_2035series_revised_Aug09.pdf)

As seen, we use the annual changes in job counts to derive housing demand on the premise that it will take an average of 1.75 new jobs to generate demand for one new house.

However, the job counts used in the charts and tables above are just the number of wage and salary jobholders, and do not encompass the self-employed or home worker. According to DBEDT's projections, self-employed workers consist of about 20% of the total work force, but are growing to 25% in the next ten to twenty years. As such, we want to add this demand for housing into our projections.

The following transforms those projections into annual job growth projections, and then summarizes it in a complete DBEDT projection table.

HOUSING DEMAND, FROM DBEDT'S 2035 JOB FORECAST, SELF-EMPLOYED

	2007	2015	2020	2025
Annual Housing Demand (1.75 Jobs: 1 Home)		332	306	282
Self Employed Housing Demand (15% of total)		33	31	28
Total Annual Housing Demand		365	336	311

Finally, we want to take into consideration offshore demand, relative to housing demand. Studies have shown that this demand varies from a low of 15% on Oahu to a high of 60% on Maui. For Kauai and our purposes here, we use a very conservative factor of 20%. Thus, the total amount of housing demanded in the future should see an increase of another 20%. The following table shows this:

HOUSING DEMAND, FROM DBEDT'S 2035 JOB FORECAST PLUS OFFSHORE DEMAND

	2007	2015	2020	2025
Total Annual Housing Demand		365	336	311
Offshore Buyer Housing Demand (20% of total)		66	61	56
Total Annual Housing Demand		431	397	367

Note that the average number of residential permits taken out in the last five years for the county is 373 units p.a., but the average over the last 2 years (projecting 2011 using YTD numbers through September, is 125 units, p.a.

In sum, housing production in the past has not satisfied housing demand, as driven by job growth, leading to higher priced housing and overcrowding in existing housing.

Looking ahead, this will only continue, as the level of permitting this year has been below what is would house just the recent growth in potential homebuyers.

IX. FORECAST

As seen earlier, the cycle for both the economy and real estate is coming off of a dramatic fall-off in overall activity and in values. Going forward, we believe the markets will right themselves and the county will resume the normal pattern of multi-year periods of both economic growth and job and personal income expansion. In turn, this will lead to housing demand. As seen in the past, the housing market will begin to overheat, manifested by rising housing prices that outrun people's rising incomes. This will lead again to an affordable housing 'crisis' – where demand outstrips supply. A major part of this problem, one of the county's own making, is that there will be limited amounts of land suitable and zoned for housing.

Given this, we believe the development this project will contribute to the satisfaction of housing demand, that has been deep and persistent, from both off-shore and on-island. We also believe that the development will be successful, particularly so in light of the coming up cycle in the housing market. Finally, the historically low level of permitting activity indicates there will little or no competitive interference coming in the short run from other housing development on the island.

The following table describes the potential pricing at the retail level for each product type in the development (note that, in the eventuality that some or all of the house/lot package units are sold as simple home sites, the prices will be lower, as reflected in the final column below).

KAPAA HIGHLANDS PRODUCT SALES PRICE PROJECTION

Housing Produced	Total Units	Retail Price Per Unit	Home Site Only Prices
A House Lot Package, Large Lots (10,000 sf)	36	$800,000-$950,000	$266,000-$316,000
A House Lot Package, Medium Lots (7,500 sf)	50	$650,000-$700,000	$216,000-$233,000
Multi-Family Dwellings (4 Plex, 8 DU/Ac)	500	$250,000-$350,000	
Affordable Housing Dwellings (12 DU/Ac)	183	$125,000-$175,000	

Given that these prices, particularly the affordable ones, are below the historical trend for housing, we expect that sales will start up strongly. We expect them then to hold this momentum over the first three years, coinciding with the market's expansion. Thereafter, they will experience a gradual fall-off, coinciding with the downturn in the cycle. After that, the market will recover, as will sales of the final units.

KAPAA HIGHLANDS PRODUCT CLOSING PROJECTION

Product	2016	2017	2018	2019	2020	2021	2022	2023
Large Lot Homes	11	9	9	7				
Medium Lot Homes	15	15	14	6				
Multi-Family Units	90	100	90	70	50	30	30	40
Affordable Housing Units	40	40	40	35	28			

Exhibit A.1

Updated
Kapa'a Housing Market Study for
HoKua Place
(Formerly Kapa'a Highlands II)

EXHIBIT "A.1"

I. INTRODUCTION

Ricky Cassiday is a market research firm that specializes in analyzing residential real estate markets for developers and lenders. We have been retained to perform a study analyzing the market for proposed master planned community on the island of Kauai, called Kapaa Highlands.

This study focuses on the historical and projected market conditions and trends in accessing the ability of the project to be successful in selling its residential properties at a price and at a velocity. The study entailed collecting, comparing and analyzing information that has a bearing on the numerous aspects of market demand for the proposed project, including but not limited to publicly available real property, economic and commercial data.

The author makes every effort to verify that all of the information in study and in particular the market description and analysis is accurate but is aware that 100% accuracy is unlikely. Finally, the analysis and statements herein are based on independent research by the author.

II. PROJECT DESCRIPTION & STUDY OUTLINE

Project

Kapaa Highlands is a master planned project on the Island of Kauai targeting primary housing demand from local and in-migrant families, as well as offshore second home demand for view estate ownership. It sits above the historic town of Kapaa and below the foothills of the mountain chain that forms the island. It is equidistant from the two major resorts on the island (and at the center of the third, the Coconut Coast). Thus, it is at or close to the centers of employment and commercial activity.

As Kapaa is arguably at the center of the island, the target market for this development will be spread across a wide range of households, but mainly appealing to local families looking for reasonably priced housing that is well-located with regard to the centers of employment in the county, as well as to a good range of shopping, recreational and social facilities.

The development contains a portion of the Kapaa bypass road, a major arterial road adjacent to the property. As such, the property is accessible from three sides and is adjacent to already improved county roads. Furthermore, the property has no significant restraints relative to adequate water availability and wastewater. Finally, the Kapaa Middle School is located adjacent to the property and adds to the attractiveness of the site to the local population.

KAPAA HIGHLANDS PRODUCT MIX AND SALES PROJECTION

Product	Units
House Lot Packages, On Large Lots (10,000 sf)	36
House Lot Packages, On Medium Lots (7,500 sf)	50
Multi-Family Dwelling Units (4 Plex, 8 DU/Ac)	500
Affordable Housing Dwelling Units (12 DU/Ac)	183

The units described above include condominiums (Multi-Family pads and Affordable Housing) and single-family homes (House Lot package).

[Note that some of the House/Lot package units may be sold as home sites, depending on future demand and market conditions].

The condominium units will be designed in a range of bedroom configurations that will best meet the demand for housing by providing designs that apply to different family types, including starter families, empty nesters, families with children, and households that qualify for affordably priced housing.

The design of the single family units will appeal to some of those in the aforementioned condominium demographic groupings, but will go further by addressing the needs of large families, families wanting to be close to the Middle School, trans-generational families needing adequate (read larger and more defined) living space, and professional families or those with multiple wage-earners.

The design of the condominiums could include stacked flats and townhomes, both of which have cost and livability advantages. They will be located in multi-unit buildings (four and six-plex, etc.) and laid out in a way that will be taking advantage of the site's benefits: including those of the ocean views, the cooling winds, the warming sunlight, etc. Their density would range from 8 to 12 units per acre.

The single-family units will be designed to take advantage of the area topography, as well as wind and sun direction and views. By having two different lot sizes allows for the land plan to address two demographics: the smaller lot size units would be most appropriate to starter families, and larger lot size units would be appropriate for larger families and multigenerational households.

It is worth being mindful that, generally speaking, the high cost of housing production in Hawaii, and Kauai in particular, often pushes housing prices beyond what local families, particularly workforce families, can afford. To counter that, often Kauai home purchasers include a number of income earners into the purchase, both family members and non-family members. It is this market demand segment that the larger lot size and house size units will address.

In keeping with the county's affordable housing requirement, the requisite number of units will be produced and priced according to the existing income guidelines when marketed. The current affordable requirement is 30%, and the fulfillment of that will be a benefit to the local families seeking better housing or a more convenient location.

Additionally, while the market homes will be priced to the open market, and done so at the time of the start of construction, they will also be more affordably priced, relative to much of the new construction on the island. This is because the large size of the overall development (750+ units) is conducive to achieving construction economies of scale, both for infrastructure and vertical construction - which can be passed on to the consumer.

Further, these homes and condos will also be designed with the needs of local families in mind, as opposed to the offshore buyer market. This will thus 'lessen' the overall demand for them, resulting in a more moderate price point. This stands in contrast to many other new home construction projects and developments on the island and in the state, which seek to address the needs of the offshore buyer (and are priced accordingly higher).

Finally, it is important to note that this development will benefit those in the community who will not be purchasing here, but who nonetheless are in the market for affordable housing. This is because this, or any, provision of new housing acts to soften the pressures that push housing prices higher – national and local studies and data has shown that the supply of new housing into an existing market place results in a moderating trend in prices.

Study Outline

In an effort to evaluate the proposed project, the study will begin by describing the area, the housing stock and the economy. It will take account of the economic factors and trends that affect housing relative to the county and to the proposed project. Thereafter, it will describe the housing market in general, and in particular to this project. In doing so, it will describe and analyze the factors and trends behind the general and specific supply and demand for housing. And it will summarize the findings and finish with some concluding remarks and expectations.

SCOPE OF WORK:

- Describe and analyze the county's economy historically, both island-wide and in the target market. Of interest are the historical trends in housing demand and supply, as well as the market's current conditions and future direction.
- Describe and analyze the target market by describing the current and future trends in business, housing and population, including the demographic composition of the population. Use that information to identify the pockets of greatest demand.
- Describe and analyze the supply side of the market, in particular the existing housing inventory and analyze the competitive set of the proposed development.
- Describe and analyze the future for this development, in terms of the future, especially the specific projects that will overlap and/or compete. Comment what the effect of that competition will be and how it will play out, relative to this specific property, as well as the area and island housing market. Focus on workforce and affordable housing.
- Combine demand and supply analysis to forecast the market acceptance of the project's pricing, and estimate the project's sales velocities, given current and projected market conditions.

GEOGRAPHIC DEFINITION OF MARKET AREA: The County of Kauai will serve as the market area for this study. Such a definition was deemed appropriate for the following reasons:

- There are no natural boundaries in the county to inhibit relocation;
- The entire island's population lives in close proximity to one another (within a 30-mile radius); and
- There is an acute need for affordably priced shelter on the island.

III. OVERVIEW OF COUNTY

Subject Property's Community

Kauai County is the fourth largest county in the state, as ranked by population and economic activity, behind the City & County of Honolulu (Oahu), Maui County and the Big Island of Hawaii.

The majority of the island's roughly 72,000 residents lives and works in the coastal areas leaving the interior of Kauai natural and pristine. Kauai's weather is near perfect year-round with daytime temperatures ranging from the mid 70's to the mid 80's, slightly warmer in the summer. The northeast trade winds average about 15 mph for most of the year, and provide refreshing breezes. Rain showers usually fall in the evening and early morning hours, predominantly over the mountain ranges. The temperature of the ocean ranges from 68 to 80 degrees Fahrenheit.

It has one of the strongest brands in the global visitor industry, as well as arguably the most diversified visitor industry of any of the islands, combining large resort master planned communities, cruise ship visitations, time share developments and small-scale bed and breakfasts.

The breadth and depth of this economic base, like the rest of the state, rests on the county's economy's unique comparative advantage relative to the other visitor destinations world-wide: it has a very high quality of life, a function of a naturally beautiful setting, with a benign environment and near perfect climate. Indeed, the proof of its attractiveness can be found in the quality of the number of 'rich and famous' who have bought in Hawaii, starting with Lawrence Rockefeller in 1960 (followed by John Wayne, George Harrison, Peter Gruber, Charles Schwab, Michael Dell, Ben Stiller, Oprah Winfrey, Akio Morita, Michael Creighton, etc.)

Kauai has three major resort destinations:

- Princeville, a 45-minute drive from the Airport, is a resort that runs across a large plateau overlooking one of the largest deep-water bays in Hawaii. The view of the sunset, looking west, is extraordinarily beautiful.

- Poipu, also a 45-minute drive from the airport, sits above the south shore, with numerous bays and beaches safe for swimming. It has the largest concentration of hotels and golf courses on the island.

- Coconut Coast, a 20-minute drive from the airport, this area was the favored area of Hawaiian royalty and the original site of resort development on the island and, save for Waikiki, the state. It today hosts one of the largest percentage of accommodations, shops, recreation, restaurants and historical sites on the island.

IV. THE ECONOMIC BACKGROUND:

Simply put, real estate sales and values move closely in sync with an area's economic growth, and the mechanism by which this growth occurs is via rising incomes and higher job counts. Both feed directly into demand for housing.

In the short run, economic growth is determined by trading activity, the most important of which is the level and balance of trade between the area and its major trading partners. In the case of Oahu, the major trade is in recreational goods and services, the largest of which is the visitor industry. The health of this industry is tied to the health of the economies which send visitors to Oahu. In the longer run, economic growth is also determined by population changes (both migration and demographic) and lifestyle preferences.

In the last 50 years, Hawaii has transitioned from an agricultural economy to one based on tourism, in the first place. In second place is government spending. Thanks to state and local government, and federal — especially military — spending, the public sector has a greater presence in Hawaii's economy than in any other state). Both of these commercial activities have compared well to their global competitors, and thus have strong long-term potential. As the most isolated inhabited land mass in the world, Hawaii's natural resources, to say nothing of its climatological and social positives, push it to the top for visitor experience and satisfaction. And, it's geographical location as the front line in the Pacific for the largest and most dynamic economy in the world similarly secure for its substantial federal funds and programs. In terms of the long-term challenges, it faces sea rising the highest cost of living in nation, including housing.

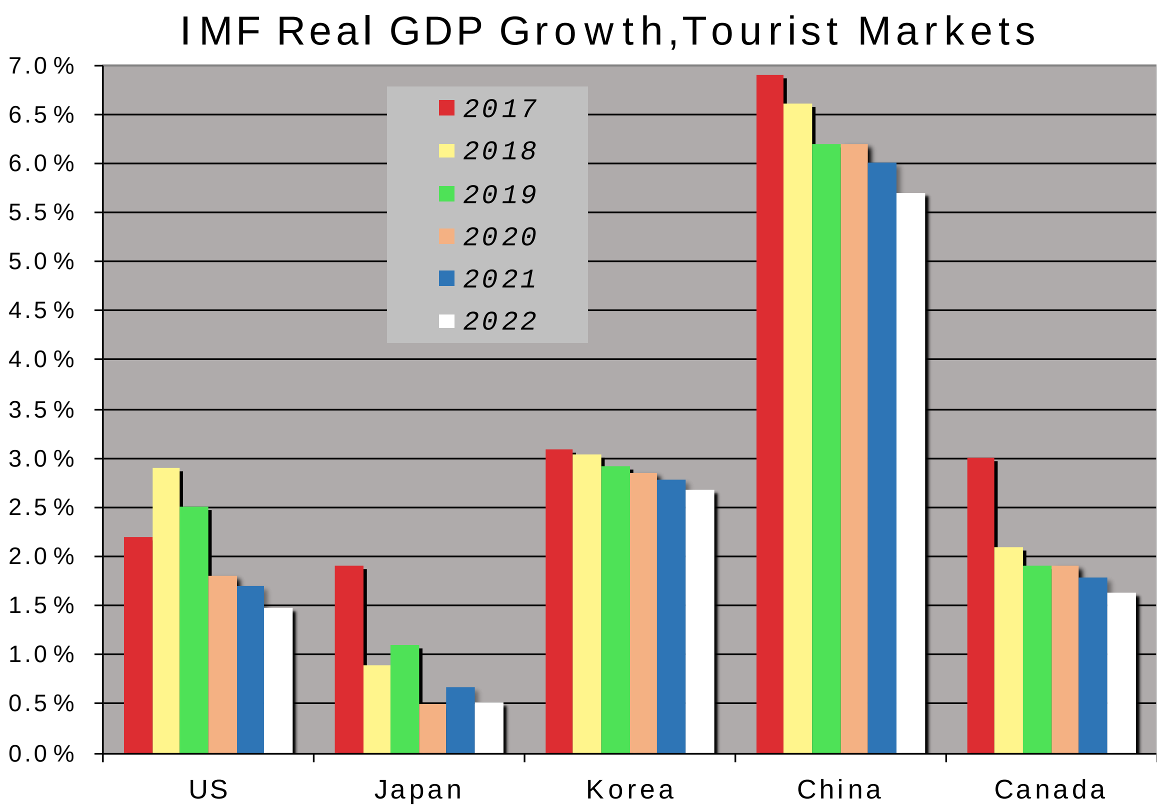
We start by looking at the economic outlook for the globe, the U.S. and the state, and end up describing Kauai's economy – and then it's residential market.

GLOBAL ECONOMY:

As Kauai's major industry is tourism, the major trading partners here would be the U.S., Canada and Asia on the international level; then California, and the west coast states, on the national level; and finally, on the state level. As such, we examine the economic health of these trading partners in order to get an understanding of their ability to trade (send visitors, home owners and capital funding) with Oahu, currently and for the future.

Thru 2018, the global economic upswing that began around mid-2016 has become broader and stronger. The latest IMF's latest World Economic Outlook (annually, January 2019) projects that advanced economies as a group will continue to expand above their potential growth rates for 2018, but not for 2019. *The global economy is projected to grow at 3.5 percent in 2019 and 3.6 percent in 2020, 0.2 and 0.1 percentage point below last October's projections. The* forecast reflects a persistent decline in the growth rate of advanced economies from above-trend levels—occurring more rapidly than previously anticipated—together with a temporary decline in the growth rate for emerging market and developing economies in 2019, reflecting the impact of trade actions on Asian economies.

Japan's economy is set to grow by 1.1%t in 2019 (0.2% higher than in the October WEO), reflecting additional fiscal support to the economy this year. Growth is projected to moderate to 0.5% in 2020 *China*'s economy will slow due to needed financial regulatory tightening and trade tensions. *India*'s economy should pick up in 2019, benefiting from lower oil prices and a slower monetary tightening, as inflation eases.



UNITED STATES

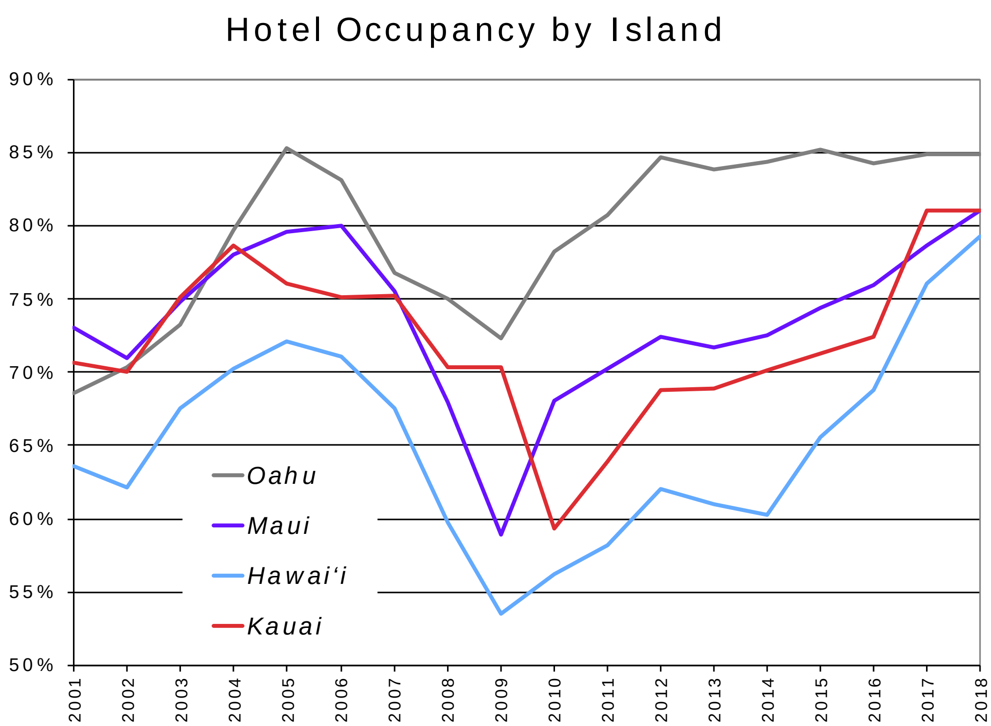
In the United States, the forecast remains unchanged. Growth should decline to 2.5% in 2019 and soften further to 1.8% in 2020 – based on the unwinding of fiscal stimulus and as the federal funds rate temporarily overshoots the neutral rate of interest, the IMF noted. This projected pace of expansion is above the US economy's estimated potential growth rate in both years, so acceleration of price inflation is possible. Strong domestic demand growth will support rising imports and contribute to a widening of the US current account deficit.

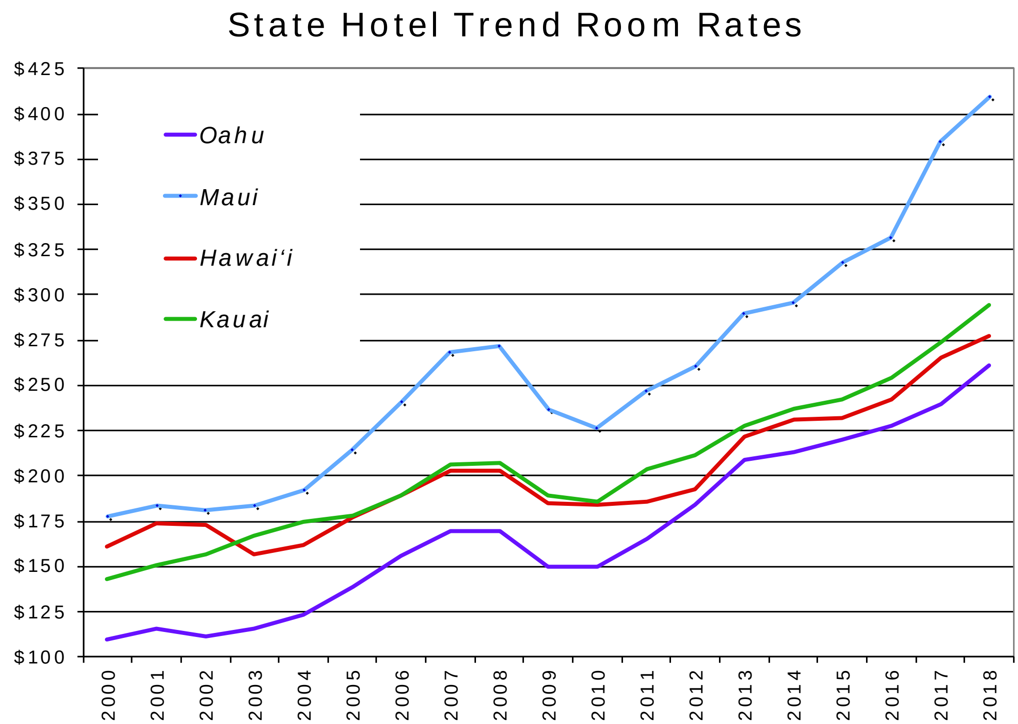
HAWAII

According to DBEDT, the state department for business, economic development and tourism which is the largest repository for economic data, visitor arrivals hit an all-time record for a half year during the first half of 2018 with 4.9 million visitors by airplanes. The corresponding nominal visitor expenditures increased 10.8% during the first half of 2018. Total number of air seats on scheduled flights to Hawaii, a leading indicator of the tourism industry, increased 10.2% during the first half of 2018 and is expected to increase by 6.2% during the rest of 2018.

For 2019, they said in November they expect visitor expenditures will grow at a lower rate than 2018, 8.9% this year vs. 4.2% and 3.6% the following two years. However, real GDP growth rate will trend higher, from 1.2% this year, to 1.4% in each of the next two.

Cyclically, we see rising room rates, daily expenditures, and occupancies, per the charts below.





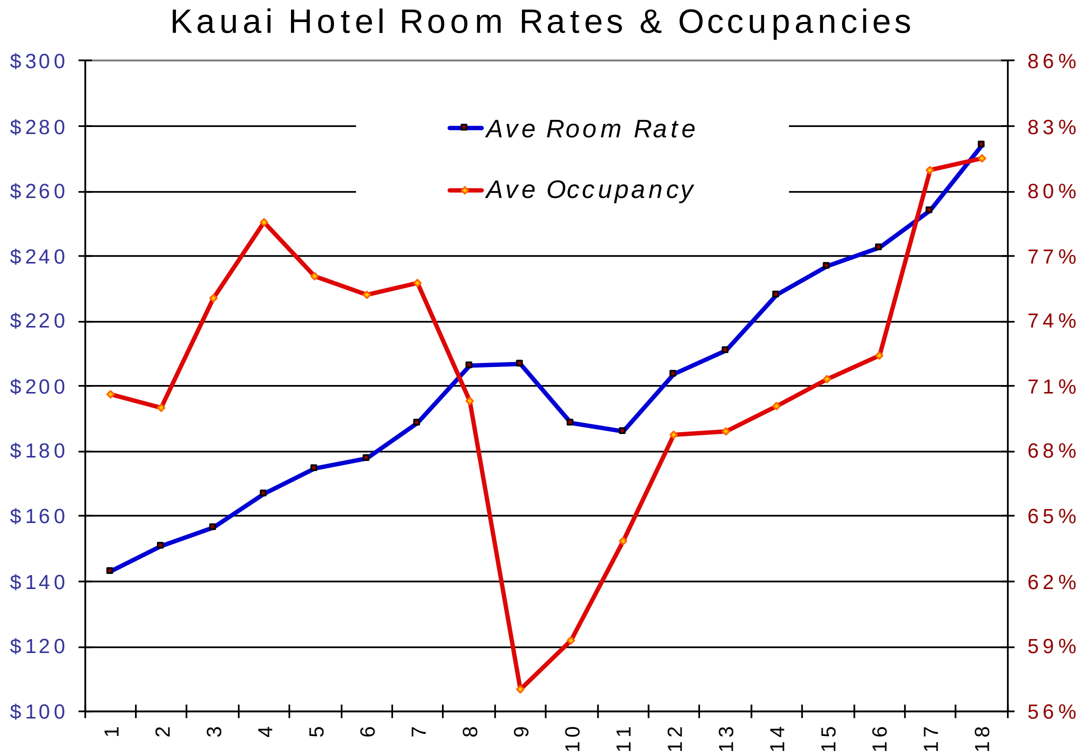
Further, construction and other services saw the value of private building permits had increased 3.9% during the first half year of 2018, and the value of government contracts awarded had increased 151%.

For 2018, Hawaii had an average unemployment rate of 2.1%, one of the very lowest in the nation and the lowest rate in Hawaii's history. For statewide employment, the number of people who are either employed for pay or self-employed, was at a record high level, and the number of people looking for jobs and available to work was at a historical low.

KAUAI

More than any other island, Kauai's economic health depends on tourism. Even some diversified agriculture businesses such as Kauai Coffee and Koloa Rum owe their success to tourism sales.

Kauai drew more than 1.37 million visitors last year, up 7.6% from the year before. Since the end of the great recession, visitor arrivals are up 47%, visitor days 60% and visitor expenditures 89%. it has more than 600 businesses involved in the leisure and hospitality sector.



Relative to the 2017, 2018 saw civilian employment increasing, the unemployment rate decreased, non-agricultural wage and salary jobs went up, and visitor arrivals by air expenditures increased, by over 7.5% - for the second year in a row.

Currently, job creation (as well as income generation, mainly wages) in the island economy is very strong. The table below shows that the rate of unemployment has been steadily falling since 2009-2010. This coincides with the rise in total visitor days and hotel room rates

SELECTED KAUAI ECONOMIC TRENDS

	Unemploymt Rate	Total Visitor Days	Non-Ag Job Counts	Private Bldg Permits ($000)
2005	2.8%	598,441	28,808	$24,011
2006	2.6%	635,811	29,642	$19,941
2007	2.7%	675,459	30,354	$22,410
2008	4.9%	605,576	29,838	$23,096
2009	9.8%	568,492	27,517	$18,176
2010	8.7%	594,028	27,658	$5,671
2011	8.7%	633,092	27,767	$4,960
2012	7.3%	680,711	28,208	$6,666
2013	5.7%	709,745	29,083	$7,118
2014	4.8%	718,361	29,533	$8,516
2015	4.0%	746,220	30,017	$8,809
2016	3.2%	757,696	30,617	$11,540
2017	2.4%	801,892	31,367	$12,106
2018	2.3%	848,084	31,708	$13,144
2019	2.9%	922,602	31,708	$16,286

One of the most significant trends in the visitor industry is the startling growth of home stay component, manifested by the internet platforms like Airbnb and the proliferation of high-end short-term rental agencies in Poipu and the North Shore. This growth is described in the following table:

GROWTH OF KAUAI HOME STAY INDUSTRY

1st Year	Unique Websites	Ave Asking Price/Night
2014	166	$263
2015	312	$316
2016	561	$353
2017	537	$339
2018	597	$367
Grand Total	2,173	$341

Kauai is also home to the Pacific Missile Range Facility which employs about 900 people. Its operating budget was $130 million three years ago, with additional spending of $2.5-$5 million for each of four to six testing events per year

The following table describes most of the kinds of commercial activity that is relevant to the economy, especially in termns of driving the jobs and incomes that then would geenerate the kind of housing demand this project is targeted: workforce housing.

SELECTED TRENDS CONCERNING THE TAX BASE OF THE COUNTY ($000s)

Year	Contracting Tax Base	Services Tax Base	Hotel Tax Base	Retailing Tax Base	Income Tax Base	TAT Revenues	GET Reveneues
1995	126,711	132,568	54,448	348,421	9,304	12,124,017	36,200
2000	118,323	141,367	68,910	491,353	22,738	11,391,418	43,865
2005	225,866	261,026	167,004	605,123	38,910	13,471,496	67,020
2006	299,814	296,309	178,189	597,588	39,483	14,326,901	67,624
2007	320,384	315,308	195,888	635,827	40,250	15,105,941	75,098
2008	342,510	316,452	176,463	565,107	37,467	14,558,961	69,723
2009	266,025	322,993	136,837	489,522	19,536	13,193,172	62,907
2010	214,719	328,234	122,595	489,652	20,068	13,500,125	60,950
2011	210,319	364,440	137,513	559,215	22,548	15,875,135	63,411
2012	220,069	383,416	162,195	528,188	29,441	14,403,663	64,930
2013	219,116	370,768	172,706	534,983	31,970	11,506,409	63,174
2014	204,228	389,897	183,810	543,737	31,591	14,210,000	71,397
2015	224,368	415,275	210,283	558,096	43,692	14,935,000	65,941
2016	248,740	421,496	180,440	527,412	48,743	14,935,000	81,321
2017	254,826	505,889	229,124	611,765	58,635	14,935,000	84,836

As seen, last three years that we have data for 2015, 2016 and 2017,

Per contracting, the tax base for these businesses has grown substantially from 1995 – it is doubled. Next the tax base for services has also grown: it is up 280% since 1995, and of 20% last year that we have data, 2017.

Most importantly, the hotel tax base has grown by over three times, 321%, since 1995. It was up 16% in 2017. Note that this is the engine that drives the economy. The effects of this can be seen in the income tax base. It is up over 5 times since 1995, and up 20% in 2017.

Next, we look at the trends in terms of the dollar amount of sales in the relevant commercial activities.

SELECTED COMMERCIAL ACTIVITY SALES TRENDS ($000s)

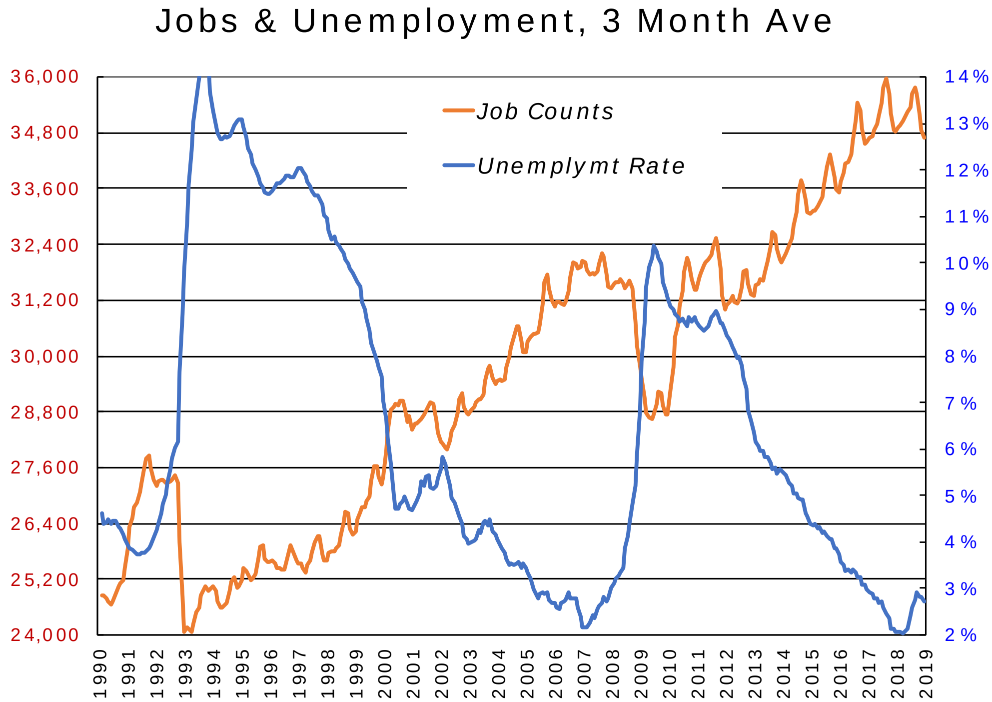
	Retail Sales	Wholesale	Contracting	Production	Manufacturing	Industrial Revenue
1997	$246.07	$97.87	$67.28	$6.58	$2.55	$174.28
2007	$635.83	$188.58	$320.38	$9.37	$7.20	$525.53
2008	$563.11	$166.19	$342.51	$13.15	$5.32	$527.17
2009	$489.52	$140.84	$266.02	$9.36	$4.38	$420.60
2010	$489.63	$148.85	$214.72	$8.08	$4.20	$375.86
2011	$539.22	$174.59	$210.32	$11.40	$4.14	$400.44
2012	$528.19	$141.97	$220.07	$6.94	$4.55	$373.53
2013	$534.98	$126.16	$219.12	$6.18	$4.95	$356.41
2014	$543.74	$145.59	$204.23	$6.12	$5.73	$361.66
2015	$558.10	$117.46	$224.37	$8.40	$6.09	$356.32
2016	$527.41	$109.13	$248.74	$16.25	$4.96	$379.09
2017	$601.77	$145.59	$273.11	$22.25	$7.00	$447.95

The data shows that there have been significant increases in commercial activity relative to the potential demand for this general commercial space.

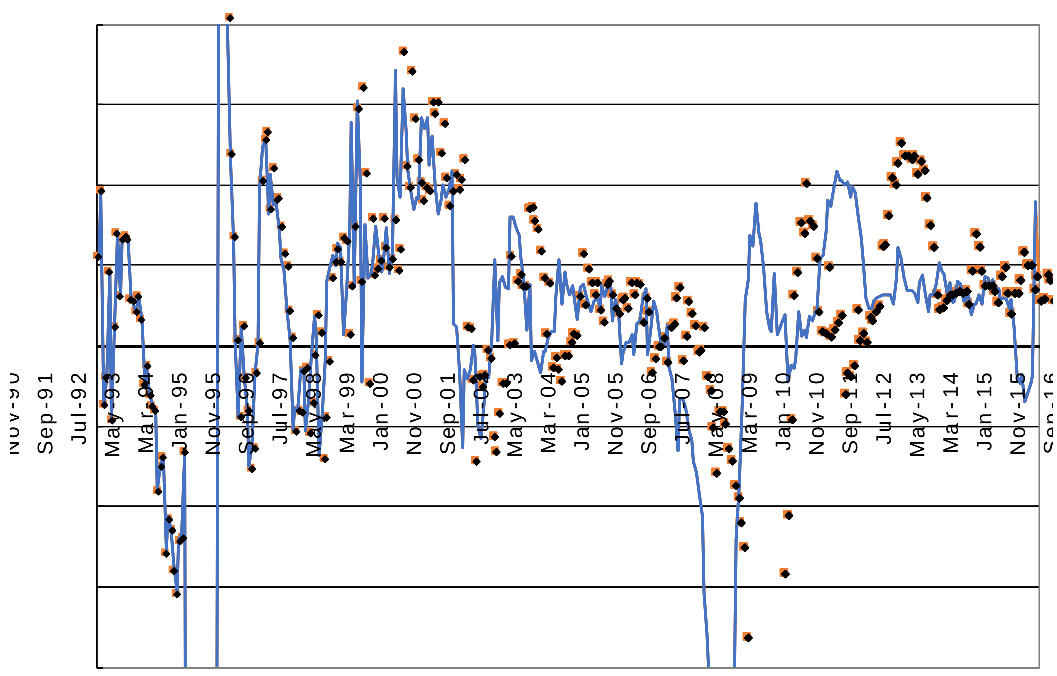
For instance, retail sales have risen 145% since 1997, or 20 years. In the last year that there is data for, 2017, these sales rose 14% over the year before. Wholesale activity has increased 49% in the last 20 years, and rose 33%, 2017 to 2016. Contracting activity is up three times what it was 20 years ago and has increased over 10% in each of the last three years. Production activity up well over 230% in the last 20 years and has risen hundred and 75% since the bottom of the market in 2010. Likewise, manufacturing is up 174% over the last 20 years and 67% since the bottom of the market.

All told, industrial business revenue is up over 150% since 1997, and is almost 20% higher measured by the bottom of the market.

The best sign of strong economic growth is the latest unemployment figures. As mentioned, the state had the nation’s lowest unemployment rate, with Kauai in the same situation. This job growth has contributed to the strong housing demand of late, as manifested by rising rents, housing prices and homelessness.



In addition, job growth has increased faster than the working force, as seen in the chart below, with the blue line sitting high above zero.

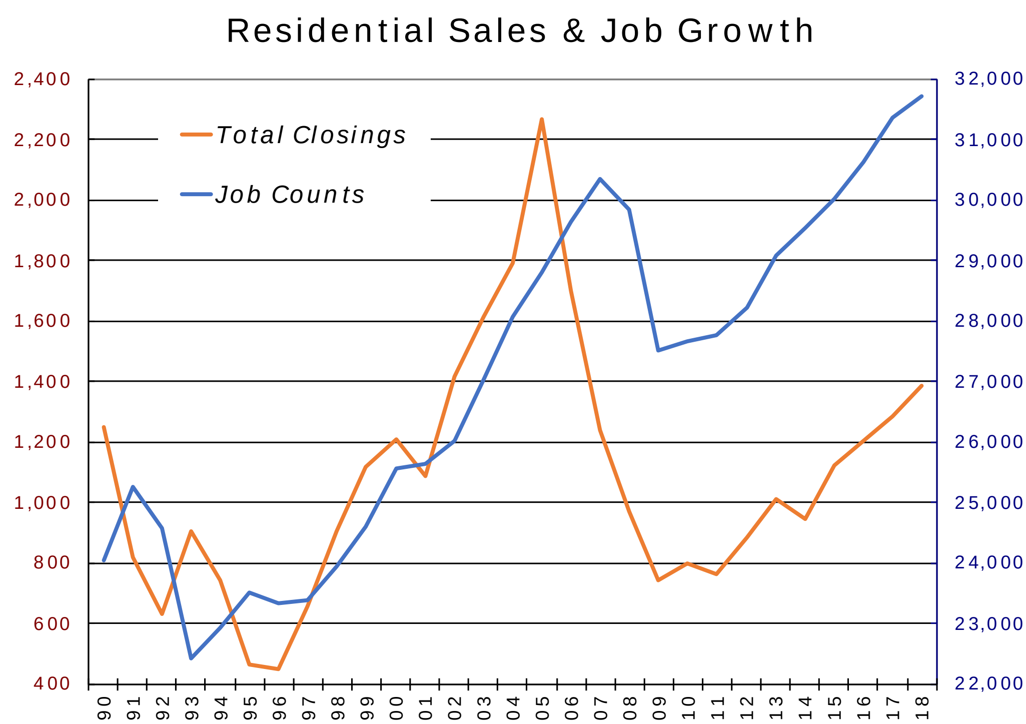


This means more jobs (demanded by the economy) than there are workers (supplied by the population). This says that local workers looking for jobs have a wider choice, and that leads to either higher wages, better satisfaction and job seekers who could immigrate to the county.

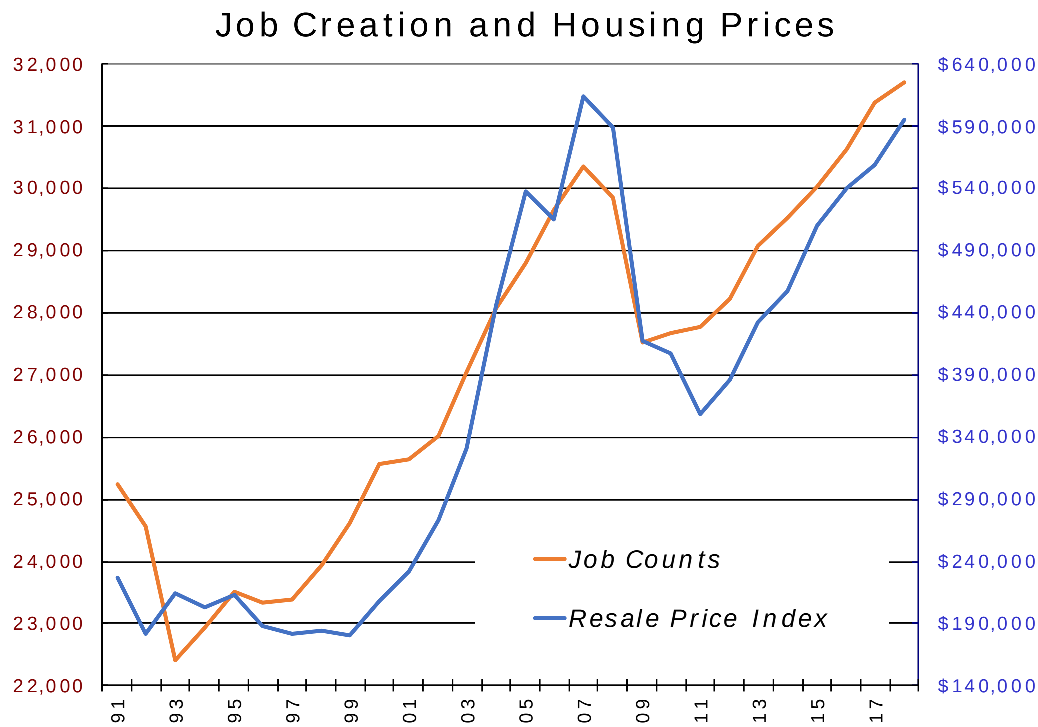
Such growth in economic activity has led to growing demand for housing, both for-sale and for-rent units. In addition, this growth exerts pressure on for-sale prices and for-rent rental rates. This makes it more difficult for households with fixed or low-incomes to secure affordable shelter. There are other factors which serve to increase housing demand overall, including vacationers and military households.

Will the economic cycle continue to support the residential real estate cycle, and for how long?

The following chart indicates the relationship between job counts and residential sales. It appears that the job count cycle (blue line) follows the residential sales cycle. Right now, the residential sales trend looks like it is in the middle stages of the cycle.



Similar to jobs pushing up sales, new job creation also impacts housing prices, both for-sale and rental shelter. Note that job counts are a leading indicator of housing prices.



V. THE HOUSING MARKET BACKGROUND:

Overview: Much like the state, Kauai's residential real estate supply is inflexible and constrained, but to a greater degree – the cost constraints are even tighter (higher costs of transporting material inputs to a remote locale, plus of sourcing labor in a small community), and the political climate there is generally unfavorable to housing development, particularly at the high end and/or in areas that are highly visible (but decidedly less so, relative to affordable and senior housing, as well as work force housing, which this project is proposing).

At the same time, demand for residential real estate is both flexible and strong, particularly in good economic times and over the long run. It can be, and is currently, constrained to an uncharacteristic degree, thanks to havoc in the financial markets the last few years and the drastic fall off in economic activity globally and nationally.

The first condition, limited supply, arises due to Kauai having a very small landmass, coupled with inadequate infrastructure and challenging geographic conditions (atop the aforementioned political, social and legal impediments).

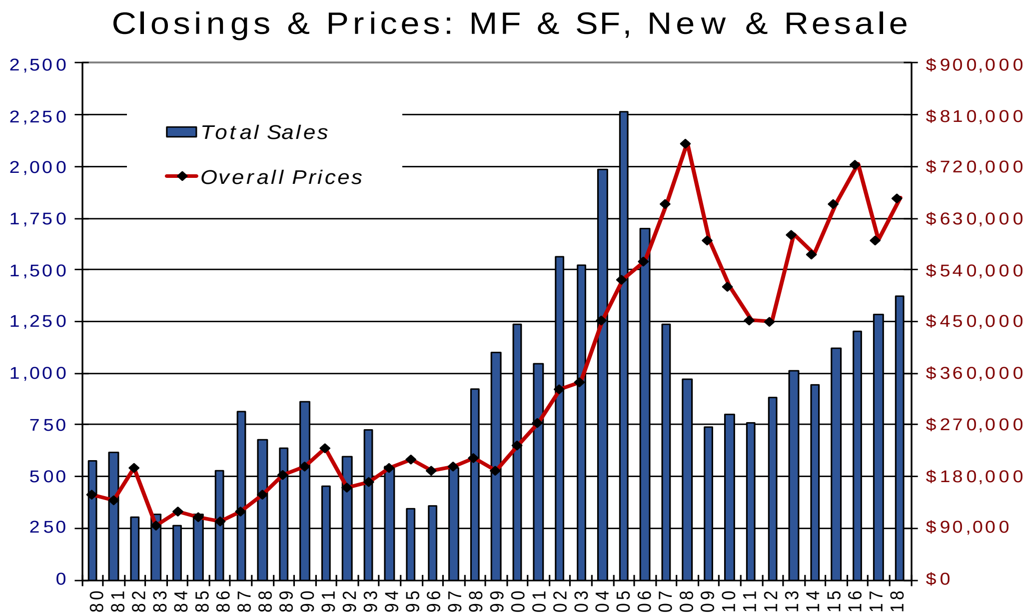
The second starts with the very high quality (defined a high quality of life, in terms of being a place that is environmentally safe, aesthetically pleasing, socially accommodating, politically stable, etc.). This is coupled by a deep and broad appreciation of that lifestyle by very large population accustomed to visiting the island (mainly West Coast and East Asia), which has one of the highest rankings in brand awareness and acceptance.

In combination, this results in a market that can dramatically volatile, up and down, in terms of sales and, to a lesser extent, prices. We note that in the past cycles, prices have been relatively 'sticky' downward, i.e., generally holding on to accumulated values. In this cycle, however, the price appreciation was so extensive and lasted so long, that the ensuing price depreciation during the down cycle has also been extensive.

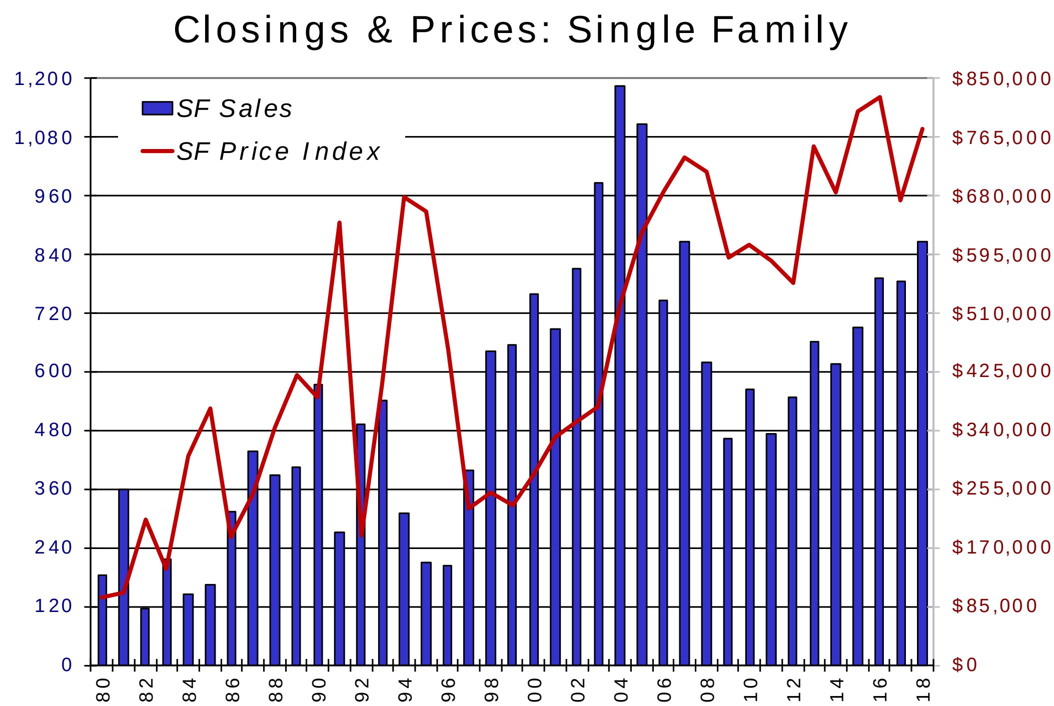
That said, Kauai was hard hit in 1982 and 1992 by hurricanes that caused significant damage to the housing stock. As a result, in the years thereafter, there was a mini-building boom.

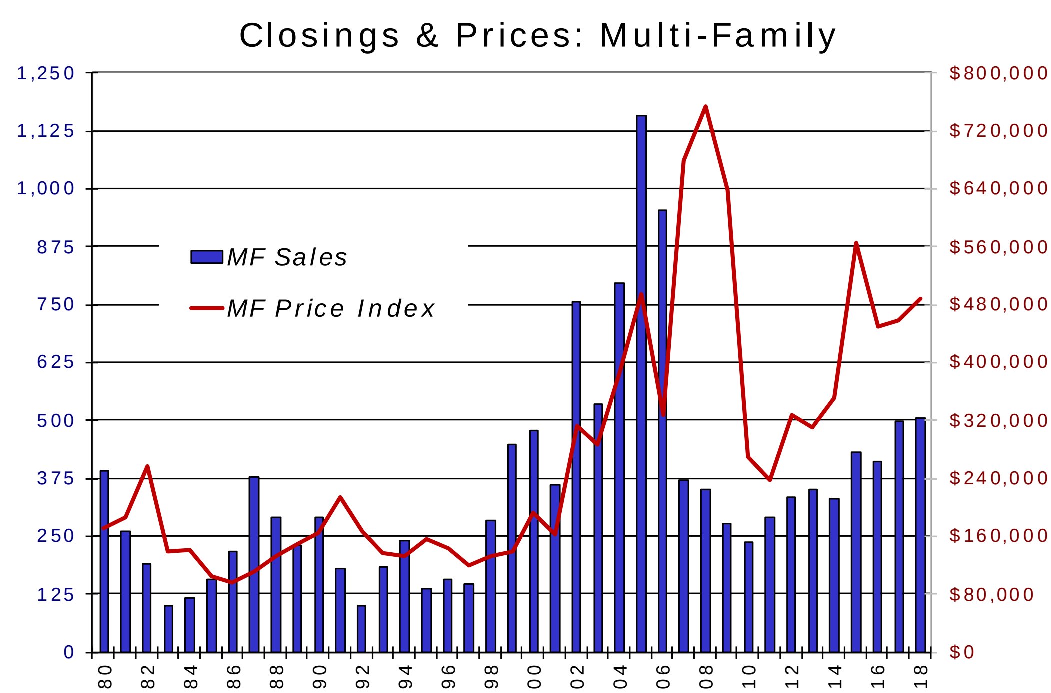
CURRENT MARKET CONDITIONS: The residential market is well into the upward swing of the housing cycle in terms of sales activity and price levels (data source is the MLS of the Kauai Board of Realtors and the Bureau of Conveyances of the State). The last such swing started in 1998 and ended in 2005, ran for some 7-8 years and then had 4-5 years of falling sales and prices. It turned in 2011-2012, with a reversal of the trend for lower sales and prices, as demand grew at a time of shrinking inventory. Going forward, we foresee that this cycle's sales and price levels will run for the next fewl years and will likely exceed the peaks of the last cycle.

The following chart shows the sales and price activity for the combined market.

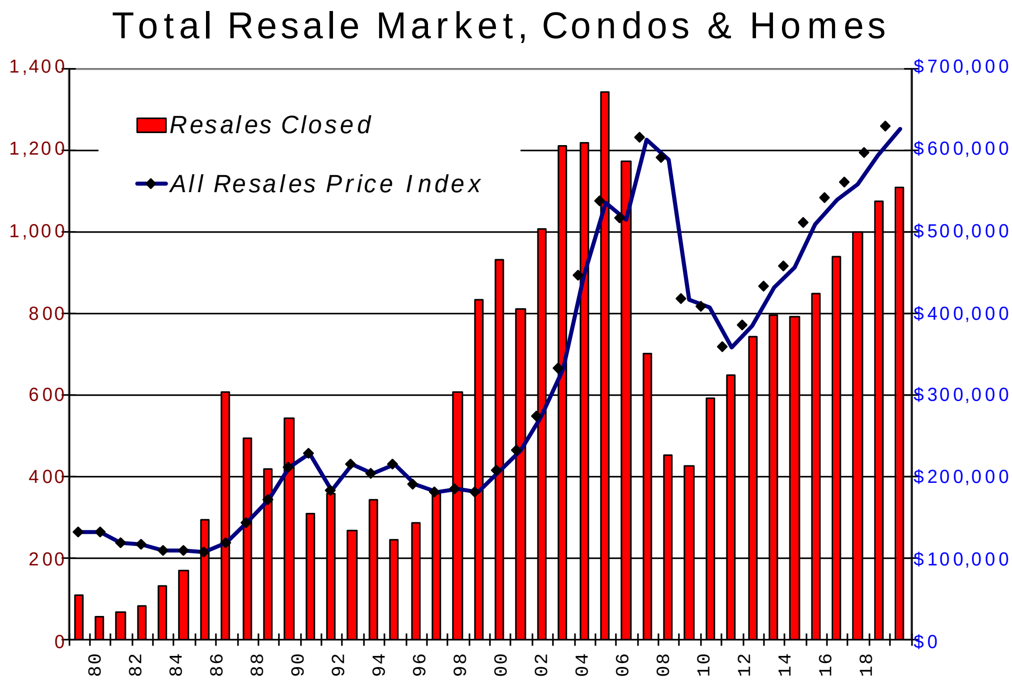


Currently, Kauai's residential markets are in an up-cycle. The question is, going forward, how long this will last. The rule of thumb for the residential market is that the upswing in the cycle, the up cycle, generally lasts about 6.5 years, and is about twice as long as the down cycles. In addition, the up cycle, through to peak, results a tripling of the number of closings.

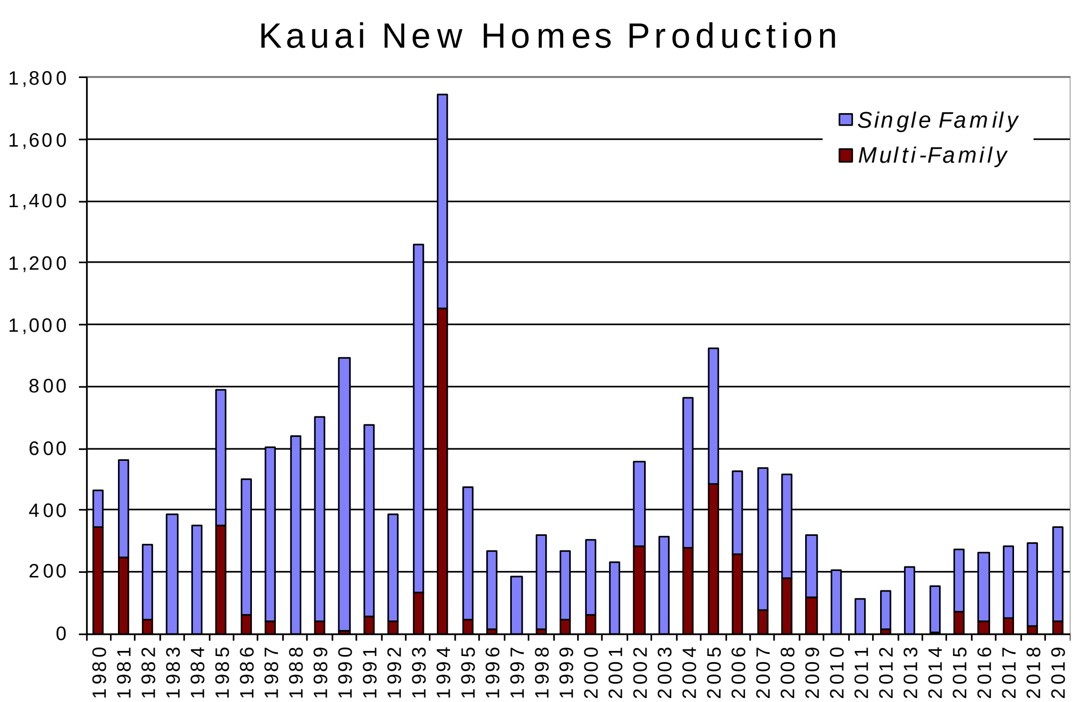




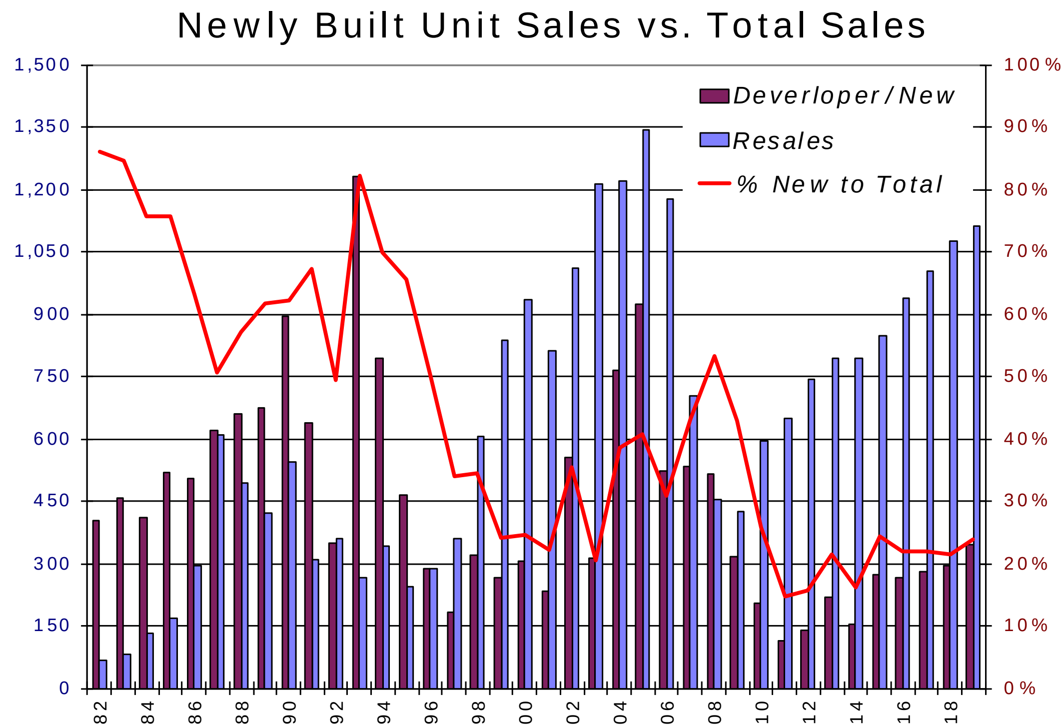
he resale makret is the best indicator of local – as opposed to offshore – demand and supply. It shows rising sales and prices, meaning that the local residents are buying more and more units at higher and higher prices. There is no better indicator of a strong economy. And, the antidote for high prices would be more supply. Historically



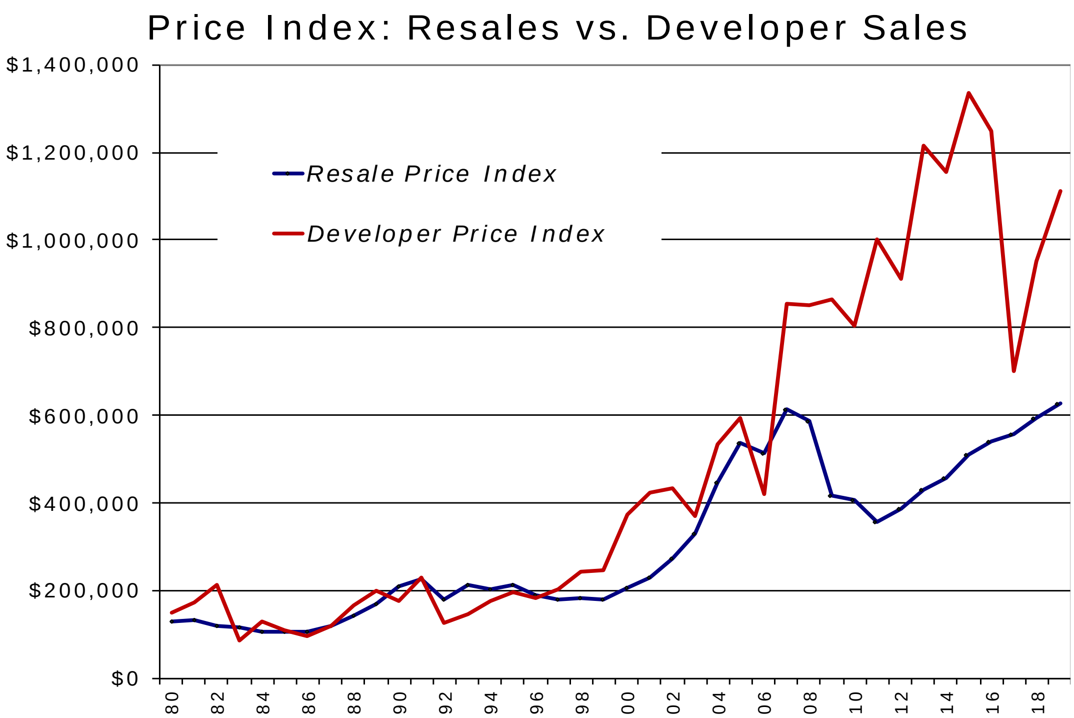
Historically, Kauai has produced a high number of new homes, but this is tied mainly to the rebuilding that occurred after the two major hurricane events. As seen in the next chart, the level of new housing production hit a historic low 7 years ago, and has not moved up much since. This is a condition of scarcity and it leads to price movement to the upside.



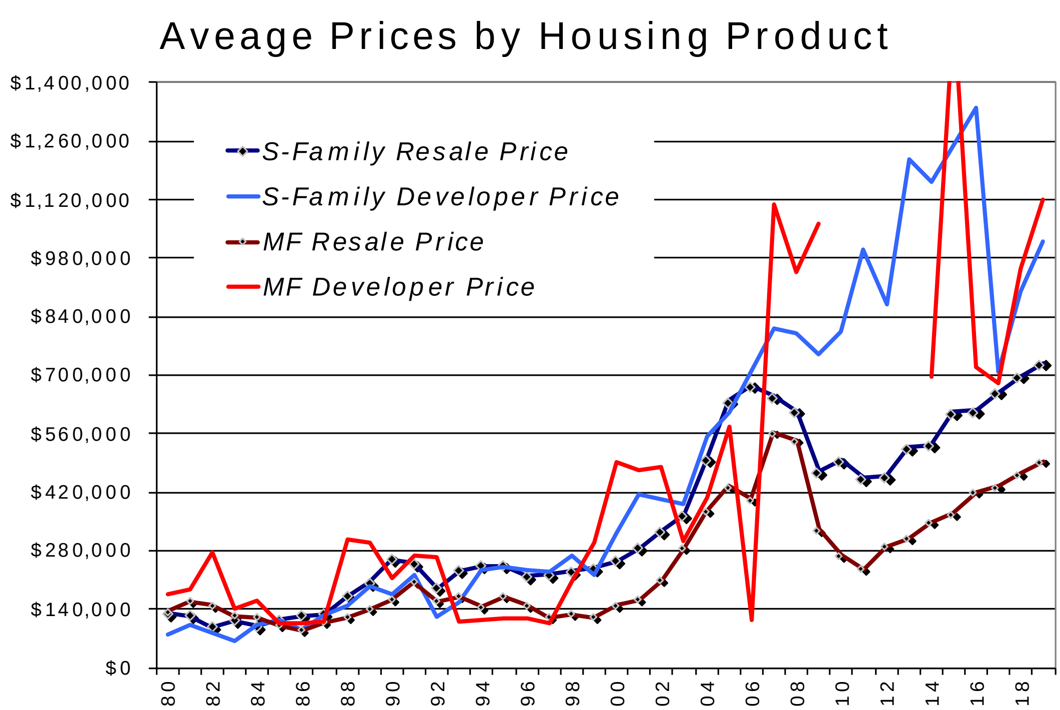
The following chart combines both new and resale unit closings, and then shows the percentage of new sales to total sales (red line). A low percentage indicates low production of new homes, and indicates that there will be price increases going forward.



The chart below shows that the average prices of the production of new housing are much higher than the resale market's prices. This indicates that most of this production is targeted on the high-end buyer and/or the offshore market. This leaves local residents exposed to price rises from lack of supply of middle market housing production.

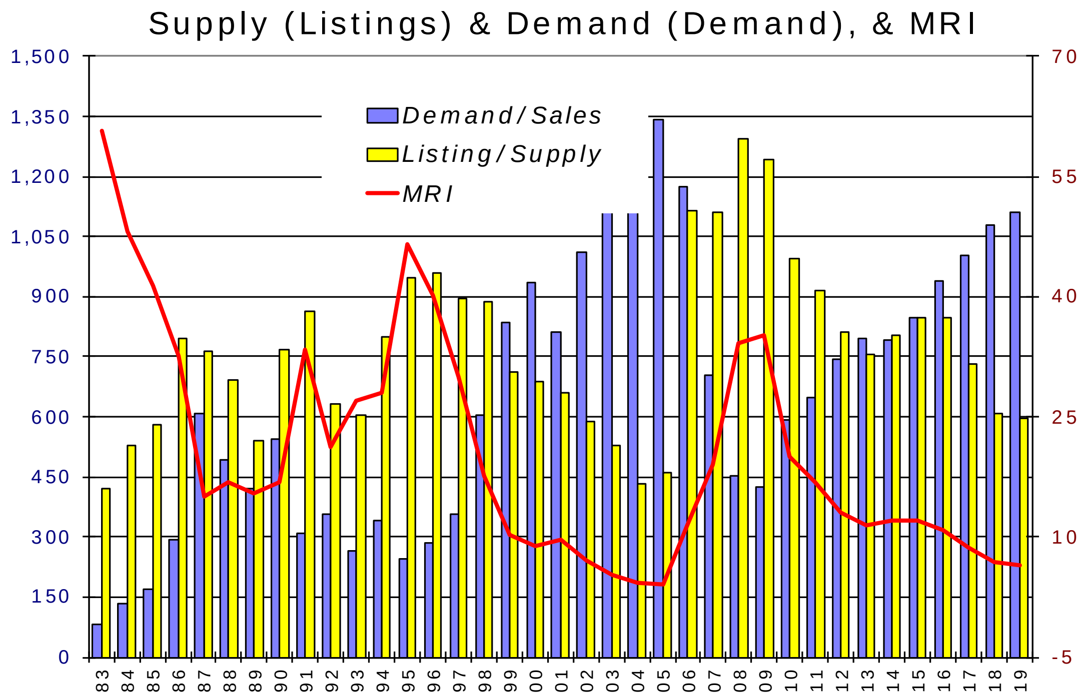


The following chart shows the price trend over the last 32 years for the four basic housing products: single-family resales and developer (newly constructed) sales, plus condominium resales and developer sales.

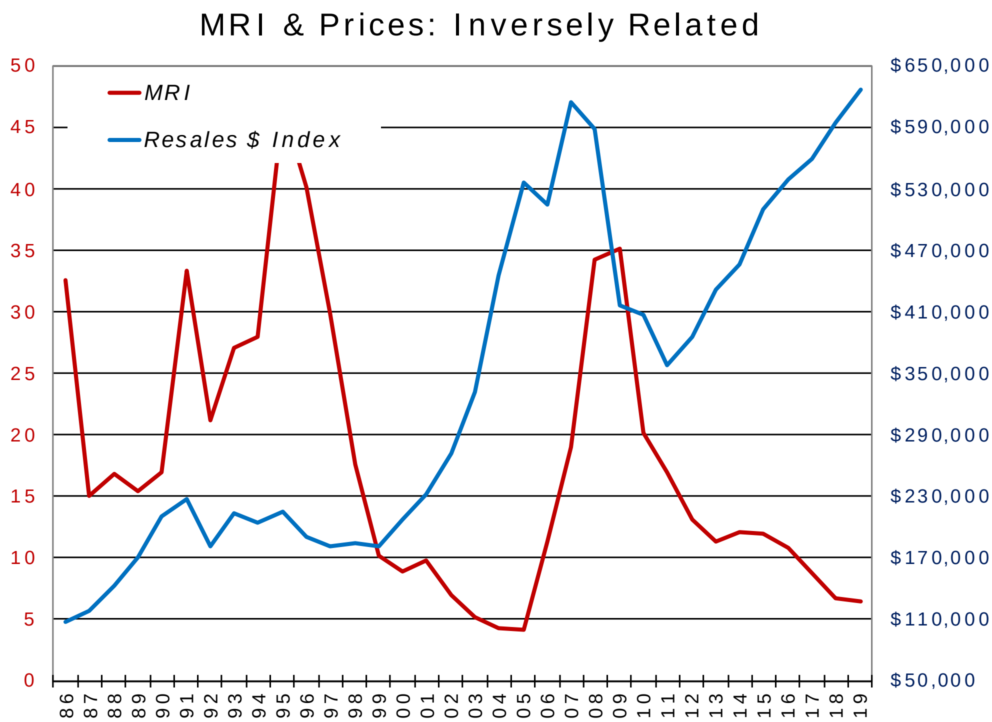


Next, we describe the balance between supply and the demand using sales and listings island-wide for all housing, as well as the indicator showing the balance between the two, MRI or Months of Remaining Inventory.

Right now, the MRI trend is declining, per the growth of sales and shrinkage of listings, indicative of a tight market. A normal reading is between 8 and 12 months, with the two balanced. In this case, the proper market response to tight supply is for sellers to raise their prices.



The chart below is another indicator that supply and demand are not well balanced – with the result being that prices will be pressured to move higher.



Higher for-sale housing prices usually encourage developers to built, and this is happening to a small extent. As will be seen, thefre is a substantial demand that has gone unmet. This is been felt especially in the rental market, as higher housing prices paid by investors for rental units translate into higher rental rates to consumers, as the investor needs a higher cash flow.

The next table illustrates how sale and rent prices are trending using MLS data for the resale prices and HUD Fair Market Rent data for the rental data. As illustrated, the table illustrates that the prices paid for for-sale two-bedroom units serves as a leading indicator for rental prices for two-bedroom rental units.

AVERAGE TWO BEDROOM SALES PRICES VS RENTAL RATES, KAUAI

	Selling Prices	Rental Rates
2006	$709,528	$1,096
2007	$587,828	$1,134
2008	$743,277	$1,183
2009	$426,092	$1,318
2010	$375,115	$1,399
2011	$363,786	$1,454
2012	$422,562	$1,413
2013	$426,340	$1,685
2014	$415,732	$1,597
2015	$460,289	$1,222
2016	$468,393	$1,238
2017	$498,973	$1,463
2018	$534,899	$1,568

VI. HOUSING DEMAND

OVERVIEW OF DEMAND: Hawaii has one of the lowest percentage ownership housing markets in the nation and is among one of the least affordable. Such can be attributed to the limited supply of land, very high costs of production and very strong housing demand, resulting in low housing production and high prices. The problem is exacerbated by the fact that housing prices have exceeded household incomes for over 25 years.

Given high demand and low supply, the large numbers of low- to moderate-income households currently have very few options for housing. For instance, in 2017, Hawaii ranked #1 in the nation for having the widest gap between wages and the price of rental housing by The National Low-Income Housing Coalition's annual report, Out of Reach.

Historically, housing demand on the island has been quite high. Numerous factors affect the demand for housing, the primary being population, household formations and job creation. In the short run, job creation is the most important, as it leads to in-migration (meaning population growth and household formation).

HOUSING DEMAND DEFINED: There are two components to residential housing demand:

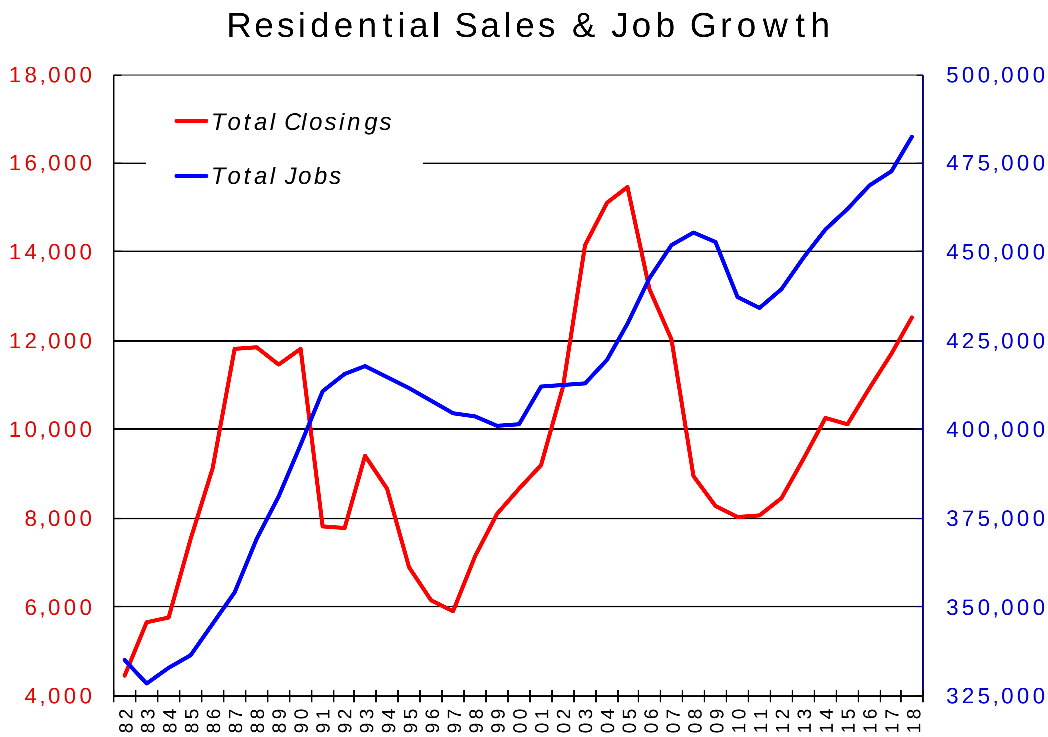
1. Local residential housing demand (primary housing)
2. Offshore demand (secondary housing, or second homes)

Local demand for primary housing is a function of household formation, itself a function of the economy's growth and the community's demographic trends. In the short term, defined as over the next two to three years, residential housing demand is driven by current economic conditions. Specifically, this is the creation of jobs, as that allows households the security to borrow money to buy a house. Alternatively, housing demand is fed by the increase or growth of household incomes.

In the medium and the long term (also in the short term, but less so) housing demand is driven by population growth, which includes in-migration, births and deaths. It also encompasses demographic trends and changes in lifestyle or living attitudes. In both cases, rising economic activity and faster population growth means greater housing demand, which brings with it higher land and housing values.

The demographic section will show that the community is aging. Thus, there is going to be a greater need for senior housing. But also, as seen, housing for the 35-44-year-old group. Note that this is a group that traditionally needs affordable housing, particularly the type that this development will be supplying.

JOB CREATION & HOUSING DEMAND: Second to none, housing demand is driven by the creation of jobs – jobs provide the incomes to buy homes, and they drive immigration, which is a prime source of housing demand (sometimes linked to population growth). This linkage is best illustrated in the Residential Sales & Job Growth Chart.



In the tables below, we describe DBEDT's predictions for wage and salary job creation on Kauai. Using that, we can derive from that a general expectation for housing demand based on job growth, out to 2030.

DBEDT'S 2030 JOB FORECAST FOR KAUAI COUNTY, WAGE & SALARY JOBS

	2016	2020	2025	2030
Total civilian wage and salary jobs	44,430	46,430	48,860	51,300
Military DOD Jobs	900	950	1,050	1,150
Self-Employed Jobs	0	118	247	387
Total Jobs	45,330	47,498	50,157	52,837
5 Year Growth		2,168	2,658	2,681
Annual Job Growth		542	665	670
Annual Housing Demand (2 Jobs: 1 Home)		271	332	335

As seen, we use the annual changes in job counts to derive housing demand on the conservative premise that it will take 2 new jobs to generate demand for one new house (the national standerd is 1.5, but Kauai and the state have a higher cost of living, so it takes a larger factor to accomodatge that) (note that with the lower the salaries, the smaller or cheaper the house needs to be).

Note that the average production of new housing on Kauai over the last 17 years has been 185 dwellings per year, as seen in next table, POPULATION GROWTH TO HOUSING DEMAND (and 135 homes p.a. since 2007). If this both the described trends continue, then only 68% of the new job growth will find housing in 2020, falling to 56% in 2025.

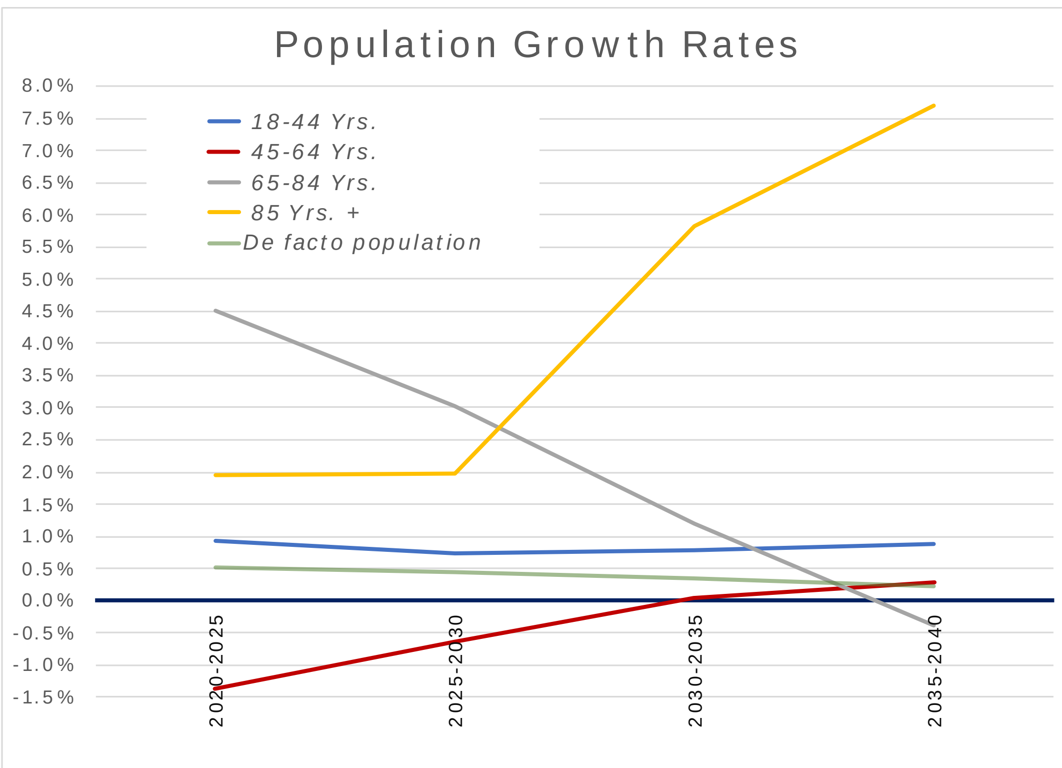
These new homes production number is over 30% underneath the housing demand that future potential job growth will be generating, or an undersupply. This will put pressure on prices, both for-sale and rental housing, pushing them upwards.

POPULATION-BASED HOUSING DEMAND: Here, we look backwards and forwards at the potential housing needs in the county. Looking backwards is useful in terms of understanding the history of housing production (supply) and the market's ability to meet housing needs (demand). And, by the same token, it is useful to carry that understanding forward by projecting into the future.

The following tables show population growth per annum, starting in 2000 and ending in 2020, using the population data we have up to 2017, and then the DBEDT projection ffor population data for 2020.

DBEDT'S 2030 POPULATION FORECAST FOR KAUAI COUNTY, WAGE & SALARY JOBS

	2016	2020	2025	2030
Population: 0 to 4 years	4,572	4,573	4,773	4,947
School age children: 5 to 11 years	6,417	6,659	6,656	6,908
School age children: 12 to 13 years	1,778	1,843	1,945	1,895
School age children: 14 to 17 years	3,198	3,448	3,728	3,770
Population: 18 to 44 years	22,767	23,632	24,522	25,495
Population: 45 to 64 years	19,863	18,788	18,195	18,242
Population: 65 to 84 years	11,488	13,703	15,911	16,888
Population: 85 years and over	1,945	2,101	2,317	3,073
De facto population	72,029	74,747	78,045	81,218



The population change per annum is changed into a household change per annum by factoring it by the average number of people in a household, as determined by the US Census. This then is how much the need for new households in the market will be, - and that equates to housing need.

Housing need is then compared to the number of homes produced (and available to them) that that year. If there were more homes produced than households were formed (an assumption), then there would be a surplus of supply (homes) over demand (population growth), and vice versa.

A note here: the number of homes shown as produced are actual new homes created, as defined in the tax assessor's data base as 'Year Built.' However, we also excluded homes built on resort zoned land, or as residential investor, as well as government owned homes.

Included were new homes assessed at over $2 million, although an argument can be made that these units were not available to those at the lower income levels. These higher value new homes are produced for households making a higher incomes, as they are a more profitable and less risky market segment.

Remember that, when the entire stock of housing of condominiums and single-family homes in the county was considered, 90% of condominiums and 44% single-family homes were not owner-occupants.

Given that, we determined housing production using the TMK data. This was compared to households created (which can be called Housing Need), again using US Census population estimates. Then, the difference between supply and demand was calculated per annum, "Need vs. Production." Finally, the table takes this surplus or deficit of housing need, and then calculates it overtime, cumulatively (Cumulative Need).

POPULATION GROWTH TO HOUSING NEED, 2001 to 2020

	Population	Annual Change	Persons Per Household	Households Created	Housing Production	Need vs. Production	Cumulative Need
2000	58,568		2.95		148		
2001	59,075	507	2.95	172	153	(19)	(19)
2002	59,981	906	2.95	307	263	(44)	(63)
2003	60,805	824	2.95	279	213	(66)	(129)
2004	62,095	1,290	2.95	437	320	(117)	(247)
2005	62,863	768	2.95	260	429	169	(78)
2006	63,465	602	2.95	204	288	84	6
2007	64,490	1,025	2.95	347	313	(34)	(28)
2008	65,603	1,113	2.95	377	175	(202)	(231)
2009	66,518	915	2.95	310	134	(176)	(407)
2010	67,199	681	2.95	231	118	(113)	(520)
2011	67,832	633	2.95	215	65	(150)	(669)
2012	68,573	741	2.95	251	62	(189)	(859)
2013	69,626	1,053	2.95	357	128	(229)	(1,087)
2014	70,523	897	2.95	304	86	(218)	(1,306)
2015	71,387	864	2.95	293	109	(184)	(1,489)
2016	71,769	382	2.95	129	144	15	(1,475)
2017	72,159	390	2.94	133	173	40	(1,435)
2018	72,749	590	2.94	201	204	3	(1,431)
2019	73,339	590	2.94	201	204	3	(1,428)
2020	74,747	1,408	2.94	479	204	(275)	(1,703)

Note that the population numbers are actual DBEDT numbers. The housing production numbers are actual numbers from the county tax assessor's data base, current up to 2017. The 2018 numbers are forecasts. The housing production number is generous, at 10% over the established benchmarket 2000-2017 of 185 dwelling units (it is 50% higher over the number since 2007).

As seen, there is a large number of dwellings in the cumulative Need column, indicating the size of unmet (or pent-up) demand. This is consistent with the earlier mentioned indicators of housing supplgy and demand.

VIII. SUPPLY OF HOUSING

OVERVIEW OF SUPPLY: Relative to demand, housing supply on the island is low. The best solution to combat the growing demand is to increase the supply of housing for this segment of the population. Unfortunately, Kauai's housing development process is uncertain, time consuming and expensive, the future supply of units is low. Factors that contribute to such short supply include the scarcity of land as well as the arduous process of zoning for housing under the laws governing land use. Furthermore, construction is costly, labor is tight, and the costs of inputs are high due to the long supply chain.

As such, the combination of inelastic supply and elastic demand lends to this market's extreme volatility: over the swing between the bottom and the top of the market, sales can more than triple and prices can more than double. Furthermore, the length of the cycle is usually 5 to 8 years, depending often on external conditions: the direction of interest rates, economic growth in the visitor and offshore buyer markets and the costs of materials.

The table below describes housing production on Kauai by year built, the average assessed tax value and the size of the interior swquare footage (and lot ofor single famo8y).

MULTI-FAMILY HOUSING PRODUCTION & CHARACTERISTICS

Year Built	Unit Counts	Ave Assessed $	Ave Interior sf
<1955	427	$66,555	756
1955-1959	1	$306,200	1,080
1960-1964	1	$2,344,400	2,538
1965-1969	184	$377,869	693
1970-1974	1,158	$395,993	717
1975-1979	1,678	$447,780	972
1980-1984	1,194	$412,223	1,095
1985-1989	487	$271,924	608
1990-1994	1,291	$483,179	822
1995-1999	116	$400,974	936
2000-2004	618	$674,404	1,201
2005-2009	1,115	$619,723	1,386
2010-2014	15	$1,207,280	1,504
2015-2019	181	$951,572	1,536

SINGLE FAMILY HOUSING PRODUCTION & CHARACTERISTICS

Year Built	Unit Counts	Ave Assessed $	Ave Interior sf	Ave Land (Lot) sf
<1955	2,621	$574,878	1,225	312,061
1955-1959	638	$498,996	1,209	21,614
1960-1964	534	$559,259	1,236	33,297
1965-1969	850	$554,691	1,354	33,744
1970-1974	1,748	$573,103	1,428	132,249
1975-1979	2,154	$616,918	1,521	77,030
1980-1984	1,662	$659,287	1,531	47,633
1985-1989	2,743	$687,739	1,598	41,165
1990-1994	3,656	$678,296	1,540	30,717
1995-1999	1,395	$947,698	1,701	58,449
2000-2004	1,547	$1,061,310	1,907	57,684
2005-2009	1,698	$1,068,633	1,922	88,611
2010-2014	811	$1,152,186	1,776	93,066
2015-2019	668	$1,088,424	1,209	81,571

As seen, the values and sizes of many condomimiums and some single family homes generally indicate a high income owner. Indeed, this is true of othr counties in the state, as well. It indicates that a good share of housing production went to satisfy the demand for second homes on the part of offshore buyers. Indeed, in the years after the establishment of the resorts (which ended roughly in the 1980s), there was a boom in condominium production, but many of these projects that were developed targeted the offshore buyer market.

TMK records show that over 90% of the condo units and 40% of the single-family homes are owned by non Owner-Occupants.

HOUSING OWNERSHIP CHARACTERISTICS

	MF	SF	TOTAL
Owner-Occupant	10%	56%	44%
Non (investor)	90%	44%	56%

As a result, the average prices for housing units are skewed upwards and do not necessarily reflect residents' ability to pay for housing.

A major effect of low homeownership and, low housing production is high housing costs. As a result, many low-ncome and workforce families re-rent part of their shelter to friends or families. The US Census measures evidence of this, and they define crowding as 2 or more persons per bedroom. US Census measures also doubling up via surveys and define that as 'more than one family group' in a household. In the last Housing Planning Study, such a survey was performed and the results from Kauai are shown below.

KAUAI HOUSEHOLDS DOUBLING UP, BY AREA

	Waimea-Kekaha	Hanapepe–'Ele'ele	Kōloa-Kalāheo	Līhu'e	East Kaua'i	North Shore-
Yes	254	558	152	488	975	254
No	2,662	2,244	2,181	4,443	6,525	2,634

KAUAI HOUSEHOLDS CROWDING, BY AREA

Ppl/Bedroom	Waimea-Kekaha	Hanapēpē–‘Ele‘ele	Kōloa-Kalāheo	Līhu‘e	East Kaua‘i	North Shore-
Less than 2	2,726	2,676	2,237	4,492	6,653	2,504
More than 2	190	126	96	439	848	384

KAUAI HOUSEHOLDS DOUBLING UP & CROWDING, BY AREA

	Waimea-Kekaha	Hanapēpē–‘Ele‘ele	Kōloa-Kalāheo	Līhu‘e	East Kaua‘i	North Shore-
Either or Both	414	628	243	858	1,725	615
Neither	2,502	2,174	2,090	4,073	5,775	2,273

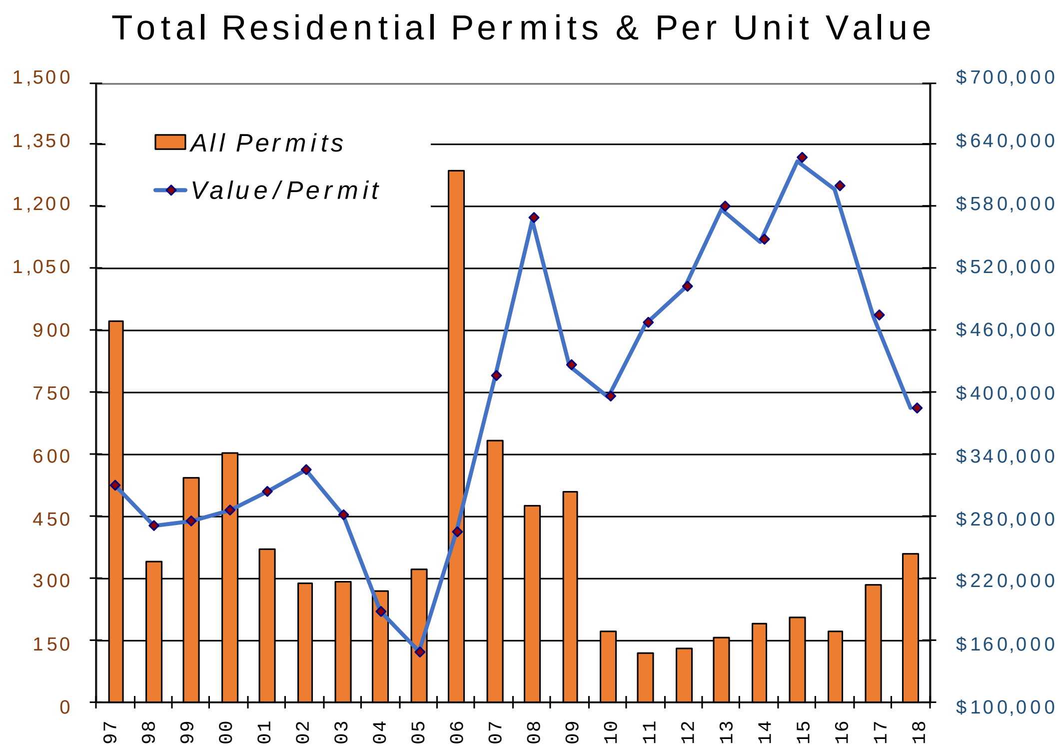
Another way that this condition is made apparent is the measurement of household size. Indeed, as households cannot afford housing, then overtime pent-up demand increases, household formation is delayed, and the average household size grows. The statewide average for household size increased by 2.8% from 2.88 persons per household to 3.11. This is consistent with a housing market where demand was greater than supply.

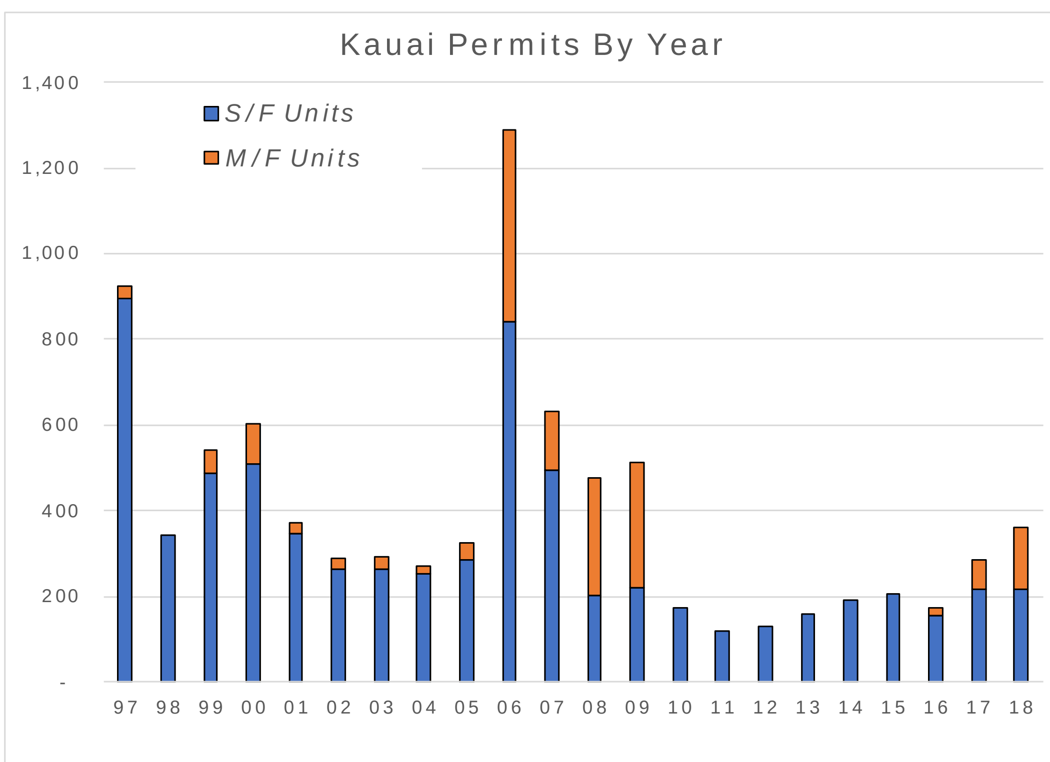
HOUSEHOLDS DOUBLING UP & CROWDING, BY AREA

	Population Growth	Household Growth	Housing Size Growth
Hawaii	19.1%	17.0%	0.3%
Honolulu	10.9%	3.5%	8.8%
Kauai	14.3%	11.7%	2.3%
Maui	19.3%	12.5%	5.8%

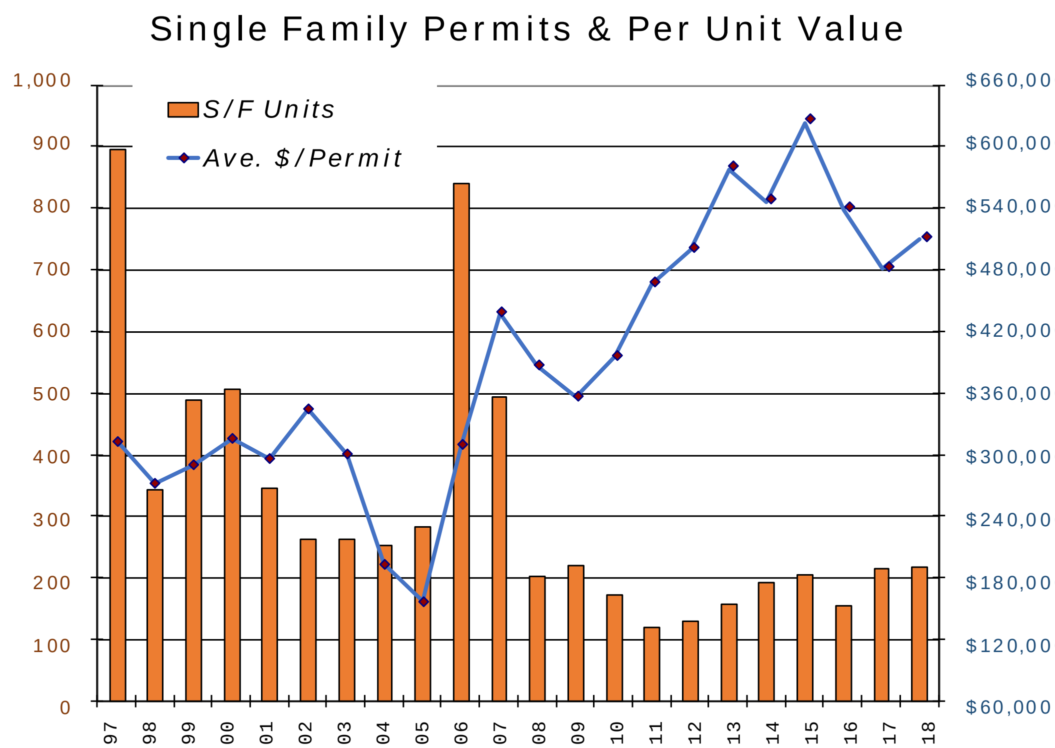
SPECIFIC SUPPLY IN NEAR TERM – PERMITS: The easiest way to look ahead to where the housing market is going in the short-term is by examining the activity in permits (where developers apply for permission, and pay their fees, for building residential units). A high level of activity indicates more supply, which means that more demand will be met, and the potential for prices adjusting downwards. Obviously, a low level of permits indicates less supply of housing (and potentially higher prices).

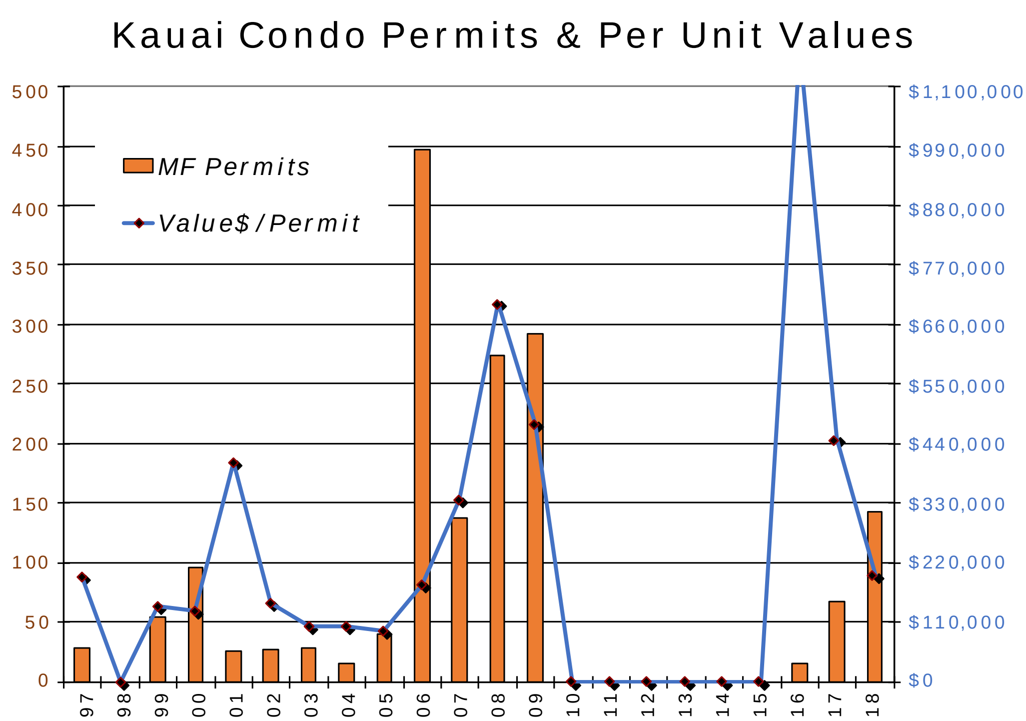
It should be noted that the long-term trend for permits – 1976 to 2018 (data through June), over 30 years is downward. This is a function primarily of restrictive land use laws, which started in the 70s, and took hold thereafter. Indeed, this restriction in the supply of land, nominally done in order to promote good planning, has acted also to raise the price of housing. It has done this by raising the cost via a limitation of supply, as well as via making the process of entitling land more time consuming, costlier and particularly riskier.





Further, the ensuing high cost of land has caused development, when conditions are right, to be focused on the most profitable segments of the housing market. For Kauai, this is the high end of the buyer demand. This fact is evident in the trend in the average dollar value per permit, shown in the next chart. For condos, as seen, it is almost always over $100,000 (which translates to a unit price of 3-4 times that amount).





XI DEMOGRAPHIC ANALYSIS OF TARGET MARKET DEMAND

The following data comes from Ribbon Demographics, a Californian firm that specializes in taking the 2010 US Census data and representing it in ways that are meaningful to those seeking to understand the demographic demand for housing. They use, to quote their website: "a custom four-way cross tabulation of household data designed specifically for affordable housing analysis that has been built by Nielsen (formerly Claritas). It is based on actual cross tabulation of Census (ACS) Data.

In particular, it identifies what kinds of housing (size, in term of bedroom counts) and at what price ranges those in the market might have a demand. We start with the total population on the island that are renting (note: this is a projection to 2018, using the info given by those polled in the 2010 Census.

OWNER ONLY HOUSEHOLD COUNTS BY INCOME AND FAMILY SIZE, 2018

	1-P'rson	2-Prsn	3-Prsn	4-Prsn	5-Prsn	6-Prsn	7+-Prsn	Total
$0-10,000	209	197	48	17	22	12	15	520
$10,000-20,000	454	282	70	35	12	6	8	866
$20,000-30,000	447	426	55	46	52	27	35	1,089
$30,000-40,000	324	463	113	27	23	12	15	976
$40,000-50,000	237	549	208	90	80	42	54	1,260
$50,000-60,000	152	438	222	127	36	19	24	1,018
$60,000-70,000	216	281	196	186	70	37	47	1,032
$70,000-75,000	108	141	98	93	35	18	23	516
$75,000-80,000	19	143	98	89	54	28	36	468
$80,000-90,000	42	322	221	201	122	64	82	1,053
$90,000-100,000	32	251	172	156	95	49	64	819
$100,000-112,500	44	405	236	211	131	69	88	1,185
$100,000-125,000	29	270	158	141	88	46	59	790
$125,000-150,000	130	365	255	209	148	77	99	1,284
$150,000-200,000	118	380	211	306	116	61	78	1,270
$200,000+	104	592	132	103	135	71	91	1,229
-	2,665	5,504	2,495	2,038	1,219	636	818	15,374

The Table shows that the deepest Segments are the $40,000-$50,000, at the low end, and $125,000 -$150,000, at the high-end.

The table below describes the incomes per family size, given relative to 100% of the area median income, or AMI.

MULTIFAMILY TAX SUBSIDY PROJECT INCOME LIMITS, 2018, HUD

	1 Person	2 Person	3 Person	4 Person	5 Person	6 Person	7 Person	8 Person
50%	$30,850	$35,250	$39,650	$44,050	$47,600	$51,100	$54,650	$58,150
60%	$37,020	$42,300	$47,580	$52,860	$57,120	$61,320	$65,580	$69,780
80%	$49,360	$56,400	$63,440	$70,480	$76,160	$81,760	$87,440	$93,040
100%	$61,700	$70,500	$79,300	$88,100	$95,200	$102,200	$109,300	$116,300
120%	$74,040	$84,600	$95,160	$105,720	$114,240	$122,640	$131,160	$139,560
140%	$86,380	$98,700	$111,020	$123,340	$133,280	$143,080	$153,020	$162,820

Using this income guidelines, the state's affordable housing financing arm, HHFDC, generated a schedule of the maximum prices that a particular household could pay for a unit. The table below shows this, given a 5% 30-year mortgage rate, plus the number of people in the household.

MAXIMUM PRICE GUIDELINES, PER AMI INCOME LIMITS, 2018, HHFDC

Household	50%	60%	80%	100%	120%	140%
1 person	$140,800	$169,000	$225,300	$281,600	$337,900	$394,200
2 person	$160,900	$193,100	$257,400	$321,800	$386,100	$450,500
3 person	$181,000	$217,200	$289,500	$361,900	$434,300	$506,700
4 person	$201,000	$241,200	$321,700	$402,100	$482,500	$562,900

Given these guidelines, we looked at the sales data in the table below. It shows the annual average of housing sales for each price range that is mentioned above.

ANNUAL SALES BY SINGLE & MULTIFAMILY UNITS

Sold $ Range	Total	MF	SF
$100,000-$199,999	41	39	2
$200,000-$299,999	85	72	13
$300,000-$399,999	77	48	29
$400,000-$499,999	125	58	67
$500,000-$599,999	140	48	92
$600,000-$699,999	129	46	83
$700,000-$799,999	87	34	53

As seen, there are overlaps where an affordable priced dwelling is available to a buyer making, say, 50% of AMI (note that the question is to what extent those sales at the low end are ones that can only be made to Hawaiians with a 50% blood quantum or more).

Given that, we looked at the housing demand potentially at these low prices ranges.

The table below describes that. It took the data in the earlier table describing the number of households making what level of income data. It then redefined that information, using the HUD 2018 AMI definitions, to arrive at the population counts, the number of owners, by AMI segment. We focused on the 50% of AMI or above, as they can afford to buy a dwelling.

OWNERS ONLY HOUSEHOLDS BY AMI AND FAMILY SIZE, 2018

	1-Person	2-Person	3-Person	4-Person	5-Person	6-Person	7+-Person	Total
50%	515	622	154	79	91	55	71	1,588
60%	227	346	156	90	45	20	26	910
80%	311	703	342	221	127	48	62	1,814
100%	221	395	321	343	214	113	145	1,753
120%	324	432	310	239	128	67	86	1,586

As a matter of general interest, 60% of AMI and below is generally where family incomes are such that most need public housing for their shelter. Thus, we focus on the number of owners who potentially can purchase a home at 80% of AMI.

Of note here is that that the data is only for households that are currently owning, as opposed to those renting – and because some renters at the higher income ranges potential could become owners, this table might underestimate demand for home ownership at the higher income ranges.

There are rules regulating the sale of an affordable unit, based on occupancy. They say that households buying studio and the one-bedrooms can have no less than one person and no more than two people. For two-bedroom units, no fewer than two people and no more than five people can buy a unit. The table below describes this more fully.

OCCUPANCY REQUIREMENT

Bedrooms	Occupancy Range
Studio	1-2 Persons
1 Bedroom	1-2 Persons
2 Bedroom	2-5 Persons
3 Bedroom	3-7 Persons

From this one can derive the number of dwellings, per their bedroom count, needed by those households in the market area who make the allowable income or less. This becomes the number of dwellings by bedroom counts that constitutes the total potential demand for the project's supply.

OWNER ONLY FAMILY HOUSEHOLD DEMAND, BY AMI AND BEDROOM COUNT, 2018

AMI	0 Bed (1-2)	1 Bed (1-2)	2 Bed (2-3)	3 Bed (3-4)	4 Bed (4-8)	Totals
50%	309	579	341	141	217	1,588
60%	136	298	232	152	91	910
80%	186	546	486	358	238	1,814
100%	133	325	351	471	473	1,753
120%	194	389	359	363	281	1,586

As seen, there is more than sufficient potential demand to the project's proposed affordable supply, 183 units, as shown in the table below (and described in a subsequent section).

PROJECT AFFORDABLER SUPPLY REQUIRMENT, BY AMI

AMI	Requirement
80%	37
100%	55
120%	55
140%	37
	183

We performed a similar analysis on the demographic data for the county (found in the first table). We derived the potential pricing of a dwelling for each of the AMI income brackets. We were using a 5% 30-year mortgage rate and put that data into price ranges. The table shows potential demand by price range.

OWNER ONLY HOUSEHOLD POTENTIAL DEMAND, BY PRICE RANGE

Incomes	Total	Price Ranges
$40,000-50,000	1,260	$177-$231
$50,000-60,000	1,018	$231-$285
$60,000-70,000	1,032	$285-$339
$70,000-75,000	516	$339-$366
$75,000-80,000	468	$366-$393
$80,000-90,000	1,053	$393-$447
$90,000-100,000	819	$447-$501
$100,000-112,500	1,185	$501-$601
$112,500-125,000	790	$601-$673
$125,000-150,000	1,284	$673-$770
$150,000-200,000	1,270	$770-$905
$200,000+	1,229	$905+
TOTALS	15,374	

XII. CURRENT INVENTORY & MARKET VALUES FOR COMPARABLE UNITS

The following table describes the potential pricing at the retail level for each product type in the development (note that, in the eventuality that some or all of the house/lot package units are sold as simple home sites, the prices will be lower, as reflected in the final column below).

KAPAA HIGHLANDS PRODUCT SALES PRICE PROJECTION

Housing Produced	Total Units
A House Lot Package, Large Lots (10,000 sf)	36
A House Lot Package, Medium Lots (7,500 sf)	50
Multi-Family Dwellings (4 Plex, 8 DU/Ac)	500
Affordable Housing Dwellings (12 DU/Ac)	183

Note that the Kapaa Highlands proposed master plan combines multifamily and single-family housing product. As such, we will look into each housing product segment.

MULTI-FAMILY

Starting with the multifamily market, it is the largest component of this development at 500 units.

the following table gives an overview of this segment. It shows multifamily sales of 2 Bedroom Units, sold in the $250,000-$750,000 range, and for sales that occurred in the North Shore, Koloa, Lihue and Kapaa TMKs. The averages that are shown are for prices, Square footage of the interior unit, the price per square foot, and the average year that the unit was built.

HISTORICAL SALES & AVERAGE PRICE TREND

	Sales	Ave$	Ave sf	$/sf	Yr Built
1998	31	$345,177	1,377	$251	1979
1999	39	$361,788	1,337	$271	1979
2000	62	$354,939	1,268	$280	1980
2001	65	$409,046	1,196	$342	1981
2002	75	$376,968	1,181	$319	1979
2003	115	$386,876	1,195	$324	1979
2004	152	$421,397	1,119	$377	1981
2005	251	$460,190	1,088	$423	1990
2006	225	$512,508	1,130	$454	1998
2007	94	$452,570	1,033	$438	1990
2008	35	$506,119	1,161	$436	1989
2009	36	$403,819	1,166	$346	1985
2010	49	$426,062	1,247	$342	1989
2011	62	$385,292	1,207	$319	1988
2012	97	$421,899	1,245	$339	1989
2013	89	$449,629	1,217	$369	1987
2014	95	$444,907	1,120	$397	1984
2015	69	$466,680	1,154	$404	1984
2016	110	$463,551	1,111	$417	1985
2017	157	$469,565	1,130	$416	1988
2018	152	$445,623	1,027	$434	1987
2019	23	$497,609	1,070	$465	1989

As seen, this segment peaked in 2006, bottomed 2010-2011, and has been rising ever since.

The following table looks at a smaller segment of this data. It shows all the sales that were made only since 2018, and only for units built after 2005. The sales occurred in all locations on the island, except in West and North Kauai.

This sales are also identified by the number of bedrooms. The table shows the sales, the average prices, the average square foot, the average price per square foot, the minimum price paid, and the maximum price paid for that bedroom type. Note that the average for the year build shows that these units are at least 10 to 12 years old.

LAST 16 MONTHS, SALES & AVERAGES

Beds	Sales	Ave$	Ave sf	$/sf	Min $	Max $	Yr_BLT
1	7	$535,571	853	$628	$445,000	$651,000	2005
2	17	$488,647	1,083	$451	$310,000	$740,000	2005
3	13	$501,054	1,371	$365	$355,000	$605,000	2005

The next table identifies the comparable sales by bedroom and by project. The projects that were chosen were those representative of the potential buyer for this project. They excluded any and all resort properties, any properties on the beach, any properties that could be rented out on a short-term basis. Thus, these sales are only for local buyers. This shows the sales since 2017.

LAST 28 MONTHS, COMPARABLE PROJECT SALES & AVERAGES

Bed/Project	Sales	Ave$	Ave sf	Ave$/list$	Yr_Blt	Min $	Max $	$/sf
1 Bedroom	**2**	**$434,563**	**1,032**	**96.2%**	**2005**	**$424,125**	**$445,000**	**$421**
REGENCY HULEIA	2	$434,563	1,032	96.2%	2005	$424,125	$445,000	$421
2 Bedroom	**24**	**$423,417**	**1,083**	**98.6%**	**2005**	**$280,000**	**$555,000**	**$391**
HALEMALU AT PUHI	2	$420,000	924	95.7%	2002	$418,000	$422,000	$455
HOOKENA AT PUHI	7	$307,857	777	98.8%	2006	$280,000	$335,000	$396
KAMAMALU	1	$310,000	870	100.0%	2009	$310,000	$310,000	$356
REGENCY HULEIA	13	$485,154	1,265	98.7%	2005	$430,000	$555,000	$384
VILLAS AT PUALI	1	$550,000	1,392	100.2%	2005	$550,000	$550,000	$395
3 Bedroom	**28**	**$472,418**	**1,292**	**98.2%**	**2004**	**$320,000**	**$605,000**	**$366**
HALEMALU AT PUHI	9	$465,167	1,174	97.7%	2002	$424,000	$515,000	$396
HOOKENA AT PUHI	4	$358,750	1,164	98.7%	2006	$320,000	$395,000	$308
REGENCY HULEIA	6	$556,667	1,404	96.6%	2005	$475,000	$605,000	$396
VILLAS AT PUALI	9	$474,023	1,392	99.5%	2005	$371,500	$510,000	$341

The next table identifies the comparable sales by project, and then by bedroom.

The following table looks at the current listings of these comparable projects. Note, these are not sales.

As listings, the value being asked by the seller are much higher than those at which sales have been made. Nonetheless, it shows how prices potentially can go, if the market continues.

LISTED UNITS FOR SALE, IN COMPARABLE PROJECTS

Bed/Project	Sales	Ave$	Ave sf	Yr_BLT	Min $	Max $	$/sf
2 Bedroom	**4**	**$492,625**	**1,146**	**2005**	**$345,500**	**$565,000**	**$430**
HOOKENA AT PUHI	1	$345,500	788	2006	$345,500	$345,500	438
REGENCY HULEIA	3	$541,667	1,265	2005	$500,000	$565,000	428
3 Bedroom	**8**	**$538,813**	**1,336**	**2005**	**$465,000**	**$628,000**	**$403**
HALEMALU AT PUHI	2	$488,000	1,172	2002	$479,000	$497,000	417
HOOKENA AT PUHI	2	$482,000	1,378	2006	$465,000	$499,000	350
REGENCY HULEIA	2	$606,750	1,404	2005	$598,500	$615,000	432
VILLAS AT PUALI	2	$578,500	1,392	2005	$529,000	$628,000	416

We next look at the tax Assessors appraised values for the units in these projects. Note that these assessed values are for all of the units in the project that were produced as one, two, and three-bedroom units. This is the total inventory of comparable units

Note also that the average assessed value it Is generally at a level that is below market values. This is because the tax appraiser always looks at the historical trend but does not tried to match it in the current year. A general rule of thumb is that these values are below market values, for the current year, buy 2 to 5%.

COUNTY TAX ASSESSED UNITS IN COMPARABLE PROJECTS

Bed	Project	Count	Ave Ass$	Ave sf	$/sf
1	REGENCY HULEIA	3	$426,933	1,032	$414
1 Total		**3**	**$426,933**	**1,032**	**$414**
2	HALEMALU AT PUHI	2	$396,950	924	$430
	HOOKENA AT PUHI	10	$274,390	776	$353
	KAMAMALU	10	$277,020	859	$323
	REGENCY HULEIA	28	$453,811	1,265	$359
2 Total		**50**	**$380,294**	**1,072**	**$355**
3	HALEMALU AT PUHI	16	$447,438	1,161	$385
	HOOKENA AT PUHI	10	$350,470	1,176	$298
	REGENCY HULEIA	13	$516,885	1,404	$368
	VILLAS AT PUALI	25	$472,304	1,392	$339
3 Total		**64**	**$456,106**	**1,303**	**$350**

In light of Both the valuations in the sales arena and in the tax appraised arena, we made an effort to come up with some Price point valuations and some price per square foot values.

A number of simple assumptions were made: that only two- and three-bedroom units would be produced; that the square footage assumed for these units would be on the small side; and that the price per square foot valuation would be conservative. Note also that these values are set for 2019, as of the study.

OUR PRICING RECOMMENDATIONS FOR MF MARKET UNIT

	Sq Ft	$/sf	Price
2 Bed	950	$345	$ 327,750
3 Bed	1,150	$310	$ 356,500

MULTIFAMILY AFFORDABLE UNITS

Current county Affordable housing regulations for developments larger than 26 units require that a percentage the total unit count be provided at prices that are affordable. The regulation says that of 100% of the total units, 20% of that total must be sold two households making 80% and 140% of area median income, or 40% of the total. Then, another 30% of the total must be sold to households making either hundred percent or 120% of Area median income, or 60% of the total.

The table below shows the split between before the four AMI segments, and then derives the total unit by AMI that This development will be required to provide. Has seen, there are 183 units total.

PROJECT AFFORDABLER SUPPLY REQUIRMENT, BY AMI

AMI	Requirement
80%	37
100%	55
120%	55
140%	37

Then, we look at the price guidelines for 2018 from HHFTC, as seen in the table below. In most cases, hey household comprised of one person or of two persons are the buyer of an affordable unit. Thus, we have highlighted those prices, and reproduce them in the table below.

PRICE GUIDELINES, 2018, HHFDC

Household	80%	100%	120%	140%
1 person	$225,300	$281,600	$337,900	$394,200
2 person	$257,400	$321,800	$386,100	$450,500
3 person	$289,500	$361,900	$434,300	$506,700
4 person	$321,700	$402,100	$482,500	$562,900

Combining both tables, we arrived at price schedule for each of the segments.

PRICE GUIDELINES, 2018, FOR THE 183 AFFORDABLE UNITS

AMI	One Pers'n	Two Pers'n	Count
80%	$225,300	$257,400	37
100%	$281,600	$321,800	55
120%	$337,900	$386,100	55
140%	$394,200	$450,500	37
TOTAL			183

Note that the priced guidelines In and around the 120% of AMI are at or above the market prices. As such, those units will be sold at lower levels, below what the price guideline calls for.

SINGLE FAMILY

Next, we turn to the single-family market. There are much fewer units in this market and they are fairly similar: one product will sit on a lot that is 10,000 ft.² in size, and the other will sit on the lot that is 7500 ft.² in size.

This first table describes single family production over the last 15 years of homes in the Koloa, Lihue, North Shore and Kapaa areas, as defined by their TMKs. Further, the data is limited to units who have assessed values between $800,000 and $1.2MM, and sit on lots under 25,000 sf.

COMPARABLE SINGLE-FAMILY PRODUCTION, 10,000 sf LOTS

Yr. Blt	Count	Ave Ass'd $	Ave Intr'r sf	Ave Lot sf
2004	49	$979,894	2,588	12,631
2005	47	$915,726	2,769	13,413
2006	28	$928,829	2,727	11,896
2007	56	$954,609	2,671	11,329
2008	27	$972,133	2,830	11,656
2009	18	$978,661	2,691	11,681
2010	25	$972,044	2,390	11,391
2011	17	$985,053	2,484	12,859
2012	14	$912,371	2,398	10,321
2013	34	$960,762	2,118	12,667
2014	30	$1,003,267	2,239	10,895
2015	25	$971,740	2,031	11,666
2016	22	$902,214	2,173	11,355
2017	47	$912,987	1,644	9,103

Note that the table extends only up to the end of 2017.This is because the tax assessor has not computed all the data for homes that were built that year and last.

Note also that the assessed values for all years are the ones assessed in 2017. Meaning, that there really is no progression overtime in those values, because they were all set in the one year of 2017, even though they were built in 2005, 2006, et cetera.

The next table describes the home/lot production by bedroom count since 2005 years of homes in the Koloa, Lihue, North Shore and Kapaa TMKs, whose assessed values are between $800,000 and $1.2MM on lots under 25,000 sf.

COMPARABLE SINGLE-FAMILY UNITS, 10,000 sf LOTS

Bedrooms	Built	Ave Ass'd $	Ave Intr'r sf	Ave Lot sf	$/sf
3	188	$973,194	2,401	11,907	$405
4	78	$957,514	2,853	11,863	$336
5	21	$955,943	3,267	12,335	$293

The table shows that recent production Is overwhelmingly in favor of the three-bedroom units. It also shows how the average interior square footage increases, as the bedroom count does… and how the average price per square foot decreases.

Turning from assessed values to actual sale prices, the following table shows the sales in this market – it shows the sales trends since 2004, the top of the last real estate market cycle. For this, we use the MLS data to describe the sales activity. Again, we start with this single-family product, house/lot packages, that are located in the same area as before, Koloa, Lihue, North Shore and Kapaa TMKs, at prices between $800,000 and $1.2MM.

SALES OF COMPARABLE SINGLE-FAMILY UNITS, 10,000 sf LOTS

Yr.	Sales	Ave Price	Ave Int sf	Ave Lot sf	Yr_Blt
2004	61	$935,119	2,331	13,445	1983
2005	96	$934,890	2,160	13,135	1984
2006	69	$953,622	2,082	12,287	1982
2007	43	$965,984	2,191	12,446	1991
2008	28	$904,983	2,047	14,117	1988
2009	23	$939,000	2,188	13,593	1984
2010	23	$926,039	2,733	12,966	1990
2011	27	$945,500	2,572	12,433	1988
2012	22	$946,984	2,363	14,218	1992
2013	46	$938,205	2,371	11,378	1997
2014	41	$975,146	2,425	13,290	1992
2015	49	$958,051	2,379	11,615	1994
2016	59	$963,610	2,305	12,770	1994
2017	65	$956,017	2,386	12,694	1996
2018	82	$969,547	2,311	12,280	1995
2019	7	$1,005,574	2,129	14,369	1992

The Table below Uses the same location, lot size and locational filters on the MLS sales data, but it is broken down by bedrooms, and summarizes only very recent sales, the ones since 2018

COMPARABLE SINGLE-FAMILY SALES, 10,000 sf LOTS, 2018+

Bedrooms	Sales	Ave Price	Ave Int sf	Ave Lot sf	$/sf	Built
2	9	$939,667	1,638	13,141	$574	1998
3	55	$969,517	2,151	11,769	$451	1993
4	16	$1,008,344	2,734	14,770	$369	1999
5	6	$951,333	3,574	11,643	$266	1994

We believe the house lot package on 10,000 sf plus lots could bring between $900,000 and $1MM.

To sell the lots to spec builders, we think the builder-ready lots should bring about 25% of retail price, or $250,000- $275,000.

The following table shows similar data except that the assessed value is between $600,000 and $1MM.

COMPARABLE SINGLE-FAMILY PRODUCTION, 7,500 sf LOTS

Yr. Blt	Count	Ave Ass'd $	Ave Intr'r sf	Ave Lot sf
2004	29	$737,028	1,895	9,955
2005	28	$758,900	2,157	9,872
2006	12	$795,642	2,169	10,335
2007	21	$798,224	2,154	9,699
2008	14	$764,450	2,185	11,148
2009	9	$781,222	2,172	10,639
2010	11	$772,200	1,849	9,584
2011	7	$805,157	2,191	9,750
2012	8	$803,700	2,150	9,478
2013	8	$751,488	1,438	11,165
2014	10	$775,650	1,608	10,211
2015	7	$777,657	1,612	10,100
2016	18	$760,483	1,711	9,984
2017	8	$784,250	2,719	10,419

The trend that was described for the larger lot unit class is similar to this, the smaller lots.

COMPARABLE SINGLE-FAMILY PRODUCTION BY BEDROOMS, 7,500 sf LOTS, 2010+

Bedroom	Count	Ave Ass$	Ave sf	Ave Lot
3	43	$787,419	1,883	10,020
4	17	$776,453	2,181	10,120
5	3	$827,567	2,397	9,253

The following table shows similar data except that the sales value, like before, is between $600,000 and $1MM, and the lots are no larger than 14,999 sf.

COMPARABLE SINGLE-FAMILY SALES, 7,500 sf LOTS

	Sales	Ave$	Ave sf	Ave Lot sf	Yr_BLT
2004	44	$862,343	2,218	10,633	1986
2005	71	$859,583	1,992	10,677	1991
2006	50	$857,938	1,970	9,861	1984
2007	31	$862,903	1,973	9,856	2005
2008	22	$834,619	2,027	10,179	1988
2009	15	$867,987	2,083	9,847	1989
2010	17	$853,500	2,503	10,123	1990
2011	23	$853,435	2,295	9,838	1991
2012	15	$869,460	2,195	10,165	1993
2013	38	$865,393	2,320	10,499	1997
2014	30	$858,400	2,149	10,014	1991
2015	30	$863,850	2,264	10,126	1995
2016	39	$853,782	2,366	10,398	1993
2017	48	$851,321	2,235	10,030	1994
2018	62	$864,264	2,110	9,834	1990
2019	2	$860,500	2,475	11,066	1988

This is the same data, broken down by bedrooms

COMPARABLE SINGLE-FAMILY SALES, 7,500 sf LOTS, 2017+

Beds	Sales,	Ave$	Ave sf	Ave Lot sf	Yr_BLT
3	77	$846,090	1,966	10,413	1991
4	25	$872,256	2,617	11,172	1995
5	10	$896,700	3,524	9,315	1993

We believe the house lot package on 7,500sf plus lots could bring between $750,000 and $850,000.

To sell the lots to spec builders, we think the builder-ready lots should bring about 25% of retail price, or $200,000- $225,000.

XIII. RATIONALE & MARKET SUPPORT FOR THE PROJECT

SUPPORT: The rationale for this Project is as follows:

- Macro-economic fundamentals show that this market suffers from excessive demand and inadequate supply, and this is not likely to change over the next century.
- Micro-economics show that project profitability can and does change over a market cycle, but given the macroeconomic fundamental above, production rarely is unprofitable.
- The demographic segment that has been relatively the most underserved (when they all have been underserved, from the mid-market on down) is workforce and blue-collar household.

The site has specific advantages, from a workforce and middle-class perspective:

- It has extraordinarily good access to services, employment and transportation;
- It has very good view planes, that will not be compromised easily in the future

XIV. FORECAST

The following table describes the potential pricing at the retail level for each product type in the development (note that, in the eventuality that some or all of the house/lot package units are sold as simple home sites, the prices will be lower, as reflected in the final column below).

KAPAA HIGHLANDS PRODUCT SALES PRICE PROJECTION

Housing Produced	Total Units	Retail Price Per Unit	Home Site Only Prices
A House Lot Package, Large Lots (10,000 sf)	36	$750,000-$1,250,000	$225,000-$250,000
A House Lot Package, Medium Lots (7,500 sf)	50	$650,000-$850,000	$200,000-$235,000
Multi-Family Dwellings (4 Plex, 8 DU/Ac)	500	$250,000-$350,000	
Affordable Housing Dwellings (12 DU/Ac)	183	$125,000-$175,000	

Given that these prices, particularly the affordable ones, are below the historical trend for housing, we expect that sales will start up strongly. We expect them then to hold this momentum over the first three years, coinciding with the market's expansion. Thereafter, they will experience a gradual fall-off, coinciding with the downturn in the cycle. After that, the market will recover, as will sales of the final units.

KAPAA HIGHLANDS PRODUCT CLOSING PROJECTION

Product	2021	2022	2023	2024	2025	2026	2027
Large Lot Homes	11	9	9	7			
Medium Lot Homes	15	15	14	6			
Multi-Family Units	50	70	80	130	70	50	50
Affordable Housing Units	40	40	40	35	28		

Exhibit B

Sustainability Plan for
HoKua Place
(Formerly Kapa'a Highlands II)

EXHIBIT "B"

Kapaʻa Highlands II Sustainability Plan

Preparedby:
Hoʻokuleana LLC
... to take responsibility ...

25 Kāneʻohe Bay Drive, Suite 212
Kailua, Hawaiʻi 96734
(808) 254-2223 (Oʻahu)
(808) 329-4447 (Big Island)
www.Hookuleana.com
Info@Hookuleana.com

Table of Contents

Kapa'a Highlands II Project Information

Kapaa Highlands II is a proposed development of a mix of singlefamily and multifa mily residential, market and affordable rate homes. This 163acre Ocean View "Planned" community is positioned to be the pride of Kapaa. The development seeks to Ůll the housing needs of Kapaa within the Urban Center of the district. Situated in close proximity to schools and commercial areas, Kapaa Highlands II is proposed to be a sustainable community that preserves the rural character of Kapaa while mee ng its growinghous ingneeds.

Kapaa Highlands II has received le ers of support from the County Mayor, County Planning Department and County Housing Department. Letters of approval have been received from the County Department of Public Works regarding wastewater, State Department of Transportation and the County Water Department.

ProjectName :	KapaaHighla ndsPhaseII
Location:	Wailua,Kauai,Hawaii
TMK:	(4)43003:001
TotalArea:	163acres
ExistingUse:	Vacant,u ndeveloped,formersugar caneland
CountyZoning:	Agriculture
GeneralPlanLand UseDesignation:	UrbanCenter
StateLandUs e:	Agricultural
Approvals Required:	LUCBoundar yAmendment;County ClassIVZoning&UsePermits; CountyCouncilA pprovalforZoningChange;BuildingPermits

Project Components:

Mixofsingle -familyand multifamily residential.

Approximately69acressubdividedinto:

- 86singlefamily(lotsra nging from5,00 0to8,000SqFt.)
  - $180,000.00to$250,000.00
- 683multifa mily(lotsfrom15a creparcels)
  - $220,000.00to$450,000.00
- Totalsaboveinclude–167 affordableunitsonsite
  - $189,000.00to$363,000.00

Openspaceencompassing 14.3acresincludi ng:

- 3.1acrepar kadjacent toKapaaMiddl eSchool
  - RelocationofCountySwimming Pool
- Greenwayss urroundingdevelopment

CommercialAreastotaling1.4acres

- Stores,personalservices
- Landforpolice/firesubstations

ƺ oject Components⍮ Infrastructure Ɩ prov ments:

Water⍮

- Contributions to repairs of Kapa'a Sewer #reaƭ nt ƺ%
- Water Master ƺlan approved by County Wat r Department
- Well on site to be dedicat * to County Water - eparƭ ent

Transportation⍮

- Dedication of Kapa'a B+-Pass Road to the Stat
- Complete multi-mo*al roa*wa+ running thru the property
- Bus stops located along roadway
- Bike/Walking path

Aerial Image Overlooking Kapa'a Highlands II Project Area

Kapa'a Highlands II Sustainability Plan

Kapa'a Highlands II Sustainability Plan

This Kapa Highlands I Sustainability ƺlan is a coˇ prehensi set of @als, strategies and actions focused on imp oving nvironmental qualityY conomic strength and social b nefit ! ithin the Kapa Hig?lands II project, as !%% as the broader coˇ ˇ unit+

This ƺlan s s as a oa*ˇ ap @iding Kapa Highlands I toward a ˇ o e sustainable future, ! it? impleˇ entation of actions through a coˇ prehensi e, inclusive stakeholder proc ss.

Befo *iscussing the @obal context of ^sustainabilityY_! explore the Xa! aiian iew of ^*<u>*āina*</u> " – co to the t m "sust<u>*aina*</u>bility."

In a traditional Hawaiian context, nature and culture a e on and the saˇ ; th is no division b tween the t! o\ #? wealth and limitations of the land and ocean resourc s ga birth to and shaped t? Hawaiian wo %*iew. In Hawaiian culture, natural and cultural resources are one and the saˇ e.

All foˇ s of the natural nvironˇ ent, f oˇ the ski s and ˇ ountain peaks, to the ! atered alleys and lava plains, and to the s?oreline and ocean depths are belie to b ˇ bodim nts of Xa! aiian @*s and deities. (Mal+|

'Āina – That Which Sustains the People
(Context, h Y primarily pro ided from writings of K pa Maly

The *'āina*, that ! hich feeds, nourishes and sustains lif (in English referred to as "land"), *wai* (water), *kai* (ocean), and *lewa* (sk+) ! re the foundation of life and the source of the spiritual relationship between people and their en irons. Xawaiian *mo'olelo*, or traditions, expr ss the attachment felt between t? Hawaiian people and the earth around thˇ \

In any *iscussion of Hawaiian land - 'āina, t which sustains the people - and its place in culture, it is also appropriate to briefly discuss traditional Hawaiian land terms, as the terms * ˇ onstrate an intimat Jnowledge of th environˇ ent about theˇ \ In the Hawaiian ˇ ind, all aspects of natural and cultural resources are interrelated. All are culturally si@ificant.

Hawaiian culture revo% s around the alue of ^aloha 'āina" or lov of the land. This love is not a passing sentiment, a suˇ mer fling or a fair ! ather affair. It is a *eep-seat d coˇ itment to the ! llbeing of the earth, which sustains us like a parent.

The Hawaiian conc pt of ˇ alaˇ a *āina (literally, caring for or living in ?armony with the land,) *ˇ ands conservation, sustainable use and enhancement of the %cal, @ional and @obal environment. <+ simply taJ ing care and respecting the land, it will sustain life. #his straightfo ! ard relationship has been hono * fo thousands of + ars, since the ƺolyn sians followed the stars to the shores of Ha! aii.

The traditional land use in the Xawaiian Islands vo%ed from shifting cultivation into a stable foˇ of agriculture a ound 1200 z - {Kirch, 2000|\ Stabilization required a new foˇ of land use. It is widel+ believed 'Uˇ i a Līloa, t? uler of the Island of Xa! ai'i, ! as the first ruler to c ate the ancient Hawaiian land division, according to a chiefly management systˇ Ynearly 600 years ago

This ! the *ahupua'a* land use systeˇ , which consisted of rtical landscape segments froˇ t? mountains to t? near-sho e ocean environment, and into the ocean as *eep as a person could stand in the water {Isabella Aiona Abbott).

For hundreds of +ears sinc , on the *eath of all *mō'ī* (kings or queens|, the ne! ˇ onarch re-divided t? land, giving control of it to his o her favorite chiefs. The coˇ ˇ on people ne owned or rul d land.

In t? t ˇ *ahupua'a*, the words *ahu* (stone altar or stoneˇ ound) and *pua'a* (pc are combined. #? *pua'a* was a carved ! oo* n image of a pig ?ead. #? se stone a%ars served as bo derˇ arkers and deposition places for offerings to t? agricultural @d *Lono* and a high chief {*ali'i nui*|Yw?o was t? go*'s representativ .

Each *ahupua'a* in turn was ruled by a lower chief, or *ali'i 'ai*. Xe in turn appointed a ?eadman, o *konohiki*. #he *konohiki* ser ed as generalˇ anager sponsible for the use of an *ahupua'a* as a r sou c systeˇ . Xe in turn was assisted by specialists, o *luna*. For example, the *luna wai* was responsible fo the fresh ! ater flow and irrigation s+steˇ {Kaˇ haˇ ha Schoo%, 1994).

Manageable parcels of land would typically run *mauka* (upland) to *makai* {toward to ocean) and ! ould beˇ arked with stonewall alignments. Tenants cultivated sˇ aller c ops fo family consuˇ ption, to supply the ne ds of chiefs and pro ide tributes.

Kapu (restrictions/pro?ibitions) ! e obser ed as aˇ atter of source and landˇ anageˇ nt aˇ ong ot? things. z ccess to esources ! as tied to esidency and earned as a result of taking esponsibility to steward the iron ent and supply the needs of *ali'i*. #he social structure reinfo ced land mana@ment\

Sustainability – United Nations Context

In 1983, t? United Nations Secretary General in ited Norwegian Priˇ e Minister Gro Xarleˇ Brundtland to chair a World Ωommission on Environment and - %pˇ ent. #he > port of the Brundtland Comˇ ission, Our Ωommon Future, ! as transˇ itt to the General Asseˇ b%+as an Annex to *document A/42/427* - - % opment and International Co-operation: En ironment, in 1987

Chapter 2, "Towards Sustainable - evelopˇ nt_ of the Brundtland ^Our Ωommon Future_ *efines "sustainable d elopment_ as:

> Sustainable % opment is % opment that ˇ ets the n ds of the present without compromising the ability of future generations toˇ et their o! n needs. It contains within it two key concepts:
>
> - the concept of 'needs', in particular the ssential needs of the ! orld's poor, to ! hich erriding priority should be given; and
> - the idea of liˇ itations iˇ posed by t? stat of technology and social organization on th environˇ ent's ability toˇ eet p sent and future ne *
>
> In its broadest sense, t? strategy for sustainable * %opm nt aiˇ s to proˇ ote harˇ ony aˇ ong human beings and bet! n humanity and nature.

Sustainability in Hawai'i (Hawai'i 2050)

The following definition, vision and guiding principles are incorporat* in the Ha! ai'i 2050.

Definition:
A Hawai'i that achieves the fo%% ing:

- Respects the culture, character, b auty and history of our state's island coˇ unities
- Strikes a balance between conoˇ ic, social and community, and environˇ ental prioritie
- ' ts the needs of the p sent ! ithout compromising the ability of future generations to meet their o! n needs

Vision:
Living sponsibly and wit?in our ownˇ eans is top-of-mind fo all individuals and organizations. Ō learn about t? irtu s and values of a sustainabl Ha! ai'i\ As a r su%Y ou goa% of econoˇ ic prosperity, social and coˇ unity ! ell-being and environˇ ental stewardship are in balance and achieved.

Hawai'i 2050 Guiding Principles of Sustainability

- Balance econoˇ ic, social, coˇ ˇ unit+ and en ironˇ ental prioriti s.
- Respect and live within the natural resources and limits of our islands.
- Achiev a diversified and *+namic economy.
- Honor the host culture.
- Make decisions based onˇ eting the present needs without coˇ proˇ isin@the needs of future generations.
- ƨrinciples of the ahupua'a s+stem guide our resourceˇ anageˇ nt decisions.
- } yon— individuals, faˇ ilies, communities, businesses and governˇ nt — ?as a responsibility for achie ing a sustainable Ha! ai'i.

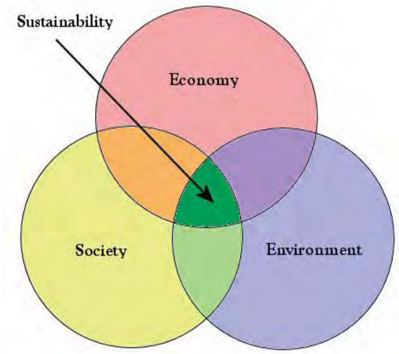
Sustainability in Hawai'iˇ ans achieving a quality of life that achieves the following goals:

- It ˇ phasizes respect fo the culture, character, beauty and histo y of ou state's island communities.
- It strikes a balance b t! een conomic prosperity, social and coˇ ˇ unit+ well-being, and environˇ ental stewardship
- Itˇ ets t? needs of t? present community ! ithout compromising the ability of future @nerations toˇ et their own needs.

Typically, "sustainability" is depicted in a three-th ˇ ed Venn diagraˇ (noted belo! Y| ?ighlighting the econoˇ y, iron ent and society. #he achiev ˇ nt of sustainable *evelopˇ nt requires integration of these components at all levels.

With resp ct to Kapa Highlands II, sustainable de%opm nt is achie ed when it is:

- economically feasible in order to be succ ssful as a %p ent, while also providing for econo ic opportunities for future generations !? o side, work or visit Kapa Highlands II
- protecting and preser ing the iron entY fo to*ay and tomo o! Yser ing as a o*% for others to follow
- addressing the n ds of a wide ariet+ of peop%, including their cultural values, as well as pro iding opportunities fo people to interact, g o! and learn together



Sustainability is not contra*icto + to @owth, profit an* *evelop nt. Sustainability means that ! e plan to our li its; sustainable community * %op nt *raws from and gives back to local str ngths, resourc s and uniqueness. Local lop ent can become ore sustainable by having a bette environ ental, econo ic and social balanc

UltimatelyYa @al is to % Xawaiian traditional wis*o ! ith modern sustainability concepts and tak an integrated approach in the design and operation at Kapa Highlands I This plan ! as created to highlight the actions of the Kapa'a Highlands || lopment in terms of sustainability.

In *eveloping this plan, a variet+ of cognized pro@ams and plans were viewed, summarized and their reco endations w e incorporated into this plan. These include:

- Smart Growth
- SmartCo*
- Hawai'i 2050 Sustainability ƺlan
- OEQC Sustainable Building Design Guidelines
- Hawaii BuiltGreen ƺrogra
- US Green Building Council Leadership in Energ+ and Environ ental - sign (LE)
- Energ+ Star ƺ ogra
- Who% Building Design Guide {Ʊ< DG,) of the National Institute of Building Scienc
- EPA Low Impact - % op ent
- One Planet Living

Further *iscussion on these pro@a s and plans fo% in the next Chapt r of this Kapa Xighlands I Sustainability ƺlan. Follo! ing this are chapters addressing issue-specific sustainability concerns. These include:

- **Natural and Cultural Resources:** ƺ otecting and preserving archaeological sites, trails and dryland fo st, for present and future generations
- **Land Use:** Focuses on consistency ! ith local land use planning, fulfilling the co unity's vision for de% opment in the fut
- **Design Features:** Incorporating design features to fit *evelop nt into natural features, protecting the resources, while taking advantag of natural ele ents
- **Transportation:** Focuses on sustainable mo* s of transportation and an i proved infrastructur including: multi- odal bic+cle, pedestrian and hicular infrastructure co plete streets, etc
- **Economic Opportunities:** }ncourages a ibrant econo + through div rsity of ploy ent and sustainable business oppo tunities
- **Open Space and Parks:** Encourages p otectio o urban open spaces by focusing on the urban landscaping, green spac s and mixed-use de%op nt and recreational opportunities
- **Water Management:** Focuses on reducing and conserving water use, as ! %%as inimizing impacts to nearby ecosyst fro source to stor! ater s+stems
- **Energy Management:** Encourages energ+ conser ation, ener@+efficiency and r newable energy
- **Health:** Encourages ?ealthy lifestyles through plac s to walk and recreat , as well as provide state of the art edical facilities to address communit+ needs
- **Education:** Encourages un*erstanding and practice of sustainable lifest+%s, as well as p o iding opportunities for life- ong l arning
- **Housing:** > sponds to the arket and de o@aphic trends and co unity needs, pro iding a broad range of housing typ s and price points

Anticipated beneficial i pacts fro theKapaX ighlands II projec include the following:

- ƺ ovision of 86 single family ho and 683 ulti-family units
- Increased housing choic s, including affordable housin@
- Increase housing inventor+ to eet future demands
- ƺ ovision of 3.1-acre park ! ith area fo %cation of Kapa'a County swi ming pool
- ƺlanned growth in an area designated for urban growth by the General Plan of t?e County of Kaua'i
- ƺrovision of a pedestrian and transit-friendly community

Kapa'a Highlands II will be a sustainable comˇ unity and will incorporat the fo%% ing:

Sustainability Programs and Plans: Kapa Xighlands ! ill incorporate the core principles of the arious sustainability pro@ams and plans.

Natural and Cultural Resources: No archaeological sites are J nown to exist on t?e property. Should any archaeo%gically significant artifacts, bones, or other indicators be uncov ed during constructionY Kapa'a Highlands II is coˇ mitted to strict compliance with State la! s and rul s.

Land Use: Kapa Xighlands is consistent with %cal land plans inclu*ing t? General ƺlan of th County of Kaua'i, the Kapa'a Town - %opˇ nt ƺlan and the Kapa'a-Ʊ ailua Basin Communit+ ƺlan.

Design Features: Kapa Xighlands II will include sustainable *esign features including strategies to reduce solar h at gain through roofs, walls and windows; using site planning and landscaping to impro natural ventilation` daylighting design; and energy fficient light fixtures.

Transportation: Kapa Xighlands II will incorporate bus stops into its oad systˇ ; ˇ ulti-modal interconnected oads; and complete streets design.

Economic Opportunities: Kapa'a Xighlands proposes t! o areas for coˇ ˇ ercial uses ! hich will provide a variet+ of job oppo tunities; construction and construction-related ˇ ployˇ ent will ha direct beneficial ĭ pact on the local economy during construction\

Open Space and Parks: Kapa Xighlands I propos open space and open @eenway areas encompassing 14\3-acr s including a 3.1-acre park for the proposed %ocation of the Kapa'a county s! ĭ min@pool\

Water Management: Kapa'a Xighlands will install water fficient fixture appliances and high efficiency toilets to reduce indoo ! ate use.

Energy Management: Kapa'a Xighlands II will incorporate energy cons ation and efficiencyˇ asures` solar energy fo ! ater heating; encourage photo oltaic syst ˇ s and ot? rene! able energ+ sources.

Health: Kapa Xighlands I — layout and * sign will create an opportunit+ for both sidents and th comˇ unit+ to have a positive effect on their ? alth through ! alkable and bikable transportation options\

Education: Kapa Xighlands I will coordinate ! ith the - OE to nsure that t? facility assessment policy addressed. In addition a 3.1-acr park ! ill be inc%ded in the plan the Kapa'a county s! ĭ ˇ ing poo% ill be relocated within the park.

Housing: Kapa'a Highlands II confo ˇ s to the Kaua'i County Affordable Housing Ordinance No\860 and offers a ariet+ of housing t+pes that will address a po tion of the housing needs of the island.

Social: Kapa Xighlands II promotes social sustainability through sociall+-focused actions that wil% support quality of life, sense of place and community livability for all residents and the comˇ unit+\

Sustainability Programs and Plans

In developing this Kapa a Xighlands II Sustainability Plan, a variety of recognized sustainability programs and plans were reviewed, summarized and incorporated into this plan. In part, the recommendations from these programs and plans serve as guides to the sustainability actions noted in this Plan.
These include:

- Smart Growth
- SmartCode
- Hawai'i 2050 Sustainability ƺ – (Hawai'i 2050|
- OEQC Sustainable Building Design Guidelines
- Hawaii BuiltGreen ƺrograˇ
- US Green Building Council Leadership in Energy and Environˇ ental Design (LE}-|
- ENERGY STAR Program
- Who% Building Design Guide {Ʊ< DG,) of the National Institute of Building Scienc
- EPA Low Impact Development
- One Planet Living
- Complete Streets

In this chapter, these various programs and plans are summarized.

As you will see, there are several consistent principles and themes that run through the various programs and plans. While some are broad-based and include several of these, others are focused on single issues.

Following are some of the consistent messages found in these programs and plans:

- Soft touch on the land
- Respect and protection of natural and cultural resources
- Use of natural % ˇ ents (s?ading, ventilation, lighting, etc
- Diversity of land uses, housing types, prices
- Live, work, play, shop and learn
- Walking, bicycle and transit transportation focused
- Reuse and minimization of waste
- Renewable and efficient electric
- People and community focused

Kapa Xighlands will implement, to the extent feasible and practicable, measures to promote energy conservation, sustainable design, environmental stewardship and protection of the natural and cultural resources into the project. These actions are in part, based on the recommendations noted in the following sustainability programs and plans.

Smart Growth Network

In 1996, the U.S. Environmental Protection Agency joined with several non-profit and government organizations to form the Smart Growth Network. The Network was formed in response to increasing community concerns about the need for new ways to grow that boost the economy, protect the environment, and enhance community vitality.

Smart growth refers to the management of growth to make it possible "for communities to grow in ways that support economic development and jobs; create strong neighborhood with a range of housing, commercial, and transportation options; and achieve healthy communities that provide families with a clean environ˘ ent." (Smart Growth Network)

There ar 10 accepted principles thatdefine Smart Growth

1. Mix land uses
2. Take advantage of compact building design
3. Create a range of housing opportunities and choices
4. Create walkable neighborhoods
5. Foster distinctive, attractive communities with a strong sense of place
6. Preserve open space, farmland, natural beauty, and critical environmental areas
7. Strengthen and direct development towards existing communities
8. Provide a variety of transportation choices
9. Make development decisions predictable, fair, and cost effective
10. Encourage community and stakeholder collaboration in development decisions

SmartCode

The SmartCode is a form-based code that incorporates Smart Growth and New Urbanism principles. It is a unified development ordinance, addressing development at all scales of design, from regional planning on down to the building signage.

The SmartCode is also a transect-based code. A "transect" is usually seen as a continuous cross-section of natural habitats for plants and animals, ranging from shorelines to wetlands to uplands. It is based on the rural-to-urban transect rather than separated-use zoning, thereby able to integrate a full range of environmental techniques.

The SmartCode is a model transect-based planning and zoning document based on environmental analysis. It addresses all scales of planning, from the region to the community to the block and building. The SmartCode is distributed by the nonprofit Center for Applied Transect Studies (CATS.)

Kapa Xighlands II has incorporated the SmartCode principles and transects into its layout and design.

Hawai'i 2050 Sustainability Plan (Hawai'i 2050)

The Hawai'i State ƹlan, ˘ bodied in Chapt r 226YXawai'i > vised Statutes {HRS), s rves as a guide fo goals, objectives, policies, and priorities for the State.

The Hawaii State ƹlanning ƶct {HRS 226) states that the State shall strive to ỉ prove the quality of life for Xawaii's present and future population through the pursuit of desirable courses of action in six major areas of statewide concern which merit priority attention: economic development, population growth and land resource management, affordable housing, crime and criminal justice, quality education and principles of sustainability.

In 2005, the %gislature aut?orized the c ations of a task fo ce to vie! the Xawaii state plan and the State's planning process and to prepare the Xa! ai'i 2050 ƹlan. #he creation of the Xa! aii 2050 sustainability plan raises questions about the long-term limits of growth in the State and highlights the ne * to begin planning an* acting to assure Xawaii's futu . #hus, t? objecti s of t? Hawaii 2050 sustainability plan focuses on the revitalization of the State's long-term planning process to better guide the future develop˘ nt of Hawaii.

The Plan offers * tailed strategic actions and indicators to ser e as a @uide to! ards˘ eeting the ƹlan's sustainability goals. #he ƹ%n incorporates tangible targets and benchmarks. ƹriority actions for 2020Y to be addressed immediately, include:

1. Increase affordable housing opportunities for households up to 140% of˘ edian inco˘ \
2\ Strengthen public education.
3. Reduce reliance on fossil (carbon-based) fuel
4. Increase recycling, reuse and waste reduction strategies.
5. Develop a more diverse and resilient economy.
6. Create a sustainability ethic.
7. Increase production and consumption of local foods and products, particularly agriculture.
8. Provide access to long-term care and elderly housing.
9. Preserve and perpetuate our Kanaka Maoli and island cultural values.

In 2011, the State established sustainability as a state priority b+ inco po ating the Xawaii 2050 sustainability plan *efinitions, guiding principles and goals, into chapter 226YHawaii > vised Statutes (the Hawaii state planning act).

"Sustainability" definition was added to the Planning Act as: "achieving the following:

(1) Respect of the culture, character, beauty, and history of the State's island communities;
(2) Striking a balance between economic, social, community, and environmental priorities; and
(3) Meeting the needs of the present without compromising the ability of future generations to meet their own needs."

The Act also added "principles of sustainability" as one of the six major areas of statewide concern which merit priority attention, economic development, population growth and land resource management, affordable housing, crime and criminal justice, quality education and principles of sustainability."

OEQC's Sustainable Building Design Guidelines

The Environmental Council, as part of a ^ƺlanner's Checklist," adopted Guidelines for Sustainable Building - sign in Xawai`i (October 13, 1999.| These guidelines do not constitute rules or law. A sustainable building is built to minimize energy use, expense, waste and impact on the environment. It seeks to improve the region's sustainability by meeting the needs of Xawai`i's esi*ents and visitors to*a+ ! ithout compromising the needs of future generations. Compared to conventional projects, a resource-efficient building project will:

1. Use less energy for operation and maintenance
2. Contain less *embodied* energy (i.e. locally produced building products often contain less *embodied* energy than imported products because they require less energy-consuming transportation.)
3. Protect the environment by preserving/conserving water and other natural resources and by minimizing impact on the site and ecosystems
4. Minimize health risks to those who construct, maintain and occupy the building
5. Minimize construction waste
6. Recycle and reuse generated construction wastes
7. Use resource-efficient building materials (e.g. materials with recycled content and low embodied energy, and materials that are recyclable, renewable, environmentally benign, non-toxic, %! VOC {Volatile O @nic Co pound) itting, durable, and that give high life cycle value for the cost.)
8. ƺ ovide the highest quality product practical at co p titive (affo dable) first and life cycle cos_

In the design and construction of Kapa Xighlands I, Three Stooges, LLC will seek to implement feasible measures to conform to these general guidelines.

Hawaii BuiltGreen Program

The Hawaii BuiltGreen ƺ ogram is a statewide p ogra to "incentivize" the designing and building of energy and resource ffici nt ?omes in Hawaii. Originally ±% oped in 2000 by a public/private partn rship between the State Dept. of Business, Economic Development ¡ #ouris {- <} - #|YUSDOE and five other partners. Now promoted by the State, BIA, Hawaii utilitcc ompanies and other organizations.

Hawai'i ltGr een is a self-certification program administered by the Building Industry Association of Hawai'i, ! hich is a professional trade organization affiliated ! ith the National Association of Xome Builders. This is a local initiative based on homegrown knowledge of professionals familiar with the unique conditions of Hawai The Ha! iltGrr een program focuses on design choices through:

- Protecting Site Features and Functions
- Energy Performance and Comfort
- Health and Indoor Air Quality
- Durability and Materials Conservation
- Environmentally-Friendly Home Op rations

US Green Building Council
Leadership in Energy and Environmental Design (LEED)

The US Green Building Council's Leadership in Energy and Environmental Design (L}} - | progra is a voluntary @een lding certification system, providing third-party verification that a building or community was designed and built using strategies aimed at improving performance across all the metrics that matter most: energy savings, water efficiency, CO_2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts.

Specific LEED programs include:

- Homes
- Neighborhood Development
- New Commercial Construction and Major Renovation projects
- Existing Building Operations and Maintenance
- Commercial Interiors projects

LEED for Homes is a voluntary rating system that promotes the design and construction of high performance "green" homes. A green home uses less energy, water and natural resources; creates less waste; and is healthier and more comfortable for the occupants.

LEED for Neighborhood Development is a collaboration between the U.S. Green Building Council, the Congress for the New Urbanism and the Natural Resources Defense Council. The LEED for Neighborhood Development Rating System integrates the principles of smart growth and green building into the first national standard for neighborhood design. LEED for Neighborhood Development recognizes development projects that successfully protect and enhance the overall health, natural environment and quality of life of our communities. The rating system encourages urban smart growth best practices, promoting the design of neighborhoods that reduce vehicle miles traveled and communities where jobs and services are accessible by foot or public transit.

ENERGY STAR Program

ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy.

In 1992Y t? US }n i on nta%P otection z@ncy {}PA) introduced ENERGY STAR as a voluntary labeling program designed to identify and promote energy-efficient products to reduce greenhouse gas emissions. Computers and monitors were the first labeled products. Through 1995, }ƺz expanded the %bel to additional office quipment products and residential heating and cooling equipment. In 1996, EPA partnered with the US Department of Energy for particular product categories.

The ENERGY STAR label is now on major appliances, office equipment, lighting, home electronics, and more. EPA has also extended the label to cover new homes and commercial and industrial buildings.

National Institute of Building Sciences
Whole Building Design Guide (WBDG)

The goal of 'Whole Building' Design is to create a successful high-performance building by applying an integrated design and team approach to the project during the planning and programming phases. The WBDG program is a collaborative effort among federal agencies, private sector companies, non-profit organizations and educational institutions. In buildings, to achieve a truly successful holistic project, these design objectives must be considered in concert with each other:

- Accessible: to address the specific needs of disabled people.
- Aesthetics: the physical appearance and image of building elements and spaces
- Cost-Effective: weighing options during concepts, design development and value engineering
- Functional/Operational: spatial needs and requirements, system performance durability and efficiency
- Historic ƨreser‑ation: ! hereby building %˝ tt s and strategies are classifiable into preservation, rehabilitation, restoration or reconstruction.
- Productive: physical and psychological comfort—including air distribution, lighting, workspaces, systems, and technology.
- Secure/Safe: physical protection of occupants and assets from man-made and natural hazards.
- Sustainable: Pertains to environmental performance of building elements and strategies.

Land Use and Development Practices - Low Impact Development (LID)

Land use practices can improve air quality, reduce stormwater runoff, increase energy efficiency and reduce greenhouse emissions to improve the quality of life for citizens. LID is a land development approach that allows land to be developed but in a manner that helps lessen potential environmental impacts. LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treat stormwater as a resource rather than a waste product.

By implementing LID principles and practices, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. LID has been characterized as a sustainable stormwater practice by the Water Environment Research Foundation and others.

In general, implementing integrated LID practices can result in enhanced environmental performance while at the same time reducing development costs when compared to traditional stormwater management approaches. LID techniques promote the use of natural systems, which can effectively remove nutrients, pathogens and metals from stormwater.

Conservation designs can be used to minimize the generation of runoff by preserving open space. Examples of Conservation Design include:

¢ Cluster development
¢ Open space preservation
¢ Reduced pa‑ ˘ ent widths {streets, sidewalks)
¢ Shared driveways

One Planet Living

One Planet Living is a vision of a sustainable world, in which people everywhere can enjoy a high quality of life within the productive capacity of the planet, with space left for wildlife and wilderness. Organizations around the world are using the one planet living approach to take measurable steps towards genuine sustainability. From zero carbon buildings to procurement policies that support the green economy, one planet living solutions are cost-effective, creative, inspirational and replicable.

- Zero Carbon - Making buildings more energy efficient and delivering all energy with renewable technologies
- Zero Waste - Reducing waste, reusing where possible, and ultimately sending zero waste to landfill
- Sustainable Transport - Encouraging low carbon modes of transport to reduce emissions, reducing the need to travel
- Sustainable Materials - Using sustainable and healthy products, such as those with low embodied energy, sourced locally, made from renewable or waste resources
- Local and Sustainable Food - Choosing low impact, local, seasonal and organic diets and reducing food waste
- Sustainable Water - Using water more efficiently in buildings and in the products we buy; tackling local flooding and water course pollution
- Land and Wildlife - Protecting and restoring existing biodiversity and natural habitats through appropriate land use and integration into the built environment
- Culture and Heritage - Reviving local identity and wisdom; supporting and participating in the arts
- Equity and Local Economy - Creating bioregional economies that support fair employment, inclusive communities and international fair trade
- Health and Happiness - Encouraging active, sociable, meaningful lives to promote good health and well being

Complete Streets

Complete Streets are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and transit riders of all ages and abilities must be able to safely move along and across a complete street. Complete Streets make it easy to cross the street, walk to shops and bicycle to work. They allow buses to run on time and make it safe for people to walk to and from train stations.

By adopting a Complete Streets policy, communities direct their transportation planners and engineers to routinely design and operate the entire right of way to enable safe access for all users, regardless of age, ability or mode of transportation. This means that every transportation project will make the street network better and safer for drivers, transit users, pedestrians and bicyclists – making your town a better place to live.

Natural and Cultural Resources

The preservation of the natural and cultural resources is essential for a prosperous and sustainable future. Kapa'a Xighlands II holds respect for the culture and the environment and will interlink natural features and cultural features as core components of the community. Archaeo%@cal and cultural sites ! ill be protect * and maintained with appropriate treatment and buffers from adjacent uses, as necessary.

No archaeo%gical or cultural historic sites are known to et on the property.

Brief discussions separately with historians of the subject area, Randy Wichman, Walter Smith and Albert Fukushi˘ a, conclud d that t? subject prop rty ?as been in sugar culti-ation since the 1800s until the early 1990s.

Albert Fukushima, who was employed by Lihue Plantation and worked in the subject area, said that no evidence of artifacts, bones, or other indicators of previous historic on-site activity were uncovered during the culti-ation of su@r. Randy Wichman and Walter Smith concurred that the subject land was consist ntly cultivated fo sugar for nearl+ a hundred years.

In 1995 SXgD stat* for the ^Site S% ction EIS_ for the adjacent Kapa'a ' id*% Sc?ool that the site may not be z chaeological o Xistorically rich because of the consistent culti-ation of sugar for nearly a hundred years.

In the late 1999, the Stat Xistoric gres rvation Division (SHPD) issued a letter of "no significanc _ to th potential developer at that time.

There]ists sparingly, vid nce of inactive sugar irrigation ditches. Nearly all have lost their banks and flattened out. Currently, SXPD ?as equested that the applicant record the %cations of the maining ˘ nants of the fo˘ er irrigation ditches prior to t? d- %p˘ nt sta@s\ T? z pp%cant is co˘ ˘ itt * to conducting and Archaeolo@cal Inventory Surv + at the time of *esign and - lop˘ ent phase in order to properly record the remains of the plantation irrigation ditches.

Should any archaeo%gically significant artifacts, bon s, or other indicators of previous historic on-site activity be unco- ed during construction, the Applicant is co˘ ˘ itted to their treat˘ ent b ing conducted in strict co˘ pliance with the require˘ nts of SHP- \

Additionally, whene- existing rocJ ! alls˘ ust be ˘ ov*Y the rocks from these walls will be s t aside and reused in the construction of new screen, buffer and retaining walls built ! ithin Kapa Xighlands I. Whenever feasible, rocks from Kapa Xighlands I will be used for such ! alls {˘ inimize importation of rock from offsit|\

Greenbelts

Greenbelts are undeveloped areas that surround the - %ped areas. Greenbelt is a strategic planning tool to pre-ent urban sprawl b+ keeping land per˘ anently open. #he purpos of the Greenbelt is to prevent urban sprawl, p - nt neighboring towns fro˘ ˘ rging into one anot?er, and to preserve the setting and the character of the area. Approximately 14.3-acres are proposed for open greenway areas.

Consistency with Regional Land Use Planning

Consistency with local land use planning documents is an essential element of sustainability. The local plans articulate and illustrate the community's vision. Without consistency with that vision, a development project cannot be sustainable.

Two primary planning documents address land use development in Kapa th General Plan of the County of Kaua'i and the Kapa- Wailua Basin Community Plan. Following are brief summaries of each.

The General Plan of the County of Kaua'i (General Plan)

The General Plan of the County of Kauai ("General Plan") was adopted in 1971 and updated in November 2000. The General Plan is a statement of the County's vision for Kauai and establishes strategies for achieving that vision. Section 7-1.2 of the amended Chapter 7 of the Kauai County Code states:

Pursuant to the provision of the Charter for the County of Kaua'i, the General Plan sets forth in graphics and text, policies to govern the future physical development of the county. The General Plan is intended to improve the physical environment of the County and the health, safety and general welfare of Kaua'i's people.

The General Plan states the County's vision for Kaua'i and establishes strategies for achieving that vision. The strategies are expressed in terms of policies and implementing actions. They may be augmented and changed as new strategies are developed.

The General Plan is a direction-setting policy document. It is not intended to be regulatory. It is intended to be a guide for future amendments to the lands regulations and to be considered in reviewing specific zoning amendment and development applications.

The vision, the maps and text policies, and the implementing actions are intended to guide the county actions and decisions. In addition, the maps and text policies are intended to guide the County in specific types of actions: making revisions to land use and land development Regulations; deciding on zoning changes; preparing and adopting Development Plans and Public Facility Plans; and preparing and adopting capital improvement plans.

The General Plan contains six major themes, each with various policies for implementation. The major themes are as follows:

1. Caring for Land, Water and Culture
2. Developing Jobs and Businesses
3. Preserving Kaua'i's Rural Character
4. Enhancing Towns & Communities and Providing for Growth
5. Building Public Facilities and Services
6. Improving Housing, Parks and Schools

In particular, the proposed reclassification of the Property responds and conforms to Theme No. 6. Market studies have shown that the population growth and correlating need and demand for housing is extremely high on Kauai.

The proposed reclassification, which will allow residents to purchase an affordable house and lot as well as allow other residents to purchase a lot to design and build their own homes, will present an opportunity to address the critical community need for residential housing. It should also be noted that the proposed development will assist in maintaining a viable economy as construction-related employment opportunities for residents would be generated.

Kapa'a-Wailua Basin Community Plan

The Kapaa-W ailua Basin community plan outlines the regional issues and opportunities that will be subjects for future community planning. A "Build-Out Analysis" of the Kapaa-Wailua Basin was prepared in the General Plan Update. As of 1998, this area had an estimated 4,700 dwelling units, making it the largest residential community on Kauai.

Based on the General Plan Land Use Map designations, the analysis found that an additional 4,000 units could be developed if the General Plan-designated lands were fully zoned, subdivided and built out. About 2Ɏ400 more units could be built in Urban >esidential areas, about 500 more in Rural esid ential areas and approximately 1,100 more units in the Agricultural areas. This would increase the housing units and population of the area by 85%.

The "Build-Out Analysis" specifically included the subject property as an "expansion area". The new General Plan Land Use Map designates the subject property as Urban Center.

The Kapa'a Xighlands II project confo˘ s to and ĭ plements t? policies of t? Kaua'i G neral ƺlan b+ developing within the designated Urban District, contiguous to Kapa town d its neighboring residential community.

Sustainable Design Features

Thoughtful planning of site, neighborhood and improvements design, incorporating mixed-use land uses, walkable streets, encouraging walking, bicycling and public transportation, and respect for the natural and cultural features creates opportunities for more environmentally-responsible and sustainable development. These sustainable neighborhoods are beneficial to the community, the individual and the environment.

Several sustainability programs and plans (noted previously in Chapter 2) identify and address a wide variety of design features that may be incorporated into a development project to enhance its sustainability. These items design features include:

- **Site Planning**
  - Respect for the Land – Work with topography
  - Siting - Proximity to mass transit, shopping, employment centers, recreation, schools
  - Interconnectivity – Connection with neighbors, Multi-modal transportation (to be discussed in another section of this Plan)
  - Intensity of Layout – Village Center; Clustering into compact villages
  - Natural/Cultural Resources – Protection of natural and cultural resources (to be addressed in another section of this Plan)

- **Improvements Planning**
  - Alternatives – Provide a range of housing options at various price levels (to be discussed in another section of this Plan)
  - Orientation – Ventilation; Take advantage of natural air flow
  - Shading – Eve overhang; Vegetation
  - Landscaping – Native plants; Low irrigation
  - Energy Efficiency – (to be discussed in another section of this Plan)

The objectives of Kapa Xighlands I are to create an attractive master-planned residential community with a variety of housing opportunities and mixed uses, as well as recreational resources.

Site Planning

As a mixed-use community, the objectives of Kapa a Hignds II are to:

- Create a diverse, sustained community of mixed uses, including residential, retail and commercial spaces, recreational spaces, and open space.
- ɒultivat intrinsic respect for the land and natural surroundings, %p an inherent Xawaiian sense of place and nourish a sustaining living environment.
- ƺrovide ?ousing for the ! orking fă ilies of Xawai'i nearby areas of ! o J force demand, resultantly improving overall quality of life through the reduction of commuting and facilitation of everyday function.
- Openly embrace a diversity of people and activities through offering mixed uses and housing types.
- Contribute to the social fabric of the community by providing infrastructure and facilities, and by including recreational, and civic sites.
- Engender and incorporate intelligent, planned sustainability by design.
- Emphasize non-vehicular transit for mainstream community-wide travel.

Kapa Xighlands I is strategically located north of Kapa'a to! . The Kapaa By-Pass Road separates the Kapa to! n and Kapa a Xighlands development. Kapa Xighlands is on the north-west corner of the Kapaa By-Pass Road and Olohena Road. Olohena Road runs along and adjacent to the east and north boundaries of the Property. The Kapa'a Middle School is located on the northern end of the Property fronted by Olohena Road. The area also has a long-standing and growing residential base.

This area will continue to be the focus of such development as the Island's population grows. This region is also the near commercial and industrial heart of Kaua, serving the needs of the visitor, residents and other industries of the western half of the Island.

Kapa Xighlands I is a compact, mixed-use, master-planned community offering a wide range of housing types and affordability, and a variety of businesses and employment opportunities with supporting retail, commercial, infrastructure, recreational and open space uses.

The Project proposes to develop Phase II of Kapa'a Xighlands into an approximatel+ 97-acre single-family and multi-family residential subdivision. Approxi ately 69-acres will be subdivided into single family lots ranging from 5,000 to 8,000 square feet and multi-family lots from 1-acre to 5-acre parcels. A total of 683 multi-family units and 86 single family units are planned. Open space encompassing 14.3-acres will be developed and associated infrastructure (e.g., new roadways, utilities, drainage, wastewater). Affordable housing will be provided in accordance with County of Kaua`i requirements.

A 3.1-acre park is proposed adjacent to the existing Kapaa Middle School. The park will have an area for the county's proposed relocation of the Kapa'a county swimming pool. A 0.4-acre parcel is proposed for commercial use. A country type store and small personal service types of use are anticipated. A remnant parcel of a one acre on the Makai side of the Kapa a Bypass road is also proposed as commercial use or for sub-stations for the police and fire departments. Approximately 14.3-acres are proposed for open greenway areas.

The site is presently fallow, undeveloped, and predominantly vegetated with weeds. The undesirable dumping of old cars, appliances, rubbish associated with undeveloped lands continue to exist on the property. The proposed project will increase the productive use of the property and significantly upgrade the immediate vicinity.

The proposed development will have minimal impact in terms of agriculture. Although the Property was previously used as part of large scale agricultural activities, it is presently fallow, and undeveloped. With the closing of the sugar plantations on Kauai, close proximity to existing residential areas, and demand for affordable housing, large-scale agricultural operations were not deemed feasible.

Construction of the proposed development will involve grading, excavation and trenching of presently undeveloped areas within the project site. The project will require alteration of existing landforms to create more efficient land development areas. Appropriate engineering, design and construction measures will be undertaken to minimize potential erosion of soils during construction.

On-Site grading and infrastructure improvements and residential construction will result in an increase in dust, storm run-offs and noise. The prevailing trade wind pattern is from the north-east directions. Potential airborne matters will generally be carried in the south-west direction, away from the school and existing residential areas. Ho! ver, on occasions, the ! sterl+ ! inds ay carry the potential

Kapa'a Highlands II Sustainability Plan

airborne matters towards the school and existing residential neighborhoods. Construction noise relating to infrastructure installations will be expected.

In the short term, during construction, measures will be taken to minimize impacts such as increased dust, noise and traffic. Construction activities shall co p% ! ith the pro isions of Hawaii z* inistrati Rules, S-11-60.11.33 on Fugitive Dust. Dust preventive measures will include;

- Planning of construction phases to minimize the amount of dust generating materials and activities, centralizing on-site vehicular traffic routes and locating of potential dust-generating equipment in areas of the least impact.
- Provide adequate water source at the site prior to start of construction.
- Landscape and provide rapid covering of bare areas developed during construction.
- Minimize dust from shoulders and access roads.
- Provide dust control measures during weekends, after hours, and prior to daily construction.
- Control dust from debris being hauled away from the site.

A national Pollutant Discharge Elimination System (NPDES) general permit will be acquired prior to construction to minimize storm run-offs during construction.

Mitigation measures will be instituted following site-specific assessments, incorporating structural and non-structural BMPs such as minimizing soil exposure and implementing erosion control measures such as silt fences and sediment basins. Following construction, erosion is anticipated to decrease since the soils will have been graded, built over, paved over or landscaped. Landscaping in turn will provide erosion control. Mass grading of the development areas will be in compliance with the County of Kaua'i's grading ordinance requirem nts and will quire N- }S per it from t?e State - OH for storm water construction activities, including BMPs to minimize off-site impacts.

The Property is encompassed by the Kapaa By-Pass Road to the south and Olohena Road to the east and the north side. The by-pass road is owned by the Applicant and the Applicant intends to dedicate said road to the Department of Transportation (DOT) for continued public use.

There is a round-about located at the south east corner of Olohena Road and the Kapaa By-Pass Road. Kuhio Hig?way is accessible from the Property b+ driving south on Olo? na and Kukui Street approximately 0.5 mile. The project will have a complete multi-modal roadway from the Kapaa By-Pass Road running north through the Property to Olohena Road. A couple of bus stops will be located along the roadway. A bike/walking path is proposed from the south of the property to the Kapaa Middle School located on the North portion of the Property.

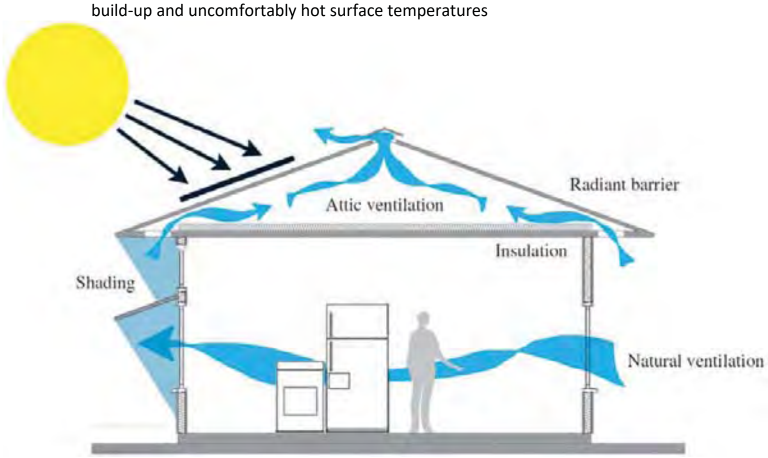
Improvements Planning

There are three major sources of unwanted heat in homes: direct solar impacts on a building and through windows and skylights; heat transfer and infiltration, of exterior high temperatures, through the materials and elements of the structure; and the internal heat produced by appliances, equipment and inhabitants.

The - BEDT Field Guide for Energy ɡerfoˇ ance, ꭥoˇ fort and Value in Xa! aii Xoˇ s provides a number of recommended ways to incorporate effective design options to address home temperatures. These items to be considered in the development of Kapaʻa Xighlands II are summarized and illustrated below:

Design for Comfort and Value

A. Control Heat Gain: Use strategies to reduce solar heat @in through roofs, walls and windows.
  1. Orient and arrange building to control heat gain
  2. Landscape and design outdoor surfaces to reduce air temperatures and glare; minimize paving area and use grassed and planted areas to provide lowered site temperatures, shade and evaporative cooling
  3. Shade roofs, walls and windows with:
     a. Architectural elements such as eaves, awnings and carports, and
     b. Window treatments such as blinds and shutters
  4. Use insulation and/or radiant heat barriers in roofs and walls exposed to the sun
  5. Use high perfoˇ ance ! indows {Lo! -e, spectrally selective, or tinted glazing) to keep solar heat out of interior spaces while admitting daylight
  6. Use light colored roofing and wall finishes
  7. Shade or insulate materials with high thermal mass, such as concrete floors, to avoid heat build-up and uncomfortably hot surface temperatures



B. Use Natural Ventilation: ɡro ide ample fresh air ventilation for living spaces and areas where hot air and humidity accumulate, such as attics, high ceiling spaces, kitchens, bathrooms and laundry areas.
  1. Orient buildings to maximize the cooling potential of prevailing winds and minimize morning and afternoon heat gain
  2. Design floor plans and opening placement and type to provide effective cross ventilation with good air circulation throughout room areas and at body level
  3. Provide generous screened openings well protected from the rain

  4. e architectural design elements such as vents and casement windows to improve interior air circulation
  5. Enhance natural ventilation with fans as needed:
     a. Use ceiling and who% house fans to provide coˇ fort on warm, humid or still days
     b. Use solar po! red at vent fans when appropriate and economically feasible

Shaded areas stay cooler

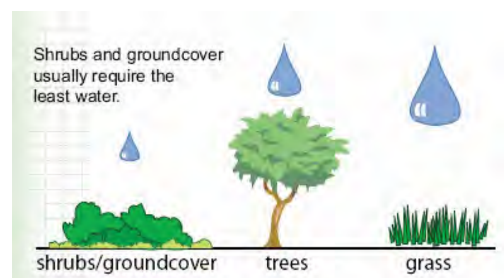
Consistent with the principles and recommendations noted in the DBEDT publication *Hawaiʻi Homeowner's Guide to Energy, Comfort & Value*, to the extent feasible and practical, Kapa Xighlands II will incorporate the following:

Site Planning and Landscaping

Orientation of homes is important. Try to minimize the area of east- and west-facing walls and windows because they are difficult to shade from the sun.

Landscaping and the design of outdoor surfaces can reduce air temperatures and glare. Landscaping minimizes paving area provides lowered site temperatures, shade and evaporative cooling.

Low impact landscaping. Selection and distribution of plants must be carefully planned when designing a functional landscape. Aesthetics are a primary concern, but it is also important to consider long-term maintenance goals to reduce inputs of labor, water, and chemicals. Properly preparing soils and selecting species adapted to the microclimates of a site greatly increases the success of plant establishment and growth, thereby stabilizing soils and allowing for biological uptake of pollutants. Dense, healthy plant growth offers such benefits as pest resistance (reducing the need for pesticides) and improved soil infiltration from root growth. Low impact landscaping can thus reduce impervious surfaces, improve infiltration potential and improve the aesthetic quality of the site.



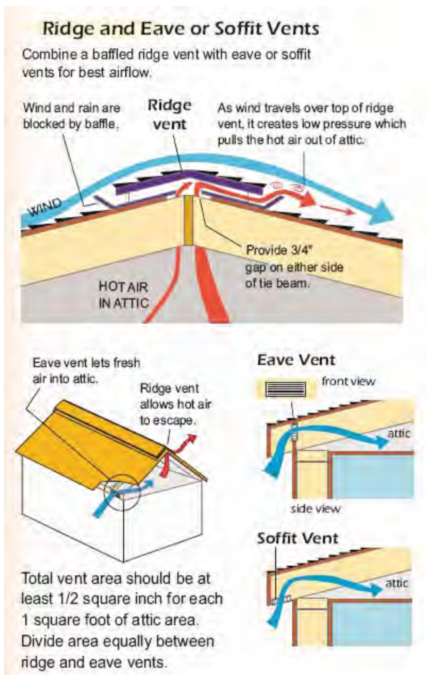
Protect and retain existing landscaping and natural features. Select plants that have low water and pesticide needs, and generate minimum plant trimmings. Use coˇ post and mulches. This will save water and time.

<u>Examples of Low Impact Landscaping</u>

- Planting native, drought tolerant plants
- Converting turf areas to shrubs and trees
- Reforestation
- Encouraging longer grass length
- Planting wildflower meadows rather than turf along medians and in open space

Control Heat Gain

By using strategies to reduce solar heat gain through roofs, walls and windows, a house can stay cool. Roofs, walls, windows and outdoor flooring can be shaded with architectural elements such as eaves, awnings and carports, and shutters.



Walls

Unshaded ! alls can @t ry ?ot and ˇ aJ your home uncomfortable. The best "cool wall" strategy is shading with overhanging eaves, lanais, or landscaping. If complete shade isn't feasible, use insulation o radiant barriers in the exposed walls. Use a white exterior finish to improve cool wall performance.

Windows

The use of high performance windows (Low-e, spectrally selective, or tinted glazing) helps keep solar heat out of interior spaces while admitting daylight. Overhangs, awning and trees can keep the sun from striking windows directly.

Roofs and Roofing Material

A cool roof is essential for a comfortable home. Insulation keeps roofs and homes cool by blocking heat on the roof thus, the attic, the ceiling and the rest of the house stay cool and comfortable. Installing a white roof will keep a home cooler.

Ventilation is another tool for keeping homes cool. For houses with attics good ventilation is recommended. Ridge and Eave or Soffit Vents work as well. If a ridge vent is not feasible, use a solar powered vent fan in combination with eave or soffit vents, to push warm air out of the house and attic.

Solar Water Heating

' inimizing the nergy [uired for water ?eating is t?e most important nergy saving st p for a Hawaii home. Conventional water heating is a big expense and accounts for about 40% of the utility bill in a Hawaii house.

Hawaii was the first state in the nation to require solar water heaters in new home construction. Act 204 SLH 2008, requires all building permits for single-family homes issued after Jan. 1, 2010, to include solar water heaters. Exceptions are allowed where homes have poor sunlight; if it is cost-prohibitive after 15 years; when the dwelling has a substitute renewable energy source; or if there is an approved tankless water heater and another appliance, both powered by gas.

Additionally insulating hot water supply lines and pipes with at least ½" foam or 1" fiberglass insulation and setting heater thermostats adjustable for 120F or less, can add additional energy savings to a homeowner.

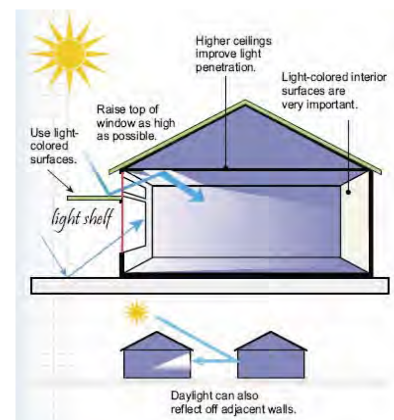
Photovoltaic systems

Alternative energy sources such as photovoltaics and fuel cells that are now available in new products and applications will be available as a house feature option. Renewable energy sources provide a great symbol of emerging technologies for the future.

Lighting

Energy Efficient Light Design

Energy efficient light design features help minimize electric lighting energy demand and heat gain. An efficient lighting system uses fluorescent lamps as the primary light source and may selectively use incandescent (also halogen, a type of incandescent) for accent lighting and for applications where the light is usually off (like exterior lights on motion sensor controls). Modern fluorescent lighting can provide excellent color rendering and be free of flicker and hum. Additionally, start up is nearly instantaneous with electronic instant-start and rapid-start ballasts. Fluorescent lamps last 10 to 20 times longer than incandescents, saving energy all the while, so the lifetime cost is much lower and fluorescent lights do not emit as much heat as incandescents.

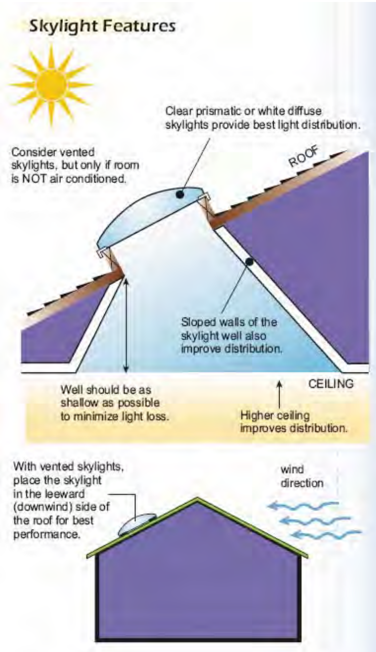


Providing controls such as timers, dimmers, sensors and separate fan/light controls to limit power use to the times and levels needed, also helps reduce lighting power consumption.

The use of solar powered landscape lighting when economically feasible is another energy saving design feature which can be used for both residential homes as well as business and civic buildings and spaces.

Daylighting

Daylighting is the use of natural sunlight to light interior spaces. Using controlled, filtered and indirect daylighting to light interior spaces reduces electric lighting loads. The effectiveness of daylighting can be increased with generous wall openings, open floor plans and light colored interior finishes.



Windows are usually a ?ǒ˘ e's ˇ ain source of daylight. Blocking direct sunlight and bouncing light on to the ceiling helps facilitate daylighting. Minimizing areas of east- or west-facing windows and using blue or green glass help.

Skylights (traditional, vented, tubular) can provide significant daylighting opportunities.

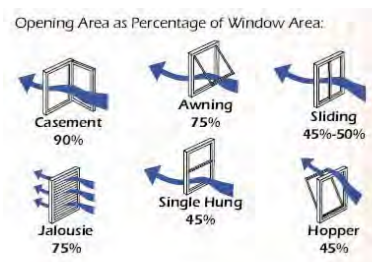
Light-colored interior finishes are critical for good light distribution thus, white ceiling is recommended.

Rooms with higher ceilings and narrow floor plans are easier to daylight. Consider several smaller skylights instead of one larger skylight for better light distribution.

Natural Ventilation

Kapa Xighlands I will optimize air-flow by designing homes that capture cooling breezes to keep ?ǒ˘ es comfortable. Utilizing natural ventilation also helps reduce health hazards such as mold and mildew.

Buildings should be oriented to maximize the cooling potential of prevailing winds and minimize morning and afternoon heat gain. Floor plan design will include effective cross ventilation with good air circulation throughout room areas and at body level.



Providing generous screened openings and using architectural design elements such as vents and casement windows will improve interior air circulation.

Ceiling fans are a great way to enhance natural ventilation. Use ceiling and whole house fans to p ovid comfort on warm, humid or still days.

Transportation

The Property is encompassed by the Kapa a By-Pass Road to the south and Olohena Road to the east and the north side. The by-pass road is owned by the Kapa'a Highlands II which is working with the Department of Transportation (DOT) and has been allowing for the continuous public use of the road. The by-pass road is in the process of being dedicated to DOT. The agreement of transfer will include that all mitigating measures will be the shared responsibility of DOT and Kapa'a Highlands II.

There is a round-about located at the south east corner of Olohena Road and the Kapa'a By-Pass Road. Kuhio Highway is accessible from the Property by driving south on Olohena and K¨Juī Street approximately 0.5-mile. The project will have a main roadway from the Kapa'a By-Pass Road running north through the Property to Olohena Road. The roadway will follow the county's resolution for complete roads and as such will be a multi-modal roadway. A couple of bus stops will be located along the roadway. A bike/walking path from the round-about south east of the property will follow the bypass road, connect to the main road and continue to the Kapaa Middle School located on the North portion of the Property. Kap'a Xighlands II is continuing to wo J with the DOT on potential traffic issues.

Transportation, housing, land use and infrastructure need to be integrated and incorporated into Kaua'i's long-term transportation policies as the population continues to grow in the years ahead. The Kaua'i General Plan, includes the following policies:

Bus Transit.

- Continue to operate The Kaua i Bus; seek to increase ridership and expand service, subject to the availability of funds.
- Improve bus stops to increase safety and convenience of service.
    - Improvements to pullover areas along roadways in order to create safe and accessible bus stops.
    - Designated areas at housing projects (particularly those with elderly and disabled residents) that provide safe and accessible paratransit stops.

Bikeways.

- Support funding to develop Kauai' s bikeway system to provide for alternative means of transportation, recreation, and visitor activities (economic development).

Regional Highways and Roads.

- Use General ʐlan polici s concerning ural character, preservation of historic and scenic resources, and scenic roadway corridors as part of the criteria for long-range highway planning and design. The goal of efficient movement of through traffic should be weighed against community goals and policies relating to community character, livability, and natural beauty.
- Consider transportation alternatives to increasing the size and capacity of roadways. Alternatives include increased utilization of public transit.
- Planning for the Kapaa By-Pass should incorporate connector roads between the By-Pass and the coastal highway and between the By-Pass and roads serving the valley.
- The State and the County should jointly undertake a study of the existing roadway network and the future transportation needs within the Kapa'a-Wailua homesteads area.

- Reser e corrido s for future oa*! ays as shown on the General ƺlan Land Use Map. The corridors are conceptual only and are subject to environmental assessment and evaluation of alternative alignments.

Kapa Xighlands is committed to Multi-modal, Interconnected and Concurrent Transportation for its residents and community.

Multi-modal Interconnected Roads and Streets

The proposed main complete, multi-modal roadway through the development will include bus stops, sidewalks and a bike and walking path connecting from Kapa'a Middle School down through the development to the round-about, facilitating green travel to and from Kapaa's town core.

Kapa'a Highlands II incorporates multiple road interconnections with neighbors.

Kapa Xighlands I will incorporate a system of interconnected roads that will provide residents alternative transportation routes within the project. The internal circulation pattern will provide safe and convenient choices for drivers, bicyclists and pedestrians.

Additional sustainable connectivity concepts including bikeways and walkways to and from the planned County pool, neighborhood commercial areas, the middle school and Kapa 'a's town core are planned.

Complete Streets

Through recent legislation, the State of Hawaii Department of Transportation (HDOT) and county transportation departments are required to ensure the accommodation of all users of the road, regardless of their age, ability, or preferred mode of transportation. In addition, the concept of "Complete Streets" is prioritized where:

> "(T)ransportation facilities ... are planned, designed, operated and maintained to provide safe access and mobility for all users, including bicyclists, pedestrians, transit riders, freight and motorists".

In addition to providing vehicle access, roadway networks are a vital part of the livability of our communities. Complete streets will provide an ease of use and access to destinations by providing an appropriate path of travel for all users, and enhance the ability to move people and goods throughout the state and its counties.

Additionally, complete streets principles will help contribute to a clean and secure energy future for Hawaii by offering flexibility and better accommodation for safe transit, walking, bicycling and alternate fuel vehicles that together, will decrease demand for imported oil.

Complete Streets are streets for everyone. They are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and public transportation users of all ages and abilities are able to safely move along and across a complete street.

Complete Streets make it easy to cross the street, walk to shops, and bicycle to work. They allow buses to run on time and make it safe for people to walk to and from transit stations.

Economic Opportunities

Kapaa Highlands II provides significant, ongoing economic and fiscal benefits for residentsofKaua'i,aswellasfortheC ountya ndStategovernments.

Development of facilities would generate employment and consequent income andtaxes.Inaddition,by providingtheopportunity fornew residentstotheIsland of Kaua'i and generating additional real estate sales activity, the Project is expected to support long term impacts, including additional consumer expenditures,employ mentopportuni ties,personal incomeandgo vernmentrev enueenhancement.

On a shortterm basis, the proposed development will have a direct beneficial impact on the local economy during construction through construction and constructionrelated employment. It should also be noted that the proposed development will assist in maintaining a viable economy as construction relatedemploymentopportunities forr esidentswouldbegenerated.

Over the long term, the residential homeowners will require various services related to home maintenanceandimprovementthatwill furthersu pportthelocaleconomy.

On-Site Employment Generators

Kapaa Highlands II proposes two areas for commercial uses that, ultimately, will serve to promote and provide a variety of job opportunities. A 0.4a cre parcel is proposed for commercial uses such as a country store and small personal service type uses are anticipated. A 1acre site on the Makai side of the Kapaa Bypass Road is also proposed for commercial development or for use as substations for the policeand/orfiredepartment.

Open Space and Parks

Kapa Xighlands I holds respect for the environ˘ ent b+ interlinking natural features and open space as co e components of the community.

There are se eral parJs ! ithin Kapa a to! nY inc%*in@a b ac? pa J\ A Count+ o! ned 1.9-acr park is located ! ithin wa%ing distance from the Property, just south ast of the corner of Olo?ena >oad and the b+-pass oad ound-about. #? park consists of a baseball field, football field, bask tball courts, restroom facilities, picnic tables and a barbecue area.

Open space and open @ nway areas encompassing 14.3-acres will be *%op within t? project. z 3.1-acr park is proposed ! ithin the project for outdoor ecreation. Land for the proposed %ocation of the Kapa'a county s! imming pool ! ill be available ! ithin the 3.1-acr park. #?e pro ision of a 3.1-acr park ! ith a county swi˘ ing pool within t? proposed *% op˘ ent will p o ide resid nts with an opportunit+ fo leisur ly creational activities.

Kapa Xighlands II is conforms with HRS § 2-a- 2(B) (3) {z} ! hich states that CZM's objective is to ^prot ct, preserve and, where desirable, estore or i˘ pro e the quality of coastal scenic and open spac resourc

The polici s to achieve this objecti are as follows:

1. Identify alued sc nic resources in the coastal zone˘ anag ment area`
2. Ensure that new *% opments a co˘ patible wit? their isual environment by *esigning and locating such develop˘ ents to˘ inimize the alteration of natural landfo˘ s and existing public views to and along the sho eline;
3. ʒreserve,˘ aintain, and, ! here *esirable, improve and resto e sho eline open space and scenic resourc s; and
4. Encourage those de %opm nts which are not coastal dependent to %cate in inland area.

No sc nic, ?istoric, cultural spaces exist or will be c ated on the subject site and sit is ! ll away fro˘ the sho eline. #? are no natural wildlife, forest,˘ arine, or unique cological pres s on o near the subject site. Thus, open space and recreation ! ill not be adversely affected. ʒark and beaches of Kapa'a are within walkin@distances fro˘ the proj ct

The proposed project ! ill not adversely impact sc nic o open space sources. #he proposed project will not involve significant alteration of the existing topographic character of the site and will not affect public views to and along t?e shor line.

Kapa'a Highlands II Sustainability Plan

Water Management

As an overarching philosophy in all source alternatives, Kapa'a Highlands II is co˘ ˘ itt* to ! ater cons rvation strategies to educe consu˘ ption, conser e sourc s and minimize water use. #? @al is to duce the total ! ater us t? gg h a combination of water saving equipment and strategi s.

A number of ˘ easur s ˘ ay be i˘ p%˘ nted to facilitate end-user conservation, including ! ater strictions during drier periods, public ducation and more fficient landscaping practices. Consumption could be significantly reduced through end-user conservation.

Efficient fixtures and appliances ! ill reduce indoor ! ater u. The water *istribution syst ˘ ! ill be maintained to pre ent water %ss and ho˘ own rs and businesses will be ncouraged to maintain fixtures to prevent leaks. Landscaping ! ill˘ phasize climat-adapted native and other appropriate plants suitable for coastal locations. < st˘ anag ˘ nt practices will be * signed and imple˘ ent d to ˘ inimize infiltration and runoff fro˘ daily operations.

WaterSense

WaterSense, a partnership program by the U.S. Environmental Protection Agency, seeks to protect the future of our nation's water supply by offering people a simple way to use less water with water-effici nt p oducts, new ?o˘ s, and services. WaterS nse brings tog t? r a variety of staJ? olders to

- Promote the value of water efficiency.
- Pro ide consu˘ s with asy ways to sa water, as both a label for p oducts and an information esource to ?elp people use water more efficiently.
- Encourage innovation in manufacturing.
- - crease ! ater use and duce strain on wat r resou ces and infrastructure.

The program seeks to ?%p consumers make smart ! ater c?oices that save˘ oney and˘ aintain ?igh environ˘ ental standards without co˘ p o˘ ig performance. ʒ oducts and s ices that have arned the WaterSense label have been certified to be at %ast 20 percent˘ o e efficient without sacrificin@ performance.

If one in y 10 ?omes in the United Stat s ! to install Wat rSense %beled faucets or faucet accessories in t? ir bat?roo˘ s, it could sav 6 billion gallons of ! at pe +ear, and˘ o than $50 ˘ illion in the nergy costs to supply, heat, and treat that wat

Water Efficient Fixtures

Water is a finite resource—even though about 70 perc nt of the Earth's surface is covered by ! ater, l ss than 1 percent is available for ?u˘ an use. Each z˘ ican uses an a erage of 100 @llons of water a *a+ at home. We can all use 30 percent less water by installing water-effici nt fixtures and pliances. The average household spends as˘ uch as ¬500 per +ear on their wat r and sewer bill and can save about $170 p r y ar b+ installing water- fficient fixtures and appliances.

Water- fficient fixtures reduce water and s ! r costsYreduce de˘ and on ! ater supplies and treat˘ ent facilities, and reduce heating energy consu˘ ption and associated greenhouse gas e˘ ission

High efficiency toilets: (HETs) educe flush olumes b+ no less than 20% compared to con ntional ultra-low flo! {ULFT) toilet. Dual-flush X — allow users to choose one of t! o f%shes: liquids or solids. In actual operation, dual-flush X — average about 1.2 to 1.4 gpf. Pressure- t XETs a pressurize* tank that creates for a more forceful flush with less water.

Faucets: Wa r flow is * uced by ***Flow limiters*** which are built into the faucet or ar installed as after-market fittings. Aerato s o %˘ inar flow ices ar types of flow limiters.

- Aeration injects air into the strea˘ of wat r, *isplacing much of the water content.
- Laminar flow uses multiple small dia˘ ter parallel streams of water that are not aerated.

Flow control valves can limit water flow down to 1.5 to 0.5 gpm per side (hot an* cold).

Showerheads: Federal law since 1994˘ andates that all showerh ads sold in the United Stat s use 2\5 gpm or less. - spite this, so˘ showerheads actually use˘ uch˘ ore than 2.5 @m, and sho! er towers that include multiple sho! rheads or jets can total 12.5 @m or˘ ore. A better option is a @o* quality low- ow showerhead * signed to use 2.0 gp˘ or less while providing satisfying shower.

Groundwater

A Water Master ƹlan ?as been appro ed, in concept, by the ɷounty Depart˘ nt of Wat {- OƱ|\ Kapa Xighlands II has a pro en well site that ! ill be *edicated to the DOW to feed the - epartment of Water's storage tanks and existing water syste˘ . Kapa'a Xighlands II is co˘ ˘ itted to ! orking with t? DOW on pertinent wat r issues during the design and %pment phas

The proposed ! ater syst m will b subject to @ulation as a public ! at syste˘ and will ˘ et conditions of the State Departm nt of Health, including HAR Chapter 11-20, 11-21 an* 11-25.

Kapa Xighlands, ƹ?ase II consists of approximate 97-acres on the eastern half of t? 163.1-acr es of Kapa Xighlands. The proposed * %opment is not anticipated to have significant adverse ĭ pacts on ground water because no active ! ater syst ˘ s are on the 97-acres. The irrigation facility for this former sugar land is no %nger available.

A stream exists on Kapa a Xighlands I, flowing f o˘ no t? to sout? a%n@t? w st n bo * of t? 163\123-acres of Kapa'a Hi@lands . Kapa'a Highlands II is co˘ ˘ itted to J eeping the flow of the stream consist nt to pre ent any potential ? alth and˘ osquito probl˘ s associated ! ith rr eams when not flowing naturally.

Storm and Surface Water Runoff

A ƹreliminary - rainage > port ?as been prepared. A detailed - rainage and Erosion Mitigation ƹlan ! il% be prepared and submitted to the ɷount+ Engineer for approval during the design and elo pment stages. The Applicant will be pro iding˘ ajor *rainage improve˘ ents in connection with * %opment of the property. Multiple *etention ponds are p opos d for the propert+. Additionally, a series of catch basins, drainage, pipes and culverts ! ill be utilized to direct run off to˘ ajo *rainage areas on the property.

The project's proposed *rainage syst˘ ! ill be *esigned to˘ ini˘ ize ĭ pacts to near sho e coasta% waters. Ʊ ater quality treatment and * tention basins will be built to prevent runoff and s dimentation from impacting groundwater resources. Prior to the occupancy of any residential or commercial unit within the project, Kapa a Highlands I shall implement and˘ aintain storm and surface-water runoff BMPs, subject to any applicable review and approval of the State DOH, design* to prevent violations of State water quality standa * s as a result of storm-water discharges originating from the project. These <'ƹ s will be docu˘ ent d in a declaration of co enants, conditions and restrictions that will be reco ** against the property and ! ill run with the land.

ƹotential water quality ĭ pacts during construction of the project will be˘ iti@ted by adherence to State and County ! ater [uality regulations @verning @ading, excavation and stockpiling. The ɷounty's grading ordinance includes pro isions related to ducing and˘ inimizing the *ischarge of pollutants associated ! ith soil disturbing activiti s in grading, grubbing and stockpiling.

Construction <' ƹ will b utilized in co˘ plianc ! ith County ordinances pertaining to @ading, grubbing, stockpiling, soil erosion and sedim ntation during constructio. BMPs will also be imp ˘ ent d for %ng ter˘ * % opment and op ation of acti ities occurring on the site as part o pollution prevention measures.

<' Ps include sto˘ ! ater runoff and non-sto˘ water sources control˘ asures and practices that ! ill be imp%˘ nted to˘ ini˘ ize the *ischarge of rosion and other pollutants fro˘ entering into t? receiving State waters. The erosion control plan for the p oposed proj ct include t ˘ porary and permanent control˘ asures <' ƹs that ! ill be imp%˘ nted in accordance ! ith Chapter 10 of t? Hawai'i County ɷo*\

Post construction <' Ps to pre ent osion and storm water unoff after construction is completed inclu the installation of *rain inlets and shallow * +wells ! ithin the project site, and landscaping and grassing of disturbed areas

Prior to occupancy, Kapa a Xighlands I will implement and˘ aintain sto˘ and surface-water runoff BMPs, subject to any applicable eview and appro al of the - . Those <' ƹs ! ill be *esigned to prevent violations of State wat r quality standards as a result of storm-water *ischarges originating from the Project.

Wastewater

Kapa Xighlands I The project will be contributing to the *eferred maintenance and repair of t? Kapaa Waste Water Treatment plant. #?e proj ct will not be a detriment to the capacity of the Plant.

Energy Management

Pursuant to Chapter 344 (State Environmental Policy) and Chapter 226 (Hawai'i State Planning Act), HRS, all Kapa Xighlands I activities, buildings and grounds will be designed with a significant emphasis on energy conservation and efficiency. Efficient design practices and technologies will be the cornerstone of Kapa Xighlands I's design phase. Buildings within Kapa Xighlands I will further comply with the County of Kaua'i Energy Conservation Code (Kaua'i County Ordinance 890). Furthermore, solar water heaters will be utilized as made requisite under Section 196-6.5, HRS. Kapa Xighlands I will confer ! ith KIUC in regards to suggestions and proposals for customized demand-oriented management programs offering rebates for the installation of alternative energy efficient technologies and measures

	Kaua	Oahu	State
'* iŭ Incŏ (2009)	$55,723	$67,019	$63,741
Electricity Price (May 2011)	44.27 cents/kWh	30.1 cents/kWh	-

Kapa Xighlands I is committed to renewable energy and energy efficiently as ways to reduce environmental harm and self sufficiency. Kapa Xighlands I will continue to improve programs and create new programs as the development is initiated.

Residents of the State of Hawaii pay the highest electricit rates in the US. #? average American pai* 10.5 centsQŌh in 2010. In the state of Xawaii, Oa hu currently has the lowest residential electricity rates, while Lanai has the highest. Residential rates on Kaua average b tween 40-45 cents/kWh. Hawaii relies on ĭ po ted oil for appro]ĭ ately 76% of its total % ctricit+ production. #he price variation across the state is largely a result of difference in power plant efficiencies, power purchasing agreement and other infrastructure.

The Kaua'i Island Utility Cooperatie (^KIU") is the sole electric utility on Kaua. KIUC began serving the people of Kauai on November 1, 2002, when it purchased Kauai Electric from Connecticut-based Citizens Communications. KIUC is America's newest %ectric coop rate, but it's by no means the only one. It is one of approximately 900 electric cooperatives serving electric consumers in 47 states. Like all cooperaties, KIUC operat s as a not-for-profit organization that is owned and controlled by the people it serves. KIUC serves o 23,300 customers with 92% of KIUC's % ctricity coming from the burning of imported fossil fuels.

In 2009 the State Legislatu e co*ified the need fo nergy effici ncy by nacting the stat ! ide en@+ efficiency portfolio standard with a target of reducing energy consumption by 30% of forecasted energy consumption by 2030 (4,300 GWh) and beginning the process for separating efficiency from the existing renewable portfolio standard.

Energy efficiency in homes and buildings

- Hawai'i Revised Statutes section 46- 9\6 quires all county agencies to place a ^priority on processing of permit applications for construction projects incorporating energy and environmental design building standards."

To reduce net energy consumption and demand, Kapa'a Highlands II will consider the implementation of % ˇ ents of the United States }nvironmental ƹ ot ction ƶgency {}ƹƶ) Energy Star ƹro@ǎ ` including efficient insulation, high performance windows, compact construction, efficient ventilation systems, and energy efficient lighting elements and appliances.

Kapa Xighlands will furthermore seek to harness energy conservations and technologies to facilitate the possibility of net energy metering in building design to empower residents and tenants to reduce their electricity costs and provide energy back to the grid.

Energy conservation and efficiency measures will be implemented and emphasized where applicable in the design of Kapa'a Highlands II. Energy-efficiency technologies to be considered include:

- Solar energy for water heating
- Photovoltaic systems, fuel cells, biofuels and other renewable energy sources
- Optimal utilization of daytime sunlight
- High efficiency light fixtures
- Roof and wall insulation, radiant barriers and energy efficient windows
- Optimized air-flow
- Installation of heat resistant roofing
- Intelligent Landscaping to provide fo shading, dust contro%and heat-mitigation
- Portable solar lighting (i.e. parking lots)

A photovoltaic system that can generate up to 1.18 MW of electricity is situat * in P?as I of t? Kapa'a Highlands project. Its op rato ntered into an agr ment to sell to Kaua'i Island Utility Cooperative electricity generated from the solar farm for 20 years. ^Creating more renewable energy alternatives is one of the most critical challenges we face," Kauai Mayor Bernard Carvalho said at a dedication ceremony for the solar farm.

The project spr ads oer fie acr s of a 165-acre property, and has 5,376 solar panels mounted on posts and piers. #? panels a age about12 -feet off the ground.

Health and Active Lifestyles

Through the layout and design of Kapaa Highlands II, there is an overall opportunity for a positive effect on the health of its residents. Communities that make it easy and safe to walk and ride bikes are opening the door to a wide range of health benefits for their residents. They are reducing barriers to being physically active and helping individuals integrate physical activity into their daily lives.

Active living is a way of life that integrates physical activity into daily routines. For individuals, the goal is to get a total of at least 30 minutes of activity each day by, for example, walking, bicycling, playing in the park, working in the yard, taking the stairs, or using recreation facilities. For communities, the goal is to provide opportunities for people of all ages and abilities to engage in routine physical activity and to create places and policies that encourage better physical health.

The burden of physical inactivity:
The Problem:

- 25% of adults are sedentary
- 60% of adults not active enough

The Outcome:

- Obesity, cardiovascular disease, cancer, diabetes, depression
- Physical inactivity is a primary factor in over 250,000 deaths annually.
- Medical costs associated with physical inactivity and its consequences may exceed $76 billion annually. (hawaii.gov/health/healthy-lifestyles)

Walkable and bikable communities increase active living. Active living can improve health by:

- Reducing the risk of dying prematurely.
- Reducing the risk of dying from heart disease.
- Reducing the risk of developing diabetes, colon cancer and high blood pressure.
- Reducing feelings of depression and anxiety.
- Helping control weight.
- Helping build and maintain healthy bones, muscles and joints.
- Promoting psychological well being. (Michigan Department of Community Health)

Growing body of evidence:

- San Diego study: 70 minutes more physical activity/week among residents in walkable neighborhood; 35% vs. 60% overweight (Saelens, Sallis, et. al. 2003)
- 6 lb weight difference in sprawling vs. compact counties
- King County study: 5% increase in neighborhood's "walkability index" correlated with 32% increase in active transportation; 0.23 point reduction in BMI (Frank, Sallis, et. al. 2006) (hawaii.gov/health/healthy-lifestyles)

Community Design Policies Work! The Task Force on Community Preventive Services concluded that:

- Community-scale policies & design are effective
  - o Zoning for compact, mixed-use development
  - o Transit-oriented development
  - o Policies related to street design & connectivity

- Street-scale policies & design are effective:
  - o Traffic calming
  - o Street lighting
  - o Improving street crossings (hawaii.gov/health/healthy-lifestyles)

Education

Schools servicing the project include Kapa   Elementary, Kapa‘a ' iddle Schoo%and Kapa‘a High Schoo%

Kapa‘a Mi**% Sc?oo%bo *   s t?   p oj ct sit   to t?   no t?\K Kapa‘a E%˘   nta + School and Kapa‘a Xigh School share a campus ! ?ich is appro] imately 2-miles from the project site.

Kapa   }%mentary School serves @ads K-5 and is on   of the largest % ˘   entar+ schoo% in t?   state. It shares a campus ! ith Kapa‘a Xigh School. Kapa‘a } lementary School's capacity is 1,373 students, and the 2009/2010 school year enrollment ! as 827 students (Department of Education, 2010a)

Kapa   ' iddle School, wit? facilities for 1,059 st   nts, was opened in 1997 and has an   nrollment of 652 students (- epartment of Education, 2010b).

Kapa   High School currently ha   a student bo*+ numbering 1,033 with a capacity of 1Y445 (Department of Education, 2010c).

The proposed project ! ill generate increased *˘   an* on student   nrollment ! ithin the region\ Kapa Highlands II will coordinate with the - OE to   nsure t?at the - OE's facility assessm nt policy pro isions are appropriat%+ addresse

Additionally, a 3\1-acr   park is proposed adjac nt to the existing Kapa'a ' iddle School. #he park ! ill have an area for the county's proposed relocation of the Kapa'a county swimming poo   Kapa Highlands II also plans to *%   op a bike/walking path from the south of the property to t?   Kapa'a ' iddle School to facilitate biking and walking around the de %opment.

Housing

Kapa   Xighlands I is a !% l located˘ aster planned project on t?   Island of Kau " targeting primary ?ousing *˘   and from local and in-migrant families, as well as offsho   secon hom * ˘ and for iew state own rship. Locat d in t? ˘ id*% of t?   is%an*Yt?   p oj ct is c%s   o t?   c nt   s of e˘ p%+˘   nt an* r so t acti it+Y plus the airpo t, beaches, s?opping, recreation etc. It sits abo e the historic town of Kapaa and below the foothills of the˘ ountain chain that forms the island.

The proposed * %opment, Kapa'a Xighlands ʓhas   II, ! ill utilize 163-acres of land for single-family and ˘ ulti-fa˘ ily residential an* comm rcial purpos s.   %p˘ ent of t?   ʓ operty will address a portion of t?   significant * ˘ and for affordable housing in t?   County of Kaua'i, ! ithout significantly affecting reser e ar as for foreseeab% urban growth.

Kapa'a Highlands II will r spond to varying spectrums of de˘ and for housing wit?in K И"   by providing a wide range of housing opportunities inclusive of affo dable housing alternativ s. Kapa'a Highlands ‖ will seek to create and sustain a mix* -incom   co˘   unit+ allowing for unparalleled social di   rsit+\

Affordable ?ousing * ˘ ands exhibited a significant upward trend o er the last several + ars. Recent market studies ?a e indicated a current shortage of single-family ?ousing in the East Kaua'i area. #? forecast is that * ˘ and for ?ousing will continue to increas , specially in the ar a of affordabl housing. #he p opos d *   %pment will assist in alle iating so˘   of the current supply-and-deman* pressures on Kaua'i's current ?ousing˘ arket by pro iding a variety of additional housing products and opportunities for long-term local r sidents.

The Kawaihau ʓlanning - istrict has substantial capacity fo   additional   sidential *   %p˘ ent, as described in S ction 6\2\3\1 (Build-Out Analysis) of the Kaua'i General ʓ%n.   "Lands p viousl+ designated for urban use but as +et mostl+ undev %ped include an area %cat d near Kapa'a, south of Olo?ena Road. This area was pre iously *esignated fo U ban Mi]   * Us   an* is s?o! n as U ban C nt on t?   new GP Land Use ' ap. O! ned partl+ by the State and partl+ by z˘ fac/¯'<   (or its successo |Y this "expansion area_ fo   Kapa'a has already accommodated the Kapa'a Middle Schoo%\

In a 2010 letter to the applicant, the ʓlanning - irector ! ote ^Ȭe are ! riting in general support of Three Stoo@s LLC's petition to a˘ end 97-acres in Kapa'a a to the Urban *istrict. #?   propos * amend˘ ent is in confo mance with the Ωounty of Kaua'i's General ʓlan and will pro ide 231 units of affordable ?ousing. Affo * able ?ousing ˘   ains an acute need on Kaua'i, even ! ith a falling real estat ˘ arket and as such the County is @enerally suppo tive of any petition that proposes additiona% affordable ?ousing, particularly ! ? n contiguous to * % oped urban areas, infrastructure and consist nt ! ith our General Plan."

Current Housing Stock

The housing stock on Kaua'i is primarily single famil+Y69%, with attached ?ousing only at 31%. Around 40% of all single-family ?o˘   s are built on lots siz*   %ss than 10,000 sf. The condo˘   inium stocJ is 64% fee-si˘ ple and 34% %as hold. It is also only 10% owner occupied, with the balance of the units invest-= owned, either in a rental pool, or part of a ?otel operation. About 30% of the condo units were built since 1990Y! ith most of the rest around 25 + a s or˘ o   in age. 38% of the condominium units are one bedroo˘   s, with t! o bedroo˘ s   45%.

Housing Mix

target market for this *evelopment is relati%y broad, as Kapa'a is arguab% at t center of t? island, ! ith strong retail and recreational faciliti s, and easy com ute to t! o out o the three ajo reso t areas on the island. The * and for affo *able ?ousing is also significant. #he propos * *% opm will not on% address a critical community n d, it will also pro ide residents with a unique opportunit+ to purchase a lot and construct a hom that best fits their needs on the p opos * *% opment's marJ et-priced lot

Kapa'a Highlands II – Market Housing Mix {2010 dolla

Type	Average Sales Price	Lot Size	Total Units
Single-Family Lots	$180,000 to $250,00	5,000 to 8,000 Sq. Ft.	86-lots
Multi-Fami% Units	$220,000 to $450,00	1 to -acr ꞔarcels	683-units

Kapa'a Highlands II – Affordable Housing Mix (2010 dollars)

Type	Average Sales Price	Lot Size	Total Units
Single-Family	$189,00 to $363,000	1,100 to 1,200 Sq. Ft. li ing area	-= %ts
Multi-Fami% Units	$189,00 to $363,000	750 to 1,200 Sq. Ft. living a ea	154-units

Affordable Housing

An affordable ?ousing % nt of the project is p oposed and will confo to Kaua'i County Ordinanc No. 860, Kaua'i's new housing policy wherein developers contribute up to thirty percent (30%) of t? total residential units for affordable housing.

The Kaua'i ?ousing policy pro ides incentives to * elopers !? o pro ide the quired affordabl units on-site and for providing single family affordable units. Kapa'a Highlands ! ill be providing all of its affordable units on site and will include affordable single family units. #his will reduce the numb r of affordable units equired fro appro]i ately 205 units {30%) to appro]i ately 167 units {21.7%|Y assuming a ix of 13 single family units and 154 multi-family units. #? number of affordable units required will fluctuate * pending on how an+ affordable single fa ily units are provided. #? proposed development will provid uch needed affo dable housing in the East Kaua'i region

Under the proposed *% opment's preli inary arketing concept, the affordable units are anticipated to be sold in the range of ¬189,000.00 to ¬363,000.00, which will be affordable to families earning from 80% up to 140% of the County's annual dian income.

Anticipated Buyer Markets

The proposed products respond to the a ket opportunities identified above as follows:

Entry-level markets – #?ose units *esignated as affordable units, as well as any of the ultifa i% arket units are conc ived to appeal to ntry-level arkets, typified by the rapi*ly increasing 25- to 3-yea -o% Echo Boo cohort\

Move-up markets – Kapa a Xighlands II's single-family lot p oducts could appeal to ove-up markets and gro! ing fa ilies.

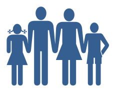
- The first level move-up arket, typified by persons aged 35 to 44, is projected to gro! particularly rapidly in the 2020 to 2030 perio* as the Echo <oomers ature.
- A ore affluent ove-up arket could also be att acted to the views, conveni nt %cation and lifestyle offerings at Kapa Highlands II.

Based on the ꞔ oject %cation, *% opment concept and the co parison p ojects surveyed, some 75% of Kapa Highlands I residents are anticipated to be %ng-term Island esid nts. Ho! Y so e product typ s could also appeal to s cond home buyers, locating retirees o others that a+ co from off-Island

There has been strong * mand historically fo these products offerings at these price rang s, and th future should be no differ nt. The location is + desirable, particularly for %cal buyers, but also fo offsho second hom o! ners ! ?o ! ant to feel a part of a 'no al' {but n! o upgraded| neighborhood (to sa+ nothing of wantin@to tak advantage of the vie! s).

Despite current conomic conditionsYt? is capacit+ amongst prospecti buyers, thanks to a strong build up in their o! n home quity. Coupled ! ith a * sire to secure a central %cation fo t? ir hom Y there should be a goo*ly number of lots purchased ! ? n they come to arJ t (particularly there is advanced notification).

Social Sustainability



A community is composed of people, as well as places where they live; it is as much a social environment as a physical development. Thus, communities must not only be environmentally sustainable, they must also be socially sustainable.

A socially sustainable development supports more equitable distribution of resources, supports diversity within the community, meets the basic needs of residents and invests in social and human capital, thereby sustaining the quality of life and community livability for all residents into the future.

Socially sustainable development includes the following:

- recognizes, respects and values cultural and social diversity;
- preserve and maintains a high quality of life for all of its residents;
- meets basic needs of food, shelter, education, work, income and safe living and working;
- is equitable, ensuring that the benefits of development are distributed fairly across society;
- promotes education, creativity and the development of human potential;
- preserves our cultural and biological heritage, thus strengthening our sense of connectedness to our history and environment;
- is democratic, promoting citizen participation and involvement;
- promotes the context of "Live Aloha," with people living together harmoniously and in mutual support and respect for each other

We saved the concept of Social Sustainability for the end of the analysis, to serve as a summary of the many socially-focused actions suggested in prior sections of this Sustainability Plan. Following are just a few of the issues previously mentioned:

- Affordable housing will be incorporated within the development, allowing for a diversity and mix of housing types and options
- Complete streets with walkways and bile lanes, allowing for slow movement through the neighborhoods for easy social interaction
- Space for the relocated County swimming pool
- Allocation for commercial spaces, affording project residents the opportunity to work near where they live
- Proximity to the Middle School affords multi-generation al interaction and learning
- Cooperation with the State by making land available for the Kapa'a Bypass Road, helping regional residents
- Project layout and design will create an opportunity for both residents and the community to have a positive effect on their health through walkable and bikable transportation options.
- Consistency with long range planning documents, implementing the community's vision for the future

Exhibit C

Agricultural Master Plan for HoKua Place (Formerly Kapa'a Highlands II)

EXHIBIT "C"

Kapaa Highlands
Agricultural Master Plan

June 1, 2007

Agricon Hawaii LLC
P.O. Box 95
Kamuela, HI 96743

Table of Contents

A. SUMMARY

Livestock (goats) can be raised successfully at Kapaa Highlands. Climate conditions will allow for normal pasture rotation the year around. The ratio of livestock to fenced pasture should be 3 animal units (AU) to 1 acre or better.

The climate and soils at Kapaa Highlands are not ideal for the growing of most commercially viable crops due to the poor soil, strong trade winds, and the salt spray from the ocean.

Goats are sold for their meat value and the local markets on all of the islands are excellent. The intended markets for goats raised on the property are the local Kauai market and the Honolulu market.

The Economics for Goats included in this report provides a picture of expected revenue and classifications of operating expenses associated with a livestock (goat) operation ("Project").

The Association of Condominium Owners of the Kapaa Highlands Condominium ("Association") may choose to operate the Project on behalf of participating owners. Alternatively, the Association may choose to enter into a contractual relationship with a livestock contractor pursuant to a license agreement in which the livestock contractor will pay an annual rent per acre to graze the property, plus a percentage of gross profits.

Livestock grazing is a permissible use within the agricultural districts as outlined under Hawaii Revised Statutes (HRS) Chapter 205, Section 205-4.5.

B. DESCRIPTION

The Kapaa Highlands Subdivision is located in Kapaa, above the Kapaa Bypass Road and adjacent to Kapaa Middle School. The property is further identified by Kauai Tax Map Key No. (4) 4-3-03:01. The total land area is 163.125 acres and the combined grazing area is approximately 101.573 acres.

Almost all of the property is located in the State Land Use Commission Agricultural District and within the Agriculture District of the Comprehensive Zoning Ordinance of the County of Kauai (CZO). As such, owners of subdivision lots will be required to comply with the requirements of HRS Chapter 205 and the CZO. Individual lot owners, through the Association, will be required either to provide a portion of their lot for the grazing of livestock as outlined in this Agricultural Master Plan, or to obtain an amendment to this Agricultural Master Plan to conduct alternative agricultural activities. The Kapaa Highlands is shown on the map attached hereto as Exhibit "A".

Kapaa Highlands Agricultural Plan
June 1, 2007

C. ENVIRONMENTAL SUITABILITY

1. Climate

The property is exposed to the northeast trade winds and, due to the proximity of the property to the ocean the trade winds will carry some salt spray to the property. This is problematic for most commercial crops, but should have no impact on livestock and minimal impact on salt resistant grasses. Annual rainfall is generally between 40 and 50 inches.

2. Soil

The soils are generally well-drained, dark reddish-brown silty clay and silty clay loam. The soil depth is generally between 10 and 15 inches.

The property was previously planted to sugar cane and due to the nature of sugar cane cultivation, these soils can be expected to be low in organic matter and have a low pH (very acid).

A Soils Map for the property is attached hereto as Exhibit "B", and a Soils Inventory (containing technical descriptions of soil types) is attached hereto as Exhibit "C".

The Land Study Bureau Land Classification for this property is B, C, D and E lands, as shown on the Detailed Land Classification Maps attached hereto as Exhibits "D" and "E".

3. Drainage

All the soils on the property are well drained indicating that, if good conservation practices are used, they should not erode.

D. CROP SUITABILITY

Due to the generally poor soils and harsh climate, the commercial crops most suited to the area are sugar and pineapple. Both of these industries are declining in Hawaii. Pineapple is no longer grown on Kauai and there is only one sugar mill that remains in operation. With appropriate irrigation and management, both tropical orchard crops (including trees) and some vegetable crops could be grown on the property, although with some difficulty and risk given the physical conditions at the property.

E. LIVESTOCK

1. Association Project

The Association may choose to operate the Project on behalf of all participating owners. In such case, the Association would be responsible for the rotation, care and marketing of the animals. The participating owners would be responsible for providing fixed assets (fences, gates, and water systems) on the owners' lots. The participating owners would be required to pay their proportionate share of all operational costs to the Association, and would be entitled to their proportionate share of all profits generated by the Project.

2. Contractor Operation

As an alternative, the Association could hire an independent contractor ("Contractor") to operate the Project. In such a case, the Contractor would own the goats and be responsible for the rotation, care, and marketing of the animals. The Association, through the participating owners, would be responsible for the fixed assets. These assets would include the fences, gates, and water systems. The Contractor would pay the Association a fixed rent per acre of pasture plus a percentage of gross profits, and would be responsible for normal maintenance of the fixed assets associated with the livestock operation.

3. Individual Goat Operators

The Owner may elect to engage in individual goat raising operations within the Owner's Agricultural Area of the Owner's Lot ("Owner's Operation"). In such case, the following shall apply:

a. The Owner shall be solely responsible for the costs of the Owner's Operation.

b. The Owner shall raise a minimum of three (3) goats for each acre within the Owner's Agricultural Area.

c. The Owner shall submit reports to, and as required by, the Association providing pertinent information concerning the Owner's Operation and in such detail as to comply with and satisfy the reporting requirement contained in the Agricultural Subdivision Agreement and the County Subdivision Approval.

Kapaa Highlands Agricultural Plan
June 1, 2007

4. Goat Husbandry

It is recommended that a breeding herd with a ratio of 1 buck to 50 does be maintained. Does will produce an average 1.5 kids per year. Kids can be weaned at approximately 5 to 6 months and should be separated from the breeding herd at this point. The gestation period for a doe is approximately 5 months.

The carrying capacity of the pasture at Kapaa Highlands is approximately 3 to 4 animal units (AU) to the acre. The breeding herd that consists of bucks and does is considered to be one AU per animal. Kids are ½ AU per animal. Therefore, assuming all of the owners became participants in the Project, there would be 101.573 acre of pasture available to carry 355 AU at 3.5 AU per acre. Attached hereto as Exhibit "F" is a spreadsheet entitled "Economics for Goats" which contains detailed assumptions regarding carrying capacity.

The breeding herd should be given good pasture and be kept on a strict health program so that its production of kids is at its optimum. The herd should be wormed every 30 to 60 days and provided with a mineral supplement. The water requirement for goats is between 2 and 3 gallons per day per AU. This will be dependent upon climatic conditions. Supplemental feeding is generally not required unless rainfall diminishes over several months to a point where the grass growth is insufficient to maintain the herd. At this point, the contractor has the option of providing supplemental feed or moving some or all of the goats to another location.

Goats are marketed at between 6 and 9 months of age at a weight of between 60 and 80 pounds. The estimate market price per goat ranges from $140 and $180. The primary market is the Kauai Island market that commands a higher price. The secondary market is Honolulu. The freight to Honolulu is paid by the buyer. Goats are generally sold to individuals who slaughter them for their meat. The market in Hawaii for goats is very stable.

The Economics for Goats spreadsheet contains details on the economics of the livestock (goat) operation.

F. HRS 205 COMPLIANCE

Hawaii Revised Statutes Chapter 205 establishes classifications of lands and requirements for land use. Section 205-4.5 defines permissible uses within the agricultural districts. This section also defines the soil classification rating that applies to the Chapter.

Section 205-4.5 uses the Land Study Bureau's (LSB) soil classification productivity rating system to determine which lands are to be governed by the Chapter. The LSB ratings for Kapaa Highlands are B, C, D and E. Land classification ratings A and B are restricted to the permitted uses as outlined in the section. The cultivation of crops and the raising of livestock are permitted uses. Uses on C, D and E lands also include crop cultivation and the raising of livestock.

G. CONCLUSION

The climate and soils at Kapaa Highlands are not ideal for the growing of most commercially viable crops due to the poor soil, strong trade winds, and the salt spray from the ocean. Thus a livestock operation provides an economically viable agricultural use for the property.

Either the Association operation of a livestock project, or a contractual relationship between the Association and a livestock Contractor, would allow the agricultural component of the property to be managed as one unit. Individual lot owners would also have the option of compliance with alternate methods of livestock grazing or with the cultivation of agricultural crops, provided they obtained the approval of the Planning Commission of the County of Kauai, Subdivision Committee, for an amendment to this Agricultural Master Plan for such alternative agricultural activities.

Livestock grazing is a permissible use within the agricultural districts as outlined under HRS Chapter 205, Section 205-4.5.

Exhibit "A"

Subdivision Map

Exhibit "B"

Soils Map

EXHIBIT "C"
Soils Inventory Report

USDA

Soils Map

Date: 5/31/2018

Field Office: LIHUE SERVICE CENTER
Agency: USDA-NRCS
Assisted By: GENOA STARRS

State and County: HI, Kauai County, Hawaii
Land Units: (4) 4-3-003:001
Approximate Acres: 163.13

Legend

600 0 600 1,200 Feet

1 inch = 600 feet

Rice Soils Map

MUSYM, MUNAME

- HnA;Hanalei silty clay, 0 to 2 percent slopes, MLRA 167
- IoB;Ioleau silty clay loam, 2 to 6 percent slopes
- IoC;Ioleau silty clay loam, 6 to 12 percent slopes
- IoD2;Ioleau silty clay loam, 12 to 20 percent slopes, eroded
- IoE2;Ioleau silty clay loam, 20 to 30 percent slopes, eroded
- LhB;Lihue silty clay, 0 to 8 percent slopes
- LhC;Lihue silty clay, 8 to 15 percent slopes
- LhD;Lihue silty clay, 15 to 25 percent slopes
- MZ;Marsh
- Mta;Mokuleia clay loam, poorly drained variant
- PkB;Pohakupu silty clay loam, 0 to 8 percent slopes
- PnB;Puhi silty clay loam, 3 to 8 percent slopes
- rRR;Rough broken land
- Rice Poly Layer

N

Soils Inventory Report

TMK (4) 4-3-3:1

Map Unit Symbol	Acres	Percent
HnA	1.4	1%
IoB	44.5	27%
IoC	16.2	10%
IoD2	10.7	7%
IoE2	24.7	15%
LhB	8.4	5%
LhC	0.8	0%
LhD	4	2%
Mta	3.2	2%
MZ	0.3	0%
PkB	0.9	1%
PnB	31.9	20%
rRR	15	9%
Total:	162	

Hanalei Series

This series consists of somewhat poorly drained to poorly drained soils on bottom lands on the islands of Kauai and Oahu. These soils developed in alluvium derived from basic igneous rock. They are level to gently sloping. Elevations range from nearly sea level to 300 feet. The annual rainfall amounts to 20 to 120 inches. The mean annual soil temperature is 74° F. Hanalei soils are geographically associated with Haleiwa, Hihimanu, Mokuleia, and Pearl Harbor soils.

These soils are used for taro, pasture, sugarcane, and vegetables. The natural vegetation consists of paragrass, sensitiveplant, honohono, Java plum, and guava.

Hanalei silty clay, 0 to 2 percent slopes (HnA).

This soil is on stream bottoms and flood plains. Included in the areas mapped on Kauai along the Waimea River and in Waipaoiki Valley are small areas where the surface layer is 8 to 10 inches of reddish-brown silty clay. Included in the areas mapped on Oahu were small areas of very deep, well-drained alluvial soils and small areas of very poorly drained to poorly drained clay soils that are strongly mottled and are underlain by peat, muck, or massive marine clay.

In a representative profile the surface layer, about 10 inches thick, is dark-gray and very dark gray silty clay that has dark-brown and reddish mottles. The subsurface layer is very dark gray and dark-gray silty clay about 3 inches thick. The subsoil, about 13 inches thick, is mottled, dark gray and dark grayish-brown silty clay loam that has angular blocky structure. The substratum is stratified alluvium. The soil is strongly acid to very strongly acid in the surface layer and neutral in the subsoil.

Permeability is moderate. Runoff is very slow, and the erosion hazard is no more than slight. The available moisture capacity is about 2.1 inches per foot of soil. Roots penetrate to the water table. Flooding is a hazard.

Representative profile: Island of Kauai, lat. 22°12'37.8" N. and long. 159°28'47" W.

Ap-0 to 6 inches, dark-gray (10YR 4/1) silty clay; common distinct mottles of dark brown (7.5YR 4/4), red (2.5YR 5/8), and dark reddish brown (5YR 3/4) ; weak, coarse and medium, granular structure; very hard, friable, sticky and plastic; abundant fine and medium roots; many fine and medium pores; very strongly acid; abrupt, wavy boundary. 4 to 6 inches thick.

A1g-6 to 10 inches, very dark gray (10YR 3/1) silty clay; many distinct mottles of dark reddish brown (5YR 3/4), yellowish red (5YR 4/8), dark brown (7.5YR 4/4), and dark grayish brown (10YR 4/2); weak, coarse, prismatic structure; very hard, firm, sticky and plastic; abundant fine and medium roots; common fine and medium pores; strongly acid; gradual, smooth boundary. 3 to 5 inches thick.

A3g-10 to 13 inches, mixed, very dark gray (10YR 3/1) and dark gray (10YR 4/1) silty clay; many distinct mottles of yellowish red (5YR 4/6) and dark reddish brown (2.5YR 3/4); weak, coarse, prismatic structure; very hard, firm, sticky and plastic; common medium and fine roots; many fine and medium pores, slightly acid, gradual, smooth boundary. 2 to 4 inches thick.

B21g-13 to 18 inches, mixed, dark-gray (10YR 4/1) and dark grayish-brown (10YR 4/2) silty clay loam; many distinct mottles of strong brown and dark red (2.5YR 3/6); massive, but a few pockets have weak, medium, angular blocky structure; hard, firm, sticky and plastic; few medium and fine roots; many fine and medium pores; neutral; gradual, smooth boundary. 4 to 7 inches thick.

B22g-18 to 26 inches, dark grayish-brown (10YR 4/2) silty clay loam; many distinct mottles of dark red (2.5YR 3/6) and strong brown (7.5YR 5/6); weak, coarse, prismatic structure breaking to weak, fine and medium, angular blocky; slightly hard, firm, sticky and plastic; few medium and fine roots; many fine and medium pores; neutral; gradual, smooth boundary. 7 to 9 inches thick.

C-26 to 36 inches, dark grayish-brown (10YR 4/2) silty clay loam; common distinct mottles of strong brown (7.5YR 5/6), dark red (2.5YR 3/6), and red (2.5YR 4/6); massive; slightly hard, friable, sticky and plastic; few medium roots; many, fine and medium, tubular pores; slightly acid; water stands above this layer.

The A horizon ranges from 10YR to 2.5Y in hue, from 3 to 4 in value, and from 1 to 2 in chroma. Mottles range from a few faint ones to many distinct ones. The B horizon ranges from 10YR to 2.5Y in hue, from 2 to 4 in value, and from 1 to 2 in chroma. Mottles in the B and C horizons range from few to many. The depth to the seasonal high water table ranges from 2 to 5 feet. The C horizon is stratified. It ranges from silty clay to sand in texture.

This soil is used for taro, pasture, and sugarcane. (Capability classification IIw, irrigated or nonirrigated; sugarcane group 3; pasture group 7; woodland group 4)

Hanalei silty clay, 2 to 6 percent slopes (HnB).

On this soil, runoff is slow and the erosion hazard is slight. This soil is used for sugarcane, taro, and pasture. (Capability classification IIw, irrigated or nonirrigated; sugarcane group 3; pasture group 7; woodland group 4)

Hanalei stony silty clay, 2 to 6 percent slopes (HoB).

This soil has a profile like that of Hanalei silty clay, 0 to 2 percent slopes, except that it is stony. Runoff is slow, and the erosion hazard is slight. Stones hinder machine cultivation.

This soil is used for sugarcane and pasture. (Capability classification IIw, irrigated or nonirrigated; sugarcane group 3; pasture group 7; woodland group 4)

Hanalei silty clay, deep water table, 0 to 6 percent slopes (HrB).

This soil has a profile like that of Hanalei silty clay, 0 to 2 percent slopes, except that it has fewer mottles and the water table is at a depth of more than 3 feet. Included in mapping were small areas of stony soils.

This soil is used for sugarcane, taro, pasture, and vegetables. (Capability classification IIw, irrigated or nonirrigated; sugarcane group 3; pasture group 7; woodland group 4)

Hanalei silty clay loam, 0 to 2 percent slopes (HmA).

This soil has a profile like that of Hanalei silty clay, 0 to 2 percent slopes, except for the texture of the surface layer. Also, this soil is underlain by sand at a depth of 30 to 50 inches. Included in mapping was an area on the Hanalei River bottom that is less than 30 inches deep over sand.

This soil is used for taro, pasture, and sugarcane. (Capability classification IIw, irrigated or nonirrigated; sugarcane group 3; pasture group 7; woodland group 4)

Hanalei peaty silty clay loam, 0 to 2 percent slopes (HpA).

This soil has a profile like that of Hanalei silty clay, 0 to 2 percent slopes, except for the texture of the surface layer. Also, the water table is at the surface.

This soil is used for pasture. (Capability classification IVw, irrigated or nonirrigated; sugarcane group 3; pasture group 7; woodland group 4)

Ioleau Series

This series consists of well-drained soils on uplands on the island of Kauai. These soils developed in material weathered from basic igneous rock, probably mixed with volcanic ash. They are gently sloping to steep. Elevations range from 100 to 750 feet. The annual rainfall amounts to 40 to 70 inches. The mean annual soil temperature is 72° F. Ioleau soils are geographically associated with Lihue and Puhi soils.

These soils are used for irrigated sugarcane, pasture, pineapple, irrigated orchards, irrigated truck crops, wildlife habitat, and woodland. The natural vegetation consists of lantana, koa haole, guava, and associated shrubs and grasses.

Ioleau silty clay loam, 6 to 12 percent slopes (IoC).

This soil is on ridgetops in the uplands.

In a representative profile the surface layer is darkbrown and yellowish-red silty clay loam 15 inches thick. The subsoil, 40 to 60 inches thick, is dark-brown and dark reddish-brown silty clay that has subangular blocky structure and is very compact in place. The substratum is soft, weathered rock. The soil is very strongly acid to extremely acid throughout.

Permeability is slow. Runoff is medium, and the erosion hazard is moderate. The available water capacity is about 1.4 inches per foot of soil. Roots penetrate to a depth of 15 to 25 inches or to the plow depth.

Representative profile: Island of Kauai, lat. 22°07'32.9" N. and long. 157°13'03" W.

Ap1-0 to 6 inches, dark-brown (7.5YR 3/4) silty clay loam, brown (7.5YR 4/4) when dry; cloddy, breaking to moderate, fine and very fine, subangular blocky structure; hard, firm, sticky and plastic; abundant medium and fine roots and plentiful very fine roots; very strongly acid; abrupt, wavy boundary. 6 to 8 inches thick.

Ap2-6 to 15 inches, mixture of yellowish-red (5YR 4/6) silty clay loam, strong brown (7.5YR 5/6) when dry; massive; slightly hard, friable, sticky and plastic; and yellowish-red (5YR 4/8) silty clay, reddish brown (5YR 4/4) when dry; strong, very fine, subangular blocky structure, hard, firm, sticky and plastic; few medium roots and plentiful fine and very fine roots; common fine pores; very strongly acid, abrupt, wavy boundary. 7 to 10 inches thick.

B21t-15 to 27 inches, dark reddish-brown (5YR 3/4) silty clay, reddish brown (5YR 4/4) when dry; strong, fine and very fine, subangular blocky structure, very hard, firm, sticky and plastic; very few fine and very fine roots; common very fine pores, very compact in place; many moderately thick clay films on ped faces; very strongly acid; clear, wavy boundary. 5 to 12 inches thick.

B22t-27 to 38 inches, dark-brown (7.5YR 3/2) silty clay, yellowish red (5YR 3/6) in pores, dark brown (7.5YR 4/4) when dry; strong, fine and very fine, subangular blocky structure; very hard, firm, sticky and plastic; very few fine and very fine roots; few medium pores and many very fine pores; compact in place; many moderately thick clay films on ped faces and in pores; few pebbles; very strongly acid; clear, wavy boundary. 9 to 11 inches thick.

B23t-38 to 57 inches, dark-brown (7.5YR 3/3) light silty clay, dark brown (7.5YR 4/4) in pores, dark brown (7.5YR 4/4) when dry; strong, fine and very fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few medium, fine, and very fine roots; many very fine pores; patchy, moderately thick clay films on ped faces; continuous in pores; few pebbles; extremely acid; clear, wavy boundary. 15 to 22 inches thick.

B24t-57 to 61 inches, dark reddish-brown (5YR 3/4) silty clay loam, reddish brown (5YR 4/4) when dry; moderate, fine and very fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; no roots; many very fine pores patchy, moderately thick clay films on ped faces; continuous in pores; extremely acid.

The A horizon ranges from 5YR to 10YR in hue. In places the texture of the A horizon is clay loam. The B horizon ranges from 2.5YR to 7.5YR in hue, from 3 to 4 in value, and from 2 to 6 in chroma. The depth to the very compact B21t ranges from 15 to 25 inches.

This soil is used for sugarcane, pasture, pineapple, orchards, and truck crops. (Capability classification IIIe, irrigated or nonirrigated; sugarcane group I; pineapple group 6; pasture group 6; woodland group 6)

Ioleau silty clay loam, 2 to 6 percent slopes (IoB).

This soil has a profile like that of Ioleau silty clay loam, 6 to 12 percent slopes, except that it is 10 to 20 inches deeper to the compact layer. Runoff is slow, and the erosion hazard is slight. Roots penetrate to a depth of 25 to 40 inches.

This soil is used for sugarcane, pasture, pineapple, orchards, and truck crops. (Capability classification IIe, irrigated or nonirrigated; sugarcane group 1; pineapple group 5; pasture group 6; woodland group 6)

Ioleau silty clay loam, 12 to 20 percent slopes, eroded (IoD2).

This soil is similar to Ioleau silty clay loam, 6 to 12 percent slopes, except that it is moderately steep and part of the surface layer has been removed by erosion. Runoff is rapid, and the erosion hazard is moderate to severe.

This soil is used for sugarcane, pineapple, and pasture. (Capability classification IVe, irrigated or nonirrigated; sugarcane group 1; pineapple group 6; pasture group 6; woodland group 6)

Ioleau silty clay loam, 20 to 35 percent slopes, eroded (IoE2).

This soil is similar to Ioleau silty clay loam, 6 to 12 percent slopes, except that it is steep and most of the surface layer has been removed by erosion. Runoff is rapid, and the erosion hazard is severe.

This soil is used for pasture, woodland, sugarcane, pineapple, and water supply. (Capability classification VIe, nonirrigated; pasture group 6; woodland group 6)

Lihue Series

This series consists of well-drained soils on uplands on the island of Kauai. These soils developed in material weathered from basic igneous rock. They are gently sloping to steep. Elevations range from nearly sea level to 800 feet. The annual rainfall amounts to 40 to 60 inches. The mean annual soil temperature is 73° F. Lihue soils are geographically associated with Ioleau and Puhi soils.

These soils are used for irrigated sugarcane, pineapple, pasture, truck crops, orchards, wildlife habitat, woodland, and homesites. The natural vegetation consists of lantana, guava, koa haole, joee, kikuyugrass, molassesgrass, guineagrass, bermudagrass, and Java plum.

Lihue silty clay, 0 to 8 percent slopes (LhB).

This soil is on the tops of broad interfluves in the uplands. Included in mapping were small areas of a soil that has a very dark grayish-brown surface layer and a mottled subsoil.

In a representative profile the surface layer is duskyred silty clay about 12 inches thick. The subsoil, more than 48 inches thick, is dark-red and dark reddish-brown, compact silty clay that has subangular blocky structure. The substratum is soft, weathered rock. The surface layer is strongly acid. The subsoil is slightly acid to neutral.

Permeability is moderately rapid. Runoff is slow, and the erosion hazard is no more than slight. The available water capacity is about 1.5 inches per foot of soil. In places roots penetrate to a depth of 5 feet or more.

Representative profile: Island of Kauai, lat. 21°59'06.7" N. and long. 159°21'50" W.

Ap1-0 to 6 inches, dusky-red (2.5YR 3/2) silty clay, yellowish red (5YR 4/8) when dry; cloddy breaking to weak, fine and medium, subangular blocky structure; very hard, firm, sticky and plastic; abundant roots; common very fine and fine pores; many black concretions; strong effervescence with hydrogen peroxide; strongly acid; abrupt, smooth boundary. 4 to 8 inches thick.

Ap2-6 to 12 inches, dusky-red (2.5YR 3/2) silty clay, yellowish red (5YR 4/6) when dry; massive; very hard, friable, sticky and plastic; many roots; many very fine and fine pores; many, very fine, black concretions; strong effervescence with hydrogen peroxide; strongly acid; abrupt, smooth boundary. 4 to 8 inches thick.

B21-12 to 21 inches, dark reddish-brown (2.5YR 3/4) silty clay, red (2.5YR 4/6) when dry; moderate, medium to very fine, subangular blocky structure; hard, friable, sticky and plastic; abundant roots; many very fine and fine pores; many, fine, black concretions; moderate effervescence with hydrogen peroxide; nearly continuous glaze on ped surfaces, glaze looks like clay films; slightly acid; clear, broken boundary. 7 to 10 inches thick.

B22-21 to 27 inches, dark reddish-brown (2.5YR 3/4) silty clay, red (2.5YR 4/6) when dry; strong, very fine, subangular blocky structure; very hard, friable, sticky and plastic; many roots; many very fine and fine pores; nearly continuous glaze on ped faces; common, black concretions; weak effervescence with hydrogen peroxide; few, fine, black, manganese dioxide stains on ped faces; neutral; clear, smooth boundary. 5 to 8 inches thick.

B23-27 to 48 inches, dark reddish-brown (2.5YR 3/4) silty clay, red (2.5YR 4/6) when dry; strong, very fine, subangular and angular blocky structure; hard, firm, sticky and plastic; few roots; many very fine and fine pores; continuous glaze on ped faces, glaze looks like thick clay films; superimposed on the glaze is dark-red (10R 3/6) material that looks like pseudosand under magnification; large, black coatings on primary structural units; neutral; gradual, smooth boundary. 15 to 30 inches thick

B24-48 to 60 inches, dark-red (2.5YR 3/6) silty clay, red (2.5YR 4/6) when dry; strong, very fine, subangular and angular blocky structure; hard, firm, slightly sticky and plastic; no roots; many very fine and fine pores; thin, patchy coatings that look like clay films; many distinct pressure cutans; ped surfaces have superimposed on them stringy, dark-red (10R 3/6) pseudosand or frostlike coatings; this condition is more prevalent than in the B23 horizon; neutral.

The A horizon ranges from 10R to 5YR in hue, from 2 to 3 in chroma, and from 2 to 3 in value. The B horizon ranges from 10R to 2.5YR in hue and from 4 to 6 in chroma.

This soil is used for sugarcane, pineapple, pasture, truck crops, orchards, wildlife habitat, and homesites. (Capability classification IIe, irrigated or nonirrigated; sugarcane group 1; pineapple group 5; pasture group 5; woodland group 5)

Lihue silty clay, 8 to 15 percent slopes (LhC).

On this soil, runoff is slow and the erosion hazard is slight. This soil is used for sugarcane, pineapple, pasture, truck crops, orchards, wildlife habitat, and homesites. (Capability classification IIIe, irrigated or nonirrigated; sugarcane group 1; pineapple group 6; pasture group 5; woodland group 5)

Lihue silty clay, 15 to 25 percent slopes (LhD).

On this soil, runoff is medium and the erosion hazard is moderate. This soil is used for sugarcane, pineapple, pasture, wildlife habitat, and woodland. (Capability classification IVe, irrigated or nonirrigated; sugarcane group 1; pineapple group 6; pasture group 5; woodland group 5)

Lihue silty clay, 25 to 40 percent slopes, eroded (LhE2).

This soil is similar to Lihue silty clay, 0 to 8 percent slopes, except that the surface layer is thin. Runoff is rapid, and the erosion hazard is severe.

This soil is used for pasture, woodland, and wildlife habitat. Small areas are used for pineapple and sugarcane. (Capability classification VIe, nonirrigated; pasture group 5; woodland group 5)

Lihue gravelly silty clay, 0 to 8 percent slopes (LIB).

This soil is similar to Lihue silty clay, 0 to 8 percent slopes, except that it contains ironstone-gibbsite pebbles and has brighter colors in the B horizon. Included in mapping in the Eleele area and north of the town of Hanamaulu were small areas of soils that have a dark yellowish-brown, friable subsoil.

This soil is used for sugarcane, pasture, and homesites. (Capability classification IIe, irrigated or nonirrigated; sugarcane group 1; pineapple group 5 ; pasture group 5 ; woodland group 5)

Lihue gravelly silty clay, 8 to 15 percent slopes (LIC).

On this soil, runoff is slow and the erosion hazard is slight. Included in mapping were areas where the slope is as much as 25 percent.

This soil is used for sugarcane, pasture, wildlife habitat, and homesites. (Capability classification IIIe, irrigated or nonirrigated; sugarcane group 1; pineapple group 6; pasture group 5; woodland group 5)

Marsh

Marsh (MZ) consists of wet, periodically flooded areas covered dominantly with grasses and bulrushes or other herbaceous plants. It occurs as small, low-lying areas along the coastal plains. Water stands on the surface, but marsh vegetation thrives. The water is fresh or brackish, depending on proximity to the ocean. Included in mapping were small areas of mangrove swamp and small areas of open water. (Capability classification VIIIw, nonirrigated)

Mokuleia Series

This series consists of well-drained soils along the coastal plains on the islands of Oahu and Kauai. These soils formed in recent alluvium deposited over coral sand. They are shallow and nearly level. Elevations range from nearly sea level to 100 feet. The annual rainfall amounts to 15 to 40 inches on Oahu and 50 to 100 inches on Kauai. The mean annual soil temperature is 74° F. Mokuleia soils are geographically associated with Hanalei, Jaucas, and Keaau soils.

In this survey area a poorly drained variant of the Mokuleia series was mapped. This soil, Mokuleia clay loam, poorly drained variant, is described in alphabetical order, along with other mapping units of this series.

These soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of kiawe, klu, koa haole, and bermudagrass in the drier areas and napiergrass, guava, and joee in the wetter areas.

Mokuleia clay loam (Mt).

This soil occurs as small areas on the coastal plains. It is nearly level. Included in mapping were small areas of Jaucas soils; small areas of very deep, well-drained soils in drainageways; and small areas of poorly drained clay soils underlain by reef limestone.

In a representative profile the surface layer is very dark grayish-brown clay loam about 16 inches thick. The next layer, 34 to more than 48 inches thick, is dark-brown and light-gray, single-grain sand and loamy sand. The surface layer is neutral in reaction, and the underlying material is moderately alkaline.

Permeability is moderate in the surface layer and rapid in the subsoil. Runoff is very slow, and the erosion hazard is no more than slight. The available water capacity is about 1.8 inches per foot in the surface layer and about 1.0 inches per foot in the subsoil. In places roots penetrate to a depth of 5 feet or more.

Representative profile: Island of Oahu, lat. 21°34'49" N. and long. 158°10'09" W.

Ap-0 to 16 inches, very dark grayish-brown (10YR 3/2) Clay loam, dark grayish brown (10YR 4/2) when dry; moderate, very fine and fine, granular and subangular blocky structure; hard, firm, sticky and plastic; plentiful fine roots; many, very fine and fine, interstitial pores; few, fine and very fine, tubular pores; common wormholes and worm casts; horizon consists of about 25 percent coral sand; slight effervescence with hydrogen peroxide; violent effervescence with hydrochloric acid; neutral, abrupt, wavy boundary. 10 to 16 inches thick.

IIC1-16 to 22 inches, dark-brown (10YR 4/3) loamy sand, brown (10YR 5/3) when dry; massive; soft, slightly hard, nonsticky and nonplastic; plentiful fine roots; porous; few pieces of reef limestone: horizon consists of about 80 percent coral sand; violent effervescence with hydrochloric acid; moderately alkaline; abrupt, smooth boundary. 6 to 20 inches thick.

IIC2-22 to 50 inches, light-gray (10YR 7/2), moist and dry, coral sand; single grain; loose when moist or dry, nonsticky and nonplastic; few fine roots; porous; few pieces of coral; violent effervescence with hydrochloric acid; moderately alkaline.

The depth to coral sand ranges from 12 to 30 inches. The A horizon ranges from 10YR to 5YR in hue and from 1 to 3 in value when moist and 3 to 5 when dry. It ranges from 1 to 3 in chroma when moist and 1 to 3 when dry. The IIC1 horizon ranges from 10YR to 7.5YR in hue, from 3 to 6 in value when moist and 4 to 7 when dry, and from 1 to 3 in chroma.

This soil is used for sugarcane, truck crops, and pasture. Capability classification IIs if irrigated, VIs if nonirrigated; sugarcane group 1; pasture group 3)

Mokuleia clay (Mtb).

This soil has a profile like that of Mokuleia clay loam, except for the texture of the surface layer. It is nearly level. Permeability is slow in the surface layer. Workability is difficult because of the sticky, plastic clay.

This soil is used for sugarcane and pasture. (Capability classification IIIs if irrigated, VIs if nonirrigated; sugarcane group 1; pasture group 3)

Mokuleia fine sandy loam (Mr).

This soil occurs on the eastern and northern coastal plains of Kauai. It is nearly level. This soil has a profile like that of Mokuleia clay loam, except for the texture of the surface layer.

Permeability is moderately rapid in the surface layer and rapid in the subsoil. Runoff is very slow, and the erosion hazard is slight. The available water capacity is about 1 inch per foot in the surface layer and 0.7 inch per foot in the subsoil. Included in mapping were small areas where the slope is as much as 8 percent.

This soil is used for pasture. (Capability classification IIIs if irrigated, IVs if nonirrigated; sugarcane group 1; pasture group 3)

Mokuleia loam (Ms).

This soil has a profile like that of Mokuleia clay loam, except that the surface layer is loam and in most places is about 8 inches thick. It is nearly level.

This soil is used for sugarcane, truck crops, and pasture. (Capability classification IIs if irrigated, VIs if nonirrigated; sugarcane group 1; pasture group 3)

Mokuleia clay loam, poorly drained variant (Mta).

This soil occurs on Kauai. It is nearly level. The soil is poorly drained, and in this way, it differs from other soils of the Mokuleia series. The surface layer is dark brown to black and is mottled.

This soil is used for sugarcane, taro, and pasture. (Capability classification IIIw, irrigated or nonirrigated; sugarcane group 3; pasture group 3)

Pohakupu Series

This series consists of well-drained soils on terraces and alluvial fans on the islands of Oahu and Kauai. These soils formed in old alluvium derived from basic igneous material. They are nearly level to moderately sloping. Elevations range from 50 to 250 feet. The annual rainfall amounts to 40 to 60 inches. The mean annual soil temperature is 73° F. Pohakupu soils are geographically associated with Alaeloa, Papaa, and Lihue soils.

These soils are used for sugarcane, pineapple, truck crops, pasture, and homesites. The natural vegetation consists of guava, Christmas berry, Japanese tea, koa haole, and kikuyugrass.

Pohakupu silty clay loam, 0 to 8 percent slopes (PkB).

This soil has smooth slopes and occurs on terraces and alluvial fans. The slopes are mainly 3 to 8 percent. Included in mapping were small areas of Alaeloa and Waialua soils and small areas where the slope is as much as 15 percent. Also included on Kauai were small areas where the texture is silty clay and small areas that have a hue of 2.5YR in the subsoil.

In a representative profile the surface layer is dark reddish-brown silty clay loam about 13 inches thick. The subsoil, 40 to more than 60 inches thick, is dark reddishbrown and dark-brown silty clay loam that has angular and subangular blocky structure. The substratum is strongly weathered gravel. The soil is slightly acid to medium acid.

Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.5 inches per foot of soil. In places roots penetrate to a depth of 5 feet or more.

Representative profile: Island of Oahu, lat. 21°22'53" N. and long. 157°45'16" W.

Ap-0 to 13 inches, dark reddish-brown (5YR 3/3) silty clay loam, reddish brown (5YR 4/3) when dry; strong, very fine, subangular blocky structure; hard, friable, sticky and plastic; abundant roots; many very fine and fine pores; common wormholes and worm casts; moderate effervescence with hydrogen peroxide; slightly acid; abrupt, smooth boundary. 8 to 13 inches thick.

B21-13 to 21 inches, dark reddish-brown (5YR 3/3) silty clay loam, reddish brown (5YR 4/4) when dry; moderate, very fine, subangular blocky structure; hard, friable, slightly sticky and plastic; abundant roots; many, very fine and fine, tubular pores; common, patchy pressure cutans; slight effervescence with hydrogen peroxide; slightly acid; abrupt, smooth boundary. 4 to 9 inches thick.

B22-21 to 38 inches, dark-brown (7.5YR 3/4) silty clay loam, brown (7.5YR 4/4) when dry; strong, very fine, blocky and subangular blocky structure; hard, friable, sticky and plastic; plentiful roots; many, very fine and fine, tubular pores; continuous pressure cutans on ped surfaces; few highly weathered pebbles; many black stains in pores and on peds; stains show strong effervescence with hydrogen peroxide; slightly acid; clear, irregular boundary. 4 to 17 inches thick.

B23-38 to 50 inches, dark-brown (7.5YR 3/4) silty clay loam, brown (7.5YR 4/4) when dry; strong, very fine, angular and subangular blocky structure; hard, friable, sticky and plastic; few roots; many, very fine and fine, tubular pores; strong, continuous pressure cutans; few highly weathered pebbles; common black stains that effervesce with hydrogen peroxide; slightly acid; clear, irregular boundary. 12 to 20 inches thick.

B3-50 to 76 inches, dark-brown (7.5YR 3/4) silty clay loam, brown (7.5YR 4/4) when dry; strong, very fine, angular and subangular blocky structure; hard, friable, slightly sticky and plastic; few roots; many, very fine and fine tubular pores; nearly continuous pressure cutans; few highly weathered pebbles; few, fine, black stains that effervesce with hydrogen peroxide; slightly acid.

Effervescence with hydrogen peroxide ranges from slight to moderate in the upper part of the profile and from slight to none below. The structure in the B horizon ranges from moderate to strong. In places a few boulder cores occur within the lower part of the profile. The A horizon ranges from 2 to 3 in chroma and value when moist. The B horizon ranges from 7.5YR to 5YR in hue and from 3 to 4 in chroma and value when moist.

This soil is used for pasture, truck crops, and homesites on Oahu and for sugarcane and pineapple on Kauai. (Capability classification IIe if irrigated, IIIe if nonirrigated; sugarcane group 1; pasture group 6; woodland group 5)

Pohakupu silty clay loam, 8 to 15 percent slopes (PkC).

On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. Workability is slightly difficult because of the slope.

Included in mapping were small areas where the surface layer and part of the subsoil have been removed. Also included, near the drainageways, were areas where the slope ranges from 15 to 25 percent.

This soil is used for pasture. (Capability classification IIIe, nonirrigated; sugarcane group 1; pasture group 6; woodland group 5)

Puhi Series

This series consists of well-drained soils on uplands on the island of Kauai. These soils developed in material derived from basic igneous rock. They are nearly level to steep. Elevations range from 175 to 500 feet. The annual rainfall amounts to 60 to 80 inches. The mean annual soil temperature is 73° F. Puhi soils are geographically associated with Lihue and Kapaa soils.

These soils are used for sugarcane, pineapple, truck crops, orchards, pasture, woodland, wildlife habitat, water supply, and homesites. The natural vegetation consists of guava, Java plum, pangolagrass, kikuyugrass, elephantopus, joee, yellow foxtail, and rhodomyrtus.

Puhi silty clay loam, 0 to 3 percent slopes (PnA).

This soil is on broad interfluves on the uplands.

In a representative profile the surface layer is brown silty clay loam about 12 inches thick. The subsoil, about 48 inches thick, is reddish-brown and dark reddish-brown silty clay loam and silty clay that has subangular blocky structure. The substratum is silty clay. The surface layer is very strongly acid. The subsoil is slightly acid to medium acid.

Permeability is moderately rapid. Runoff is very slow, and there is no erosion hazard. The available water capacity is about 1.3 inches per foot of soil. In places, roots penetrate to a depth of 5 feet or more.

Representative profile: Island of Kauai, lat. 22°01'14" N. and long. 159°23'8.1" W.

Ap-0 to 12 inches, brown (10YR 4/3) silty clay loam, brown (10YR 4/3) when rubbed, yellowish brown (10YR 5/4) when dry; moderate, very fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; abundant roots; many, very fine and fine, tubular pores and common interstitial pores; many gritty particles that are hard to break down; delayed efforvescence with hydrogen peroxide; very strongly acid; abrupt, wavy boundary. 11 to 14 inches thick.

B21-12 to 21 inches, reddish-brown (5YR 4/4) silty clay loam, yellowish red (5YR 4/6) when dry; weak, very fine and fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; plentiful fine and very fine roots; many very fine pores and common fine pores; nearly continuous, shiny glaze on peds; patchy coatings that look like clay films on some peds; medium acid; gradual, smooth boundary. 7 to 11 inches thick.

B22-21 to 33 inches, dark reddish-brown (5YR 3/4) silty clay loam, yellowish red (5YR 4/6) when dry; common black specks; moderate, very fine and fine, sub angular blocky structure; hard, friable, slightly sticky and slightly plastic; plentiful fine and very fine roots; many very fine pores and common fine pores; nearly continuous, shiny glaze on peds, patchy coatings that look like clay films on some pads; stringy coatings of stronger chroma; slightly acid; gradual, smooth boundary. 10 to 14 inches thick.

B23-33 to 41 inches, dark reddish-brown (2.5YR 3/4) silty clay loam, yellowish red (5YR 4/6) when dry; moderate, very fine, subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine roots; many very fine pores and common medium pores; continuous, shiny glaze on peds ; patchy coatings that look like clay films on peds ; many shiny particles; many, very fine, black specks; medium acid; gradual, smooth boundary. 6 to 9 inches thick.

B24-41 to 80 inches, dark reddish-brown (5YR 3/3) silty clay, yellowish red (5YR 4/8) when dry; strong, very fine and fine, subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; many very fine and fine pores and common medium pores; continuous, shiny glaze on peds; many, very fine, black specks and shiny particles; medium acid.

The A horizon ranges from 7.5YR to 10YR in hue, from 2 to 4 in value, and from 2 to 4 in chroma. The B horizon ranges from 2.5YR to 7.5YR in hue, from 3 to 4 in value, and from 3 to 4 in chroma.

This soil is used for sugarcane, pineapple, orchards, truck crops, pasture, and homesites. (Capability classification IIs, irrigated or nonirrigated; sugarcane group 1; pineapple group 4; pasture group 8; woodland group 7)

Puhi silty clay loam, 3 to 8 percent slopes (PnB).

On this soil, runoff is slow and the erosion hazard is slight. This soil is used for sugarcane,

pineapple, orchards, pasture, truck crops, and homesites. (Capability classification IIe, irrigated or nonirrigated; sugarcane group 1; pineapple group 5; pasture group 8; woodland group 7)

Puhi silty clay loam, 8 to 15 percent slopes (PnC).

On this soil, runoff is slow and the erosion hazard is slight. This soil is used for sugarcane, pineapple, pasture, and orchards. (Capability classification IIIe, irrigated or nonirrigated; sugarcane group 1; pineapple group 6; pasture group 8; woodland group 7)

Puhi silty clay loam, 15 to 25 percent slopes (PnD).

On this soil, runoff is medium and the erosion hazard is moderate. Included in mapping were small, eroded areas.

This soil is used for sugarcane, pineapple, orchards, pasture, woodland, wildlife habitat, and water supply. (Capability classification IVe, irrigated or nonirrigated; sugarcane group 1, pineapple group 6; pasture group 8; woodland group 7)

Puhi silty clay loam, 25 to 40 percent slopes (PnE).

On this soil, runoff is rapid and the erosion hazard is severe.

This soil is used for pasture, woodland, wildlife habitat, and water supply. (Capability classification VIe, nonirrigated; pasture group 8; woodland group 7)

Rough Broken Land

Rough broken land (rRR) consists of very steep land broken by numerous intermittent drainage channels. In most places it is not stony. It occurs in gulches and on mountainsides on all the islands except Oahu. The slope is 40 to 70 percent. Elevations range from nearly sea level to about 8,000 feet. The local relief is generally between 25 and 500 feet. Runoff is rapid, and geologic erosion is active. The annual rainfall amounts to 25 to more than 200 inches.

These soils are variable. They are 20 to more than 60 inches deep over soft, weathered rock. In most places some weathered rock fragments are mixed with the soil material. Small areas of rock outcrop, stones, and soil slips are common. Included in mapping were areas of colluvium and alluvium along gulch bottoms.

This land type is used primarily for watershed and wildlife habitat. In places it is used also for pasture and woodland. The dominant natural vegetation in the drier areas consists of guava, lantana, Natal redtop, bermudagrass, koa haole, and molassesgrass. Ohia, kukui, koa, and ferns are dominant in the wetter areas. Puakeawe, aalii, and sweet vernalgrass are common at the higher elevations. (Capability classification VIIe, nonirrigated)

Exhibit "D"

LSB Map 100

EXHIBIT "D"

Exhibit "E"

LSB Map 107

EXHIBIT "E"

Exhibit "F"

Economics For Goats

Exhibit "G" of "C"

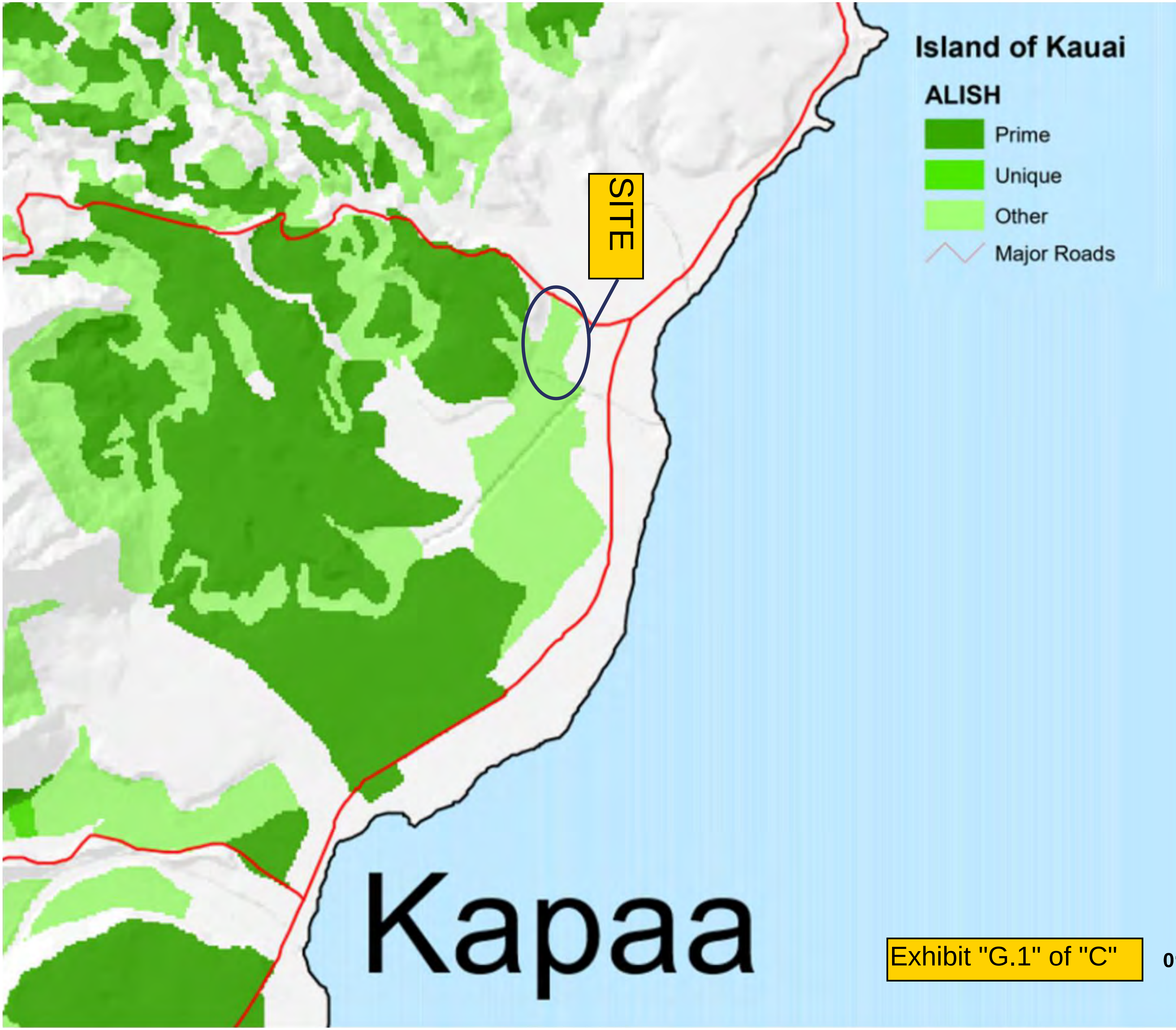
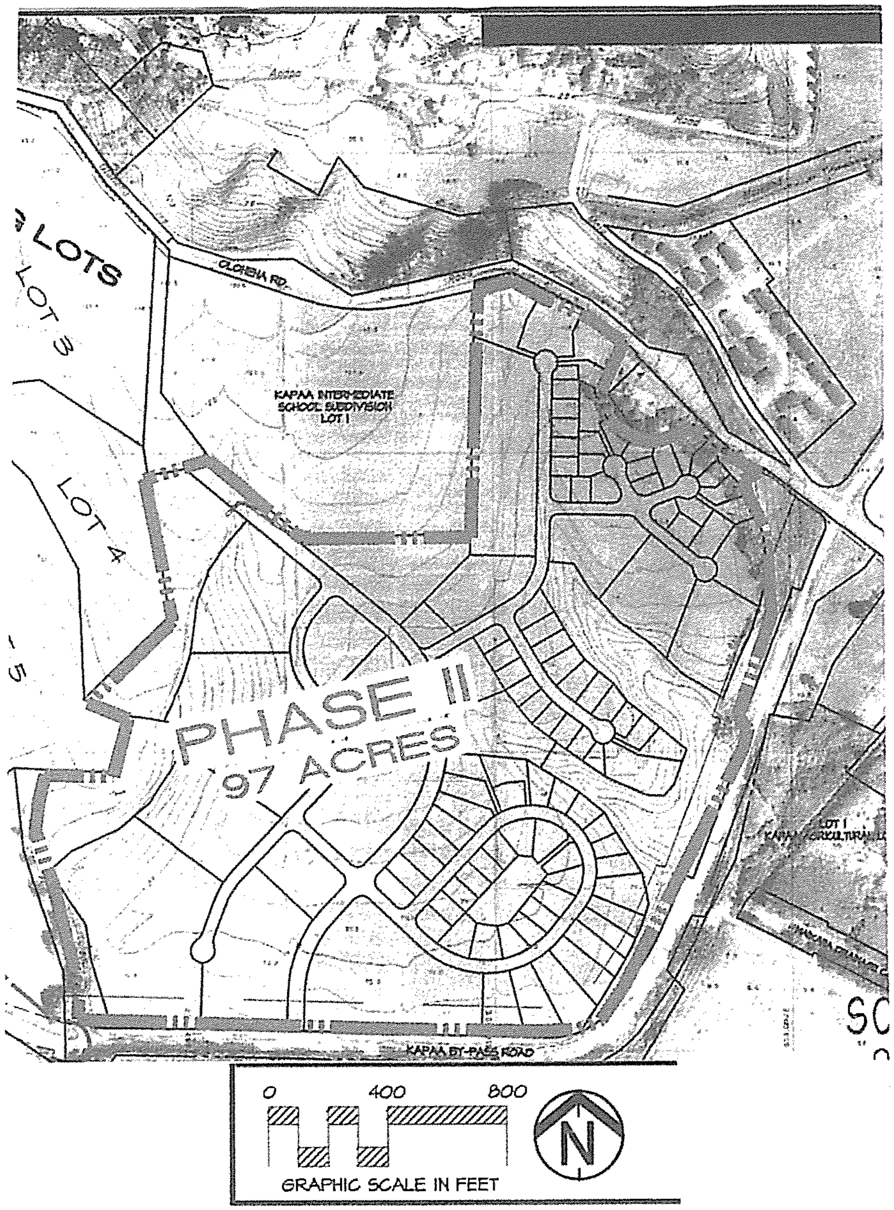


Exhibit "G.1" of "C"

Agricultural Suitability for
HoKua Place
(Formerly Kapa'a Highlands Phase II)

June, 2018



Agricon Hawaii LLC
P.O. Box 95
Kamuela, HI 96743

Kapaa Highlands Phase II
Agricultural Suitability
June 2018

Table of Contents

Kapaa Highlands Phase II
Agricultural Suitability
June 2018

INTRODUCTION

Kapaa Highlands Phase II is a 97 acre parcel of land in Kapaa, Kauai, Hawaii near Kapaa Middle School. Phase II is part of tax map key number (4) 4-3-003:001, a 163.42 acre parcel. Phase II is presently classified and zoned agriculture under the Hawaii State Land Use and County of Kauai designations. Because of Phase II's location adjacent to urban areas and constraints that lessen its agricultural importance to the County of Kauai and the State, reclassifying Phase II from agriculture to urban would not have a significant negative impact on farming for Kauai or for the state.

SUMMARY

The climate and soils at Phase II are not ideal for the growing of most commercially viable crops due to the strong trade winds and the salt spray from the ocean.

The proximity of Kapaa Middle School and residential subdivisions to the property will require extensive buffers around the agricultural property and will require extreme care in the implementation of farming practices to prevent any dust, spray drift or noise pollution that may impact the school or existing residential property.

The cost of labor, the cost of water, less expensive food imports, food safety requirements, transportation costs and the economies of scale are all hinderances to creating a sustainable farming community on Kauai.

Kauai has an abundance of large parcels of good agricultural land that are not located within urban and rural areas.

The reclassification of 97 acres of agricultural land that is surrounded by urban development and is designated in the Kauai General Plan for urban expansion will have a minor impact on the potential of Kauai's ability to feed its population over time.

DESCRIPTION OF THE PROPERTY

The property is located in Kapaa, Kauai above the Kapaa by-pass road and adjacent to Kapaa Middle School. The property is further identified by TMK (4) 4-3-003-001, Phase II. The land area in Phase II totals 97 acres that is classified and zoned as agricultural land. The property is not currently being used for any type of agriculture.

Kapaa Highlands Phase II
Agricultural Suitability
June 2018

CLIMATE & SOILS

Climate

The climate is dominated by northeasterly tradewinds caused by high pressure weather systems with winds in the 15 to 35 plus mile per hour (mph) range. Low pressure systems occur during the winter and occasionally during the rest of the year. This latter type of weather system has winds that are variable and usually light to moderate (5 mph to 15 mph) from the south or west or a combination. There are conditions when the low pressure systems generate storms with high winds (50+ mph) and excessive rainfall. From June to November hurricanes can occur although they are infrequent.

The rainfall is approximately 50 inches although, possibly because of global warming, rainfall is difficult to predict and can be considerably higher at times than 50 inches per year.

Temperature during the day ranges from high 80 degrees Fahrenheit ('F) in the summer to low 70's 'F during the winter with slightly cooler temperatures during the night.

The strong tradewinds throughout this property are a negative factor for agricultural production. Costly windbreaks would be required to protect the crops. Another factor that will inhibit plant growth is the salt spray from the ocean carried by the strong winds. The salt spray can limit the crop selection as some agricultural crops are not tolerant of salt spray. Also, the salt spray can damage the production and decrease the quality and sale price.

Topography and Soils

The property elevation slopes gently from approximately 50 feet above sea level at southeast boundary of the property to 100 feet at the northwest section. There are no designated floodplains on the property except for a very small area on the western edge that lies within the 100 year floodplain.

The most extensive soil type on the property is the Ioleau silty clay loam with 2 to 30 percent slope although most of this soil type on Phase II has 2 to 6 percent slopes (approximately 40 acres). Soil depth to underlying igneous rock is 60 inches. This soil's natural drainage is good and flooding and ponding are not a problem. The surface soil has some organic matter (5%). There are approximately 30 acres of the Puhi silty clay loam soil with 3 to 8 percent slopes. This soil is similar to the Ioleau soils except that the surface organic matter is 7 percent. There are about 12 acres of soil categorized as rough broken land on the eastern side of Phase II, along with 3.1 acres of poorly drained Mokuleia clay loam. There is a small section of marsh (.3 acres) on the south boundary.

Because the most prevalent soils on the property drain rapidly and rainfall can be erratic, an irrigation system would be required for optimum crop production.

A large portion of this property is presently covered with common trees and bushes all of which would require removal prior to any development.

See Appendix A – Climate and Soils Information.

HAWAII LAND CLASSIFICATIONS

The Hawaii Land Study Bureau (LSB) rates this property as B, C, D and E. This rating indicates that the agricultural potential is mediocre with some areas of good soil and others fair to poor soil. The Agricultural Lands of Importance to the State of Hawaii (ALISH) designation includes Prime and Other. This rating as with the LSB rating indicates areas of the property have the potential for some good crop production as well as medium to poor production.

See Appendix B - Hawaii Land Classification Maps.

AGRICULTURAL LAND ON KAUAI & ITS USE

The total land area of the Island of Kauai is 353,900 acres. The island's four (4) basic land classifications are:

Urban	14,573 acres
Rural	1,253 acres
Conservation	198,769 acres
Agricultural	139,305 acres

Kauai has a farming and ranching community that utilizes approximately one half of the agriculturally classified acreage. There are a total of 63,244 acres in agricultural use. Pasture covers the largest acreage at 41,934 acres. Crops account for the remaining acreage with seed corn production the largest crop segment at 13,299 acres followed by coffee at 3,788 acres.

Recently the seed companies have been decreasing their acreage planted for seed production. Kauai Coffee, one of Kauai's larger agricultural operations, is not expanding its acreage, but improving and replacing coffee trees on its existing acreage under cultivation to increase per acre production. Hawaii Department of Land and Natural Resources has agricultural land that is not being farmed and could be leased to farmers.

Because of the cessation of sugar production on Kauai and the release of these lands, these former sugar lands are available for other agricultural crops. Consequently, there is adequate agricultural land available on the island to produce food to supply the residents of Kauai. Presently, however, the available agricultural land is not being fully utilized because of other constraints to agricultural development.

See Appendix C – Crop Summary by Acreage (2015).

FUTURE FOOD PRODUCTION ON KAUAI

The total acreage on Kauai that is classified for agriculture is 139,305. Of this land, 63,244 acres is currently in active agriculture. The total land area in active agriculture that is not in livestock production is 21,310 acres. Food crops account for 2,314 acres (includes aquaculture) and the predominant food crops are taro and tropical fruit. Food crops (for the purpose of this report) are crops that produce an edible vegetable or fruit. Livestock acreage is considered separately.

Providing food on Kauai for the people living on Kauai or for export is not a land availability issue and should not be in the future. The land that is classified for agriculture but is not in livestock or diversified crops totals 76,061 acres. If 75 % of this land is suitable for growing food crops, the potential for growing food crops increases by approximately 57,000 acres. Suitable is land where the soils have a LSB rating of A, B or C; have adequate rainfall (approximately 60 inches per year) or adequate water for irrigation; are not impacted by salt spray from the ocean; and are tillable.

LOCATION

A major constraint to agricultural development on Phase II of this property is the proximity of the Kapaa Middle School, located on the northern side of the property. Additionally, there are adjacent subdivisions on the north and eastern sides of the property. The existing substantial urban development that is in close proximity to the agriculturally classified parcel will require extensive buffers around the agricultural property and will require extreme care in the implementation of farming practices to prevent any dust, spray drift or noise pollution that may impact the school or existing residential property. The Kauai General Plan designates this property as future urban expansion.

LABOR

The growing of food on Kauai for the people of Kauai is constrained by the lack of people willing to farm this land. A seasoned vegetable farmer expressed the opinion that if a farmer can make money farming, more farmers will farm.

The lack of both skilled and unskilled labor for the agricultural industry on Kauai is a major problem. The present unemployment rate on Kauai is 1.8%, which is essentially full employment. The competition for labor is a serious problem for most of the industries on Kauai. The tourist industry generally pays higher wages and has better benefits for its employees. Many workers prefer the type of jobs offered in the tourist industry versus the agricultural industry. In addition, the technology industry, construction industry, suppliers to these industries and some smaller cottage industries all compete for a finite labor supply and generally offer higher wages.

The County of Kauai Economic Development Department has a very proactive farm internship program in the local high schools to address the lack of farm labor on the island. This program has grown from two high school intern participants in 2014 to 41 interns in 2018. Although it will be many years before this program can supply sufficient farm labor with the skills, experience, and desire to farm, it will eventually help to ameliorate the farm labor shortage.

INFRASTRUCTURE COSTS

Infrastructure costs to develop a farm are another constraint to farming Phase II. County water is available to the property. Although the County has an agricultural water rate to provide an incentive for farming, the water is still expensive. The current rate is $2.20 per 1,000 gallons. Installing an irrigation system would be required to ensure consistent and quality crop production. Well-designed windbreaks are needed to protect the crops from the prevailing tradewinds and require installation and time to grow large enough to provide adequate wind protection. Extensive brush clearing is required to remove the invasive plant material presently growing on the property. The primary plant species are Haole Koa (Leucaena leacocephala) and Guinea Grass (Megathyrsus maximus). Equipment and materials storage are required and would entail constructing a building. Land preparation and application of soil amendments based on a soil analysis would have to be done prior to planting the crops. A farm road(s) would need to be constructed. Incurring all these costs prior to receiving any income from the sale of the farm production requires capital and that can be difficult for a farmer to obtain.

MARKETING

For a profitable farm operation on this property investing in a good marketing program for the production is a key component. The County of Kauai is developing markets through its Sunshine Markets program for quality produce from small Island farms. However, most of the food presently consumed on Kauai is imported from the mainland because it is cheaper than the food that is produced on Kauai. Price of the product is the most important factor although quality and organic production can be factors in selling a product at a high price if the customer is motivated to pay more for what he or she considers a better product.

An important cost of marketing farm production is the requirement to comply with the United States Department of Agriculture (USDA) food security regulations. These USDA regulations are for consumer protection from diseases carried by food such as salmonella.

Efficient and available transportation to the market is another cost factor for the farm. Kauai has a severe traffic problem, and this increases the cost and makes transporting farm production to the markets a challenge.

FOOD SECURITY

Food security, defined as having sufficient food grown on Kauai to support the resident population in the event of a disruption in transportation between Hawaii and the U.S. Mainland, is a significant issue in Hawaii and is discussed on a regular basis. On Kauai the constraints listed here make achieving the production of sufficient food to feed the population difficult. There is sufficient unused agricultural land on the island if these other issues are addressed satisfactorily to supply Kauai with adequate food for its population.

CONCLUSION

The reclassification of 97 acres of agricultural land surrounded by urban development will have minimal impact on Kauai's ability to feed its population over time. The Island of Kauai has an abundance of good agricultural land that can be put into the production of food for the Island's population. The bottlenecks are first and foremost the lack of farmers and farm workers. Until the farmer can make a good living farming, it will be difficult to provide enough local food to feed the people of Kauai. Other constraints are competition from imports (lower price), infrastructure costs and marketing.

Appendix A
Climate and Soils Information

Soils Map

Date: 5/31/2018

Field Office: LIHUE SERVICE CENTER
Agency: USDA-NRCS
Assisted By: GENOA STARRS

State and County: HI, Kauai County, Hawaii
Land Units: (4) 4-3-003:001
Approximate Acres: 163.13

Legend

600 0 600 1,200 Feet

1 inch = 600 feet

Rice Soils Map

MUSYM, MUNAME

- HnA;Hanalei silty clay, 0 to 2 percent slopes, MLRA 167
- IoB;Ioleau silty clay loam, 2 to 6 percent slopes
- IoC;Ioleau silty clay loam, 6 to 12 percent slopes
- IoD2;Ioleau silty clay loam, 12 to 20 percent slopes, eroded
- IoE2;Ioleau silty clay loam, 20 to 30 percent slopes, eroded
- LhB;Lihue silty clay, 0 to 8 percent slopes
- LhC;Lihue silty clay, 8 to 15 percent slopes
- LhD;Lihue silty clay, 15 to 25 percent slopes
- MZ;Marsh
- Mta;Mokuleia clay loam, poorly drained variant
- PkB;Pohakupu silty clay loam, 0 to 8 percent slopes
- PnB;Puhi silty clay loam, 3 to 8 percent slopes
- rRR;Rough broken land
- Rice Poly Layer

N

Soils Inventory Report

Thu May 31 2018 11:17:28 GMT-1000 (Hawaiian Standard Time)

Map Unit Symbol	Map Unit Name	Acres	Percent
HnA	Hanalei silty clay, 0 to 2 percent slopes, MLRA 167	1.1	1%
IoB	Ioleau silty clay loam, 2 to 6 percent slopes	45.1	28%
IoC	Ioleau silty clay loam, 6 to 12 percent slopes	16.2	10%
IoD2	Ioleau silty clay loam, 12 to 20 percent slopes, eroded	10.6	7%
IoE2	Ioleau silty clay loam, 20 to 30 percent slopes, eroded	24	15%
LhB	Lihue silty clay, 0 to 8 percent slopes	8.2	5%
LhC	Lihue silty clay, 8 to 15 percent slopes	0.7	0%
LhD	Lihue silty clay, 15 to 25 percent slopes	3.9	2%
Mta	Mokuleia clay loam, poorly drained variant	3.1	2%
MZ	Marsh	0.3	0%
PkB	Pohakupu silty clay loam, 0 to 8 percent slopes	0.8	0%
PnB	Puhi silty clay loam, 3 to 8 percent slopes	31.4	19%
rRR	Rough broken land	16.1	10%
	Total:	161.5	100%

Map Unit Description (Brief, Generated)

Island of Kauai, Hawaii

[Minor map unit components are excluded from this report]

Map unit: HnA - Hanalei silty clay, 0 to 2 percent slopes, MLRA 167

Component: Hanalei (85%)

The Hanalei component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on valley floors on islands. The parent material consists of alluvium derived from basalt. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is frequently flooded. It is occasionally ponded. A seasonal zone of water saturation is at 42 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 8 percent. This component is in the F164XY500HI Volcanic Ash Forest ecological site. Nonirrigated land capability classification is 2w. Irrigated land capability classification is 2w. This soil does not meet hydric criteria. The soil has a maximum sodium adsorption ratio of 3 within 30 inches of the soil surface.

Map unit: IoB - Ioleau silty clay loam, 2 to 6 percent slopes

Component: Ioleau (100%)

The Ioleau component makes up 100 percent of the map unit. Slopes are 2 to 6 percent. This component is on uplands. The parent material consists of basic igneous rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 2e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: IoC - Ioleau silty clay loam, 6 to 12 percent slopes

Component: Ioleau (100%)

The Ioleau component makes up 100 percent of the map unit. Slopes are 6 to 12 percent. This component is on uplands. The parent material consists of basic igneous rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit Description (Brief, Generated)

Island of Kauai, Hawaii

Map unit: IoD2 - Ioleau silty clay loam, 12 to 20 percent slopes, eroded

Component: Ioleau (100%)

The Ioleau component makes up 100 percent of the map unit. Slopes are 12 to 20 percent. This component is on uplands. The parent material consists of basic igneous rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 4e. Irrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: IoE2 - Ioleau silty clay loam, 20 to 30 percent slopes, eroded

Component: Ioleau (100%)

The Ioleau component makes up 100 percent of the map unit. Slopes are 20 to 30 percent. This component is on uplands. The parent material consists of basic igneous rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map unit: LhB - Lihue silty clay, 0 to 8 percent slopes

Component: Lihue (100%)

The Lihue component makes up 100 percent of the map unit. Slopes are 0 to 8 percent. This component is on uplands. The parent material consists of basic igneous dust. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 2e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria. The soil has a maximum sodium adsorption ratio of 3 within 30 inches of the soil surface.

Map unit: LhC - Lihue silty clay, 8 to 15 percent slopes

Component: Lihue (100%)

The Lihue component makes up 100 percent of the map unit. Slopes are 8 to 15 percent. This component is on uplands. The parent material consists of basic igneous dust. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The soil has a maximum sodium adsorption ratio of 3 within 30 inches of the soil surface.

Map Unit Description (Brief, Generated)

Island of Kauai, Hawaii

Map unit: LhD - Lihue silty clay, 15 to 25 percent slopes

Component: Lihue (100%)

The Lihue component makes up 100 percent of the map unit. Slopes are 15 to 25 percent. This component is on uplands. The parent material consists of basic igneous dust. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 4e. Irrigated land capability classification is 4e. This soil does not meet hydric criteria. The soil has a maximum sodium adsorption ratio of 3 within 30 inches of the soil surface.

Map unit: Mta - Mokuleia clay loam, poorly drained variant

Component: Mokuleia variant (85%)

The Mokuleia variant component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on coastal plains. The parent material consists of alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is occasionally flooded. It is occasionally ponded. A seasonal zone of water saturation is at 48 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 3w. Irrigated land capability classification is 3w. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 97 percent. There are no saline horizons within 30 inches of the soil surface.

Map unit: MZ - Marsh

Component: Marsh (100%)

The Marsh component makes up 100 percent of the map unit. Slopes are 0 to 2 percent. This component is on along Coastal Plains marshes. The parent material consists of organic. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very high. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 80 percent. Nonirrigated land capability classification is 8w. This soil meets hydric criteria. The soil has a slightly saline horizon within 30 inches of the soil surface.

Map Unit Description (Brief, Generated)

Island of Kauai, Hawaii

Map unit: PkB - Pohakupu silty clay loam, 0 to 8 percent slopes

Component: Pohakupu (100%)

The Pohakupu component makes up 100 percent of the map unit. Slopes are 0 to 8 percent. This component is on and terraces alluvial fans. The parent material consists of alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: PnB - Puhi silty clay loam, 3 to 8 percent slopes

Component: Puhi (100%)

The Puhi component makes up 100 percent of the map unit. Slopes are 3 to 8 percent. This component is on uplands. The parent material consists of basic igneous rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 7 percent. Nonirrigated land capability classification is 2e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria. The soil has a maximum sodium adsorption ratio of 3 within 30 inches of the soil surface.

Map unit: rRR - Rough broken land

Component: Rough broken land (100%)

The Rough broken land component makes up 100 percent of the map unit. Slopes are 40 to 70 percent. This component is on mountain sides gulches. The parent material consists of alluvium and colluvium. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 55 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

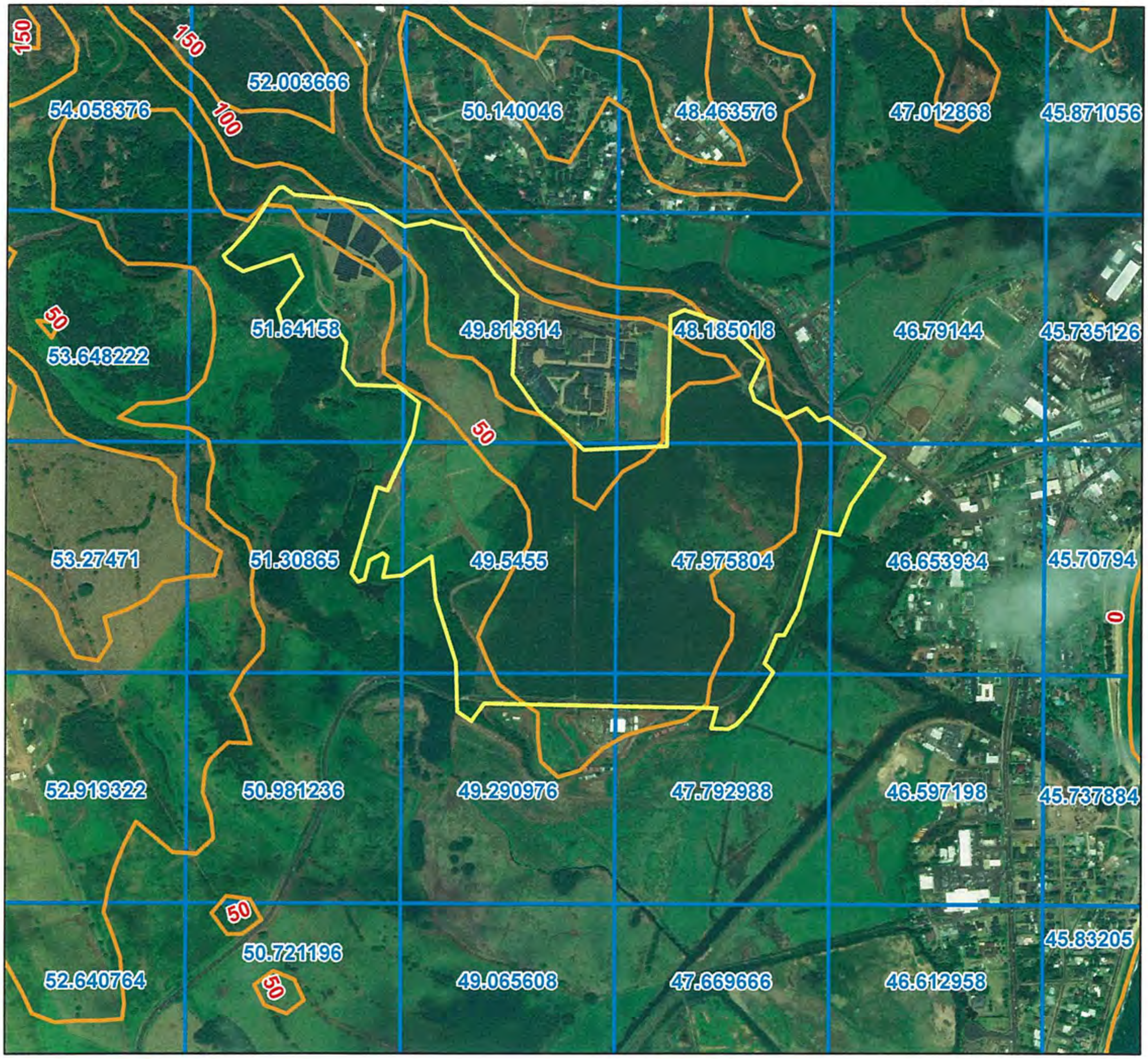
USDA

Elevation and Precipitation Map

Date: 5/31/2018

Field Office: LIHUE SERVICE CENTER
Agency: USDA-NRCS
Assisted By: GENOA STARRS

State and County: HI, Kauai County, Hawaii
Land Units: (4) 4-3-003:001
Approximate Acres: 163.13



Legend

Rice Poly Layer
precip2000_a_hi007
contour50f_l_hi007

1,000 0 1,000 2,000 Feet

1 inch = 1,000 feet

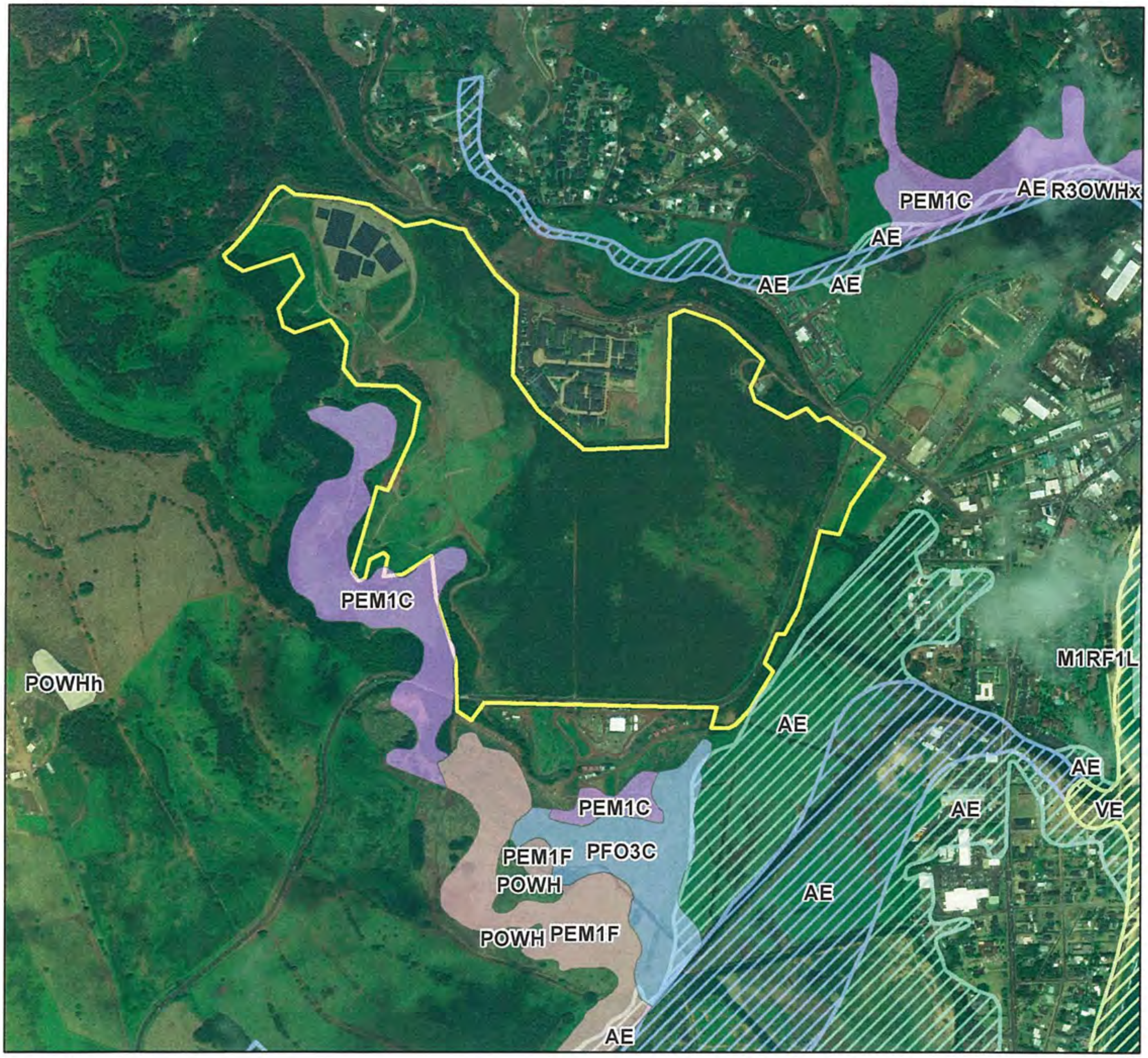
N

Date: 5/31/2018

Wetland/Floodplain Map

Field Office: LIHUE SERVICE CENTER
Agency: USDA-NRCS
Assisted By: GENOA STARRS

State and County: HI, Kauai County, Hawaii
Land Units: (4) 4-3-003:001
Approximate Acres: 163.13



Legend

1,000 0 1,000 2,000 Feet

1 inch = 1,000 feet

N

WCODE	ZONE, FLOODWAY, Descrip
M1RF1L	A; ;100yr floodplain determined by approximate methods, no base flood elevations
PEM1C	AE; ;100yr floodplain by analyses, whole-foot elevations within zone
PEM1F	AE;FLOODWAY;100yr floodplain by analyses, whole-foot elevations within zone
PFO3C	VE; ;100yr coastal floodplain with storm waves, approx. analysis, no base flood elev
POWHh	Rice Poly Layer
R3OWH	

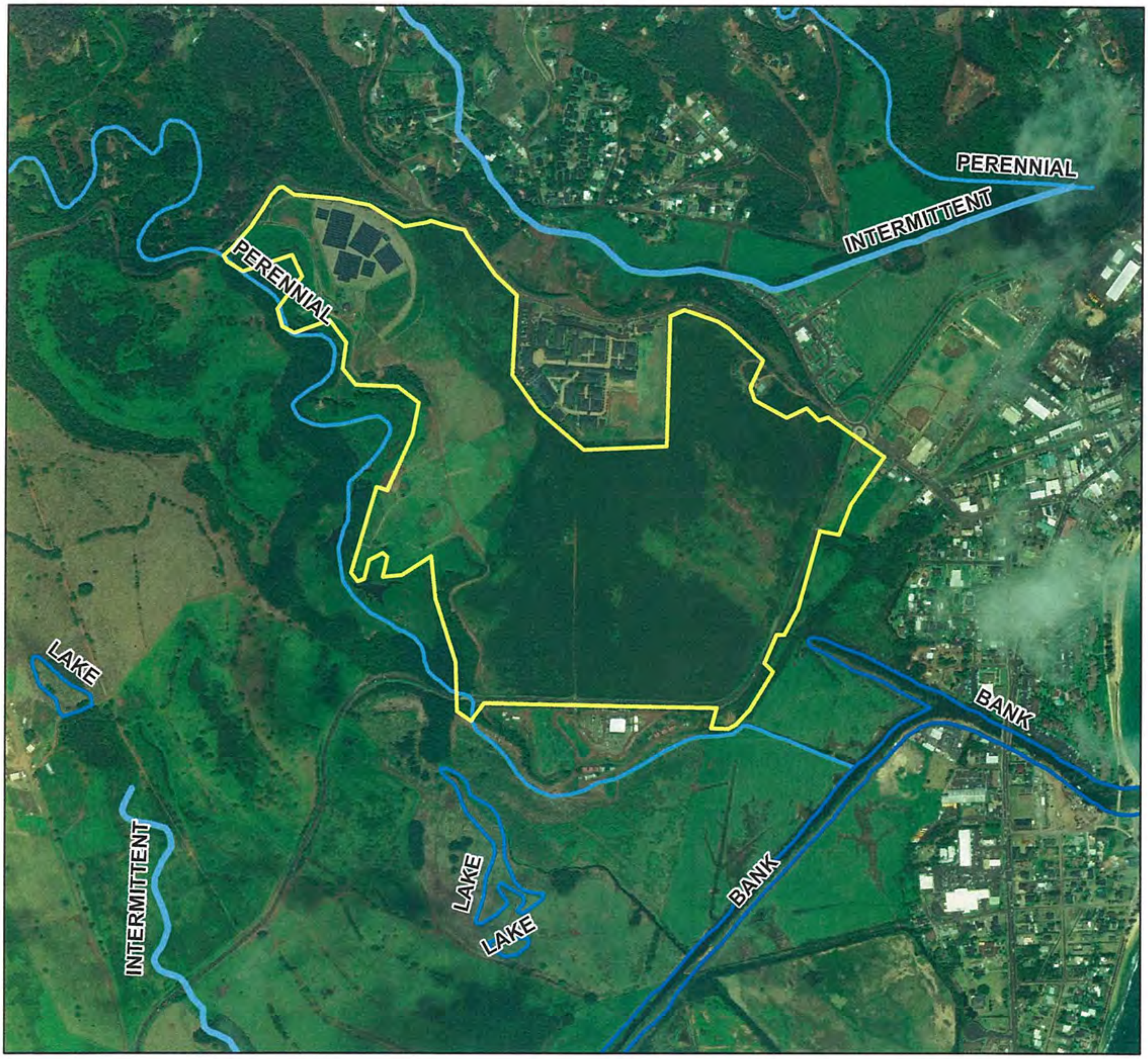
USDA

Hydrology Map

Date: 5/31/2018

Field Office: LIHUE SERVICE CENTER
Agency: USDA-NRCS
Assisted By: GENOA STARRS

State and County: HI, Kauai County, Hawaii
Land Units: (4) 4-3-003:001
Approximate Acres: 163.13



Legend

Rice Poly Layer

TYPE

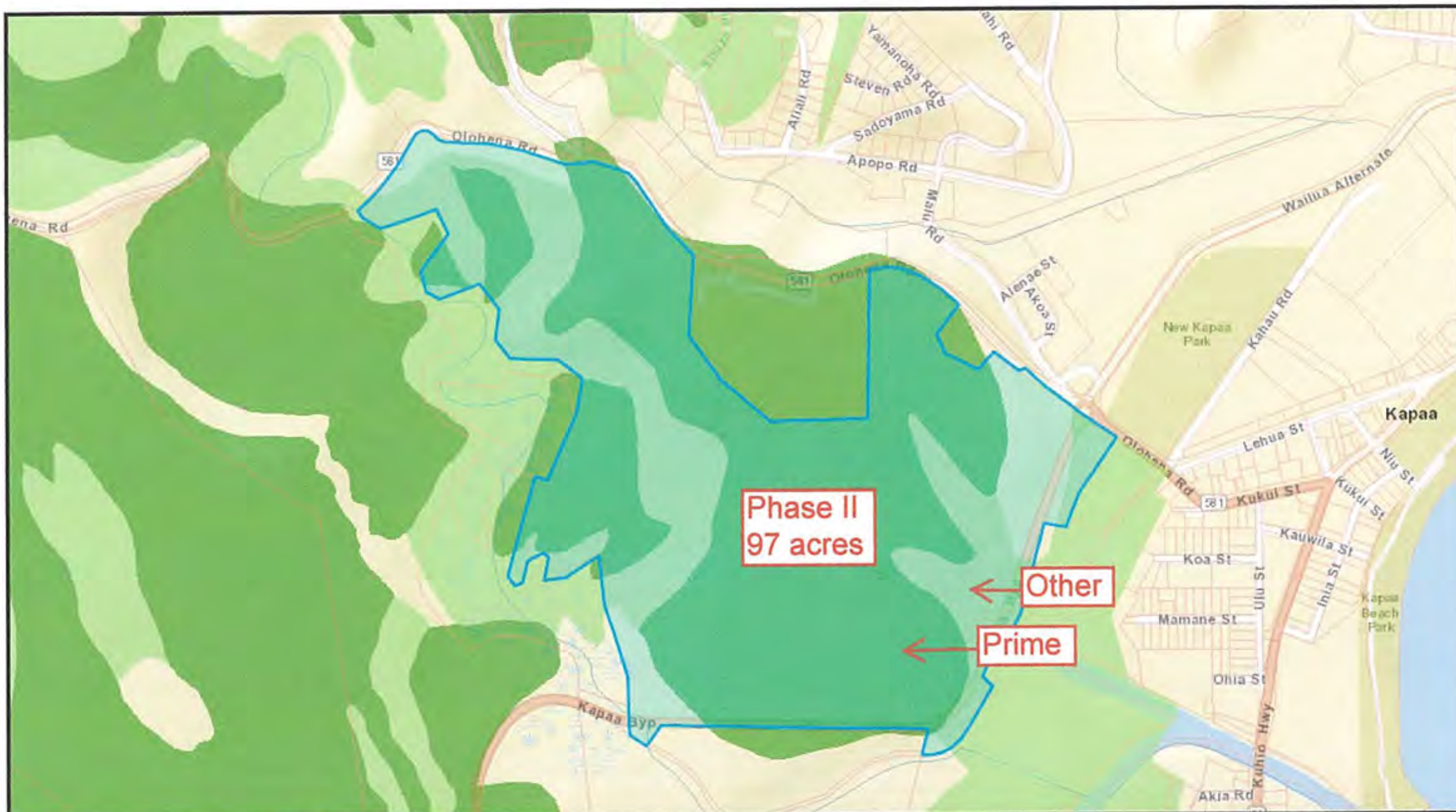
- BANK
- INTERMITTENT
- LAKE
- PERENNIAL

1,000 0 1,000 2,000 Feet

1 inch = 1,000 feet

N

Appendix B
Hawaii Land Classification Maps



Renewable EnerGIS Parcel Report - (4) 4-3-003:001

SITE DESCRIPTION

Parcel Area (acres): **163.420**

County Zoning: **No data**

County Address: **Olohena Rd**

State Land Use District: **Agriculture; Urban**

LAND ECOLOGY

Critical Habitat: **No**

Special Management Area (SMA): **No**

Thermal Springs Potential: **No data**

High Temperature Resource Areas: **No data**

Reserves: **No**

LAND USE / LAND COVER

Ag Land Use (2011-2015): **Pasture**

Ag Land Use (ALUM 1980): **Grazing; S**

Ag Lands of Importance (ALISH): **Unclassified; Prime; Other**

LSB Soil Rating: **B; C; D; E**

Important Ag Land (IAL): **No data**

INFRASTRUCTURE

Ditches: **DITCH**

Studied Hydro Projects: **No**

HYDROLOGY

Flood Zone: **X**

Streams: **Waikaea**

Point Details – Coordinates of Point: 22.07523, -159.32730

SOLAR RESOURCES

Solar Radiation (calories/cm2/day): **400-450**

DNI Annual (Wh/m2/day): **4,303**

GHI Annual (Wh/m2/day): **5,095**

TERRAIN

NOAA Elevation (m): **31**

USGS Slope (%): **2.81974**

USGS Aspect (degress from N): **219.137**

MARINE RESOURCES

Temp Avg Diff (degrees C): **No data**

Temp Amplitude Diff (degrees C): **No data**

3-Mile Ocean Boundary: **Not applicable**

12-Mile Ocean Boundary: **Not applicable**

Benthic Habitat: **No data**

Whale Sanctuary: **No data**

Marine Managed Area: **No data**

Annual Rainfall: **45.168198**

WIND RESOURCES

Wind Power Density at 50m (W/m2): **239.00**

Wind Speed at 30m (m/s): **No data**

Wind Speed at 50m (m/s): **No data**

Wind Speed at 70m (m/s): **No data**

Wind Speed at 100m (m/s): **No data**

DBEDT
STATE OF HAWAII

06/24/2018

Layer Name:	Agricultural Lands of Importance to the State of Hawaii
Coverage Name:	ALISH
Layer Type:	Polygon
Status:	Complete
Geog. Extent:	Main Hawaiian Islands
Projection:	Universal Trans Mercator, Zone 4
Datum:	NAD 83
Description:	Agricultural Lands of Importance to the State of Hawaii for islands of Kauai, Oahu, Maui, Molokai, Lanai & Hawaii.
Source:	State Department of Agriculture 1:24,000 hand drafted blueline maps; compiled and drafted in 1977. Prepared with the assistance of the Soil Conservation Service, U.S.Department of Agriculture, and the College of Tropical Agriculture, University of Hawaii. See text below for information about the classification system, including criteria for classification.
History:	Digitized in Arc/Info version 6 using ArcEdit by the Office of State Planning (OSP) from State Department of Agriculture's 1:24,000 blueline maps.
Attributes:	Polygons:

AREA	area of polygon (sq. meters)
PERIMETER	perimeter of polygon (meters)
ALISH#	Polygon internal number (for Arc/Info use)
ALISH-ID	Polygon ID (for Arc/Info use)
AGTYPE	Agricultural Type

AGTYPE	Definition
<blank>	Unclassified
0	Unclassified
1	Prime Lands
2	Unique Lands
3	Other Lands

Notes: (from "Agricultural Lands of Importance to the State of Hawaii Revised," State Department of Agriculture, November, 1977).

The Classification System:

The classification system for identification of agriculturally important lands in the State of Hawaii provides for the:

1. Establishment of classes of agricultural lands primarily, but not exclusively, on the basis of soil characteristics;

2. Establishment of criteria for classification of lands; and

3. Identification of lands which meet the criteria for the respective classes.

Three classes of agriculturally important lands were established forthe State of Hawaii with the intent of facilitating the SCS effort to inventory prime farmlands nationally and adapting the classification to the types of agricultural activity in Hawaii. These classes and their corresponding SCS (national) equivalents are:

Hawaii Classification System	**SCS Classification System**
Prime Agricultural Land	Prime Farmland
Unique Agricultural Land	Unique Farmland
Other Important Agricultural Land	Additional Farmland of Statewide and Local Importance

The criteria for classification of PRIME AGRICULTURAL LAND are identical to the criteria established by SCS for national application. The criteria for UNIQUE AGRICULTURAL LAND and OTHER IMPORTANT AGRICULTURAL LAND were established cooperatively by the Soil Conservation Service in Hawaii, the College of Tropical Agriculture, and the State Department of Agriculture.

Land considered for classification may or may not currently be in agricultural use, or may be in an agricultural use other than that which its classification may indicate as its agricultural capability. An example of the latter situation is land currently being used for grazing but which meets the criteria for Prime Agricultural Land. Lands not considered for classification as agricultural lands of importance to the State of Hawaii are:

1. Developed urban land over 10 acres;

2. Natural or artificial enclosed bodies of water over 10 acres;

3. Forest reserves;

4. Public use (parks and historic sites) lands;

5. Lands with slopes in excess of 35%; and

6. Military installations, except undeveloped areas over 10 acres.

The classification of agriculturally important lands does not in itself constitute a designation of any area to a specific land use. The classification should, however, provide decision makers with an awareness of the long-term implications of various land use options for production of food, feed, forage, and fiber crops in Hawaii.

Over time new areas may be developed for agricultural uses, other areas may be converted to irreversible non-agricultural uses, and new knowledge may be gained regarding soil interpretations. These and other developments will necessitate the periodic review and revisionof the classification system and lands identified for the various classes.

The Criteria for Classification:

PRIME AGRICULTURAL LAND

PRIME AGRICULTURAL LAND is land best suited for the production of food, feed, forage and fiber crops. The land has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops economically when treated and managed, including water management, according to modern farming methods.

PRIME AGRICULTURAL LAND meets the following criteria:

1. The soils have an adequate moisture supply. Included are:

    a. Soils having aquic or udic moisture regimes. (For definitions of moisture regimes see Soil Taxonomy, Agricultural Handbook 436, December 1975). These soils commonly are in humid or subhumid climates that have well distributed rainfall or have enough rain in the summer that the amount of stored moisture plus rainfall is approximately equal to or exceeds the amount of potential evapotranspiration. Water moves through the soils at some time in most years.

    b. Soils having xeric or ustic moisture regimes and in which the available water capacity is great enough to provide adequate moisture for the commonly grown crops in 7 or more years out of 10.

    c. Soils having aridic or torric moisture regimes and the area has a developed irrigation water supply that is dependable and of adequate quality. Also included are soils having xeric or ustic moisture regimes in which the available water capacity is limited but the area has a developed irrigation water supply that is dependable and of adequate quality.

    d. Soils having sufficient available water capacity within a depth of 40 inches (1 meter), or in the root zone if the root zone is less than 40 inches deep, to produce the commonly grown crops in 7 or more out of 10 years.

    A dependable water supply is one in which enough water is available for irrigation in 8 out of 10 years for the crops commonly grown.

2. The soils have a soil temperature regime that is isomesic, isothermic, or isohyperthermic. These are soils that, at a depth of 20 inches (50 cm), have a mean annual temperature higher than 47 degrees F (8 degrees C), and the difference between the mean summer and mean winter temperature differ by less than 9.0 degrees F (5 degrees C).

3. The soils have a pH between 4.5 and 8.4 in all horizons within a depth of 40 inches (1 meter) or in the root zone if the root zone

is less than 40 inches deep. (Soils which have a pH of less than 4.5 in surface soil because of use of fertilizers are excluded). This range of pH is favorable for growing a wide variety of crops without adding large amounts of amendments.

4. The soils have no water table or a water table that is maintained at a sufficient depth during the cropping season to allow crops common to the area to be grown.

5. The soils can be managed so that in all horizons within a depth of 40 inches (1 meter) or in the root zone if the root zone is less than 40 inches deep, during part of each year the conductivity of saturation extract is less than 4 mmhos/cm and the exchangeable sodium percentage (ESP) is less than 15.

6. The soils are not flooded frequently during the growing season (less often than once in 2 years).

7. The soils have a product of K (erodability factor) x percent slope of less than 2.0. That is, soils having a serious erosion hazard are not included.

8. The soils have a permeability rate of at least 0.06 inches (0.15 cm) per hour in the upper 20 inches (50 cm) and the mean annual soil temperature at a depth of 20 inches is less than 57 degrees F (14 degrees C). Permeability rate is not a limiting factor if the mean annual soil temperature is 57 degrees F (14 degrees C) or higher.

9. Less than 10 percent of the surface layer in these soils consists of rock fragments coarser than 3 inches (7.6 cm). These soils present no particular difficulty in cultivating with large equipment.

10. Must not be thixotropic and have isomesic temperature regime.

UNIQUE AGRICULTURAL LAND

UNIQUE AGRICULTURAL LAND is land other than PRIME AGRICULTURAL LAND and is used for the production of specific high-value food crops. The land has the special combination of soil quality, growing season, temperature, humidity, sunlight, air drainage, elevation, aspect, moisture supply, or other conditions, such as nearness to market, that favor the production of a specific crop of high quality and/or high yield when the land is treated and managed according to modern farming methods. In Hawaii, some examples of such crops are coffee, taro, rice, watercress and non-irrigated pineapple.

Land that qualifies as PRIME AGRICULTURAL LAND and is used for a specific high-value crop is classified as PRIME AGRICULTURAL LAND rather than as UNIQUE AGRICULTURAL LAND.

OTHER IMPORTANT AGRICULTURAL LAND

OTHER IMPORTANT AGRICULTURAL LAND is land other than PRIME or UNIQUE AGRICULTURAL LAND that is of state-wide or local importance for the production of food, feed, fiber and forage crops. The lands in this classification are important to agriculture in Hawaii yet they exhibit properties, such as seasonal wetness, erodibility, limited rooting zone, slope, flooding, or droughtiness, that exclude them from the PRIME or UNIQUE AGRICULTURAL LAND classifications. Two examples are lands which do not have an adequate moisture supply to qualify as PRIME AGRICULTURAL LAND and lands which have similar characterisitics and properties as UNIQUE AGRICULTURAL LAND except that the land is not currently in use for the production of a "unique" crop. These lands can be farmed satisfactorily by applying greater inputs of fertilizer and other soil amendments, drainage improvement, erosion control practices, flood protection and produce fair to good crop yields when managed properly.

Other criteria which may qualify lands as OTHER IMPORTANT AGRICULTURAL LAND are:

1. The land has slopes less than 20%, is presently in crop or has cropping potential, and is not classified as PRIME or UNIQUE AGRICULTURAL LAND. The soils have a moisture supply which is adequate for the commonly grown crop.

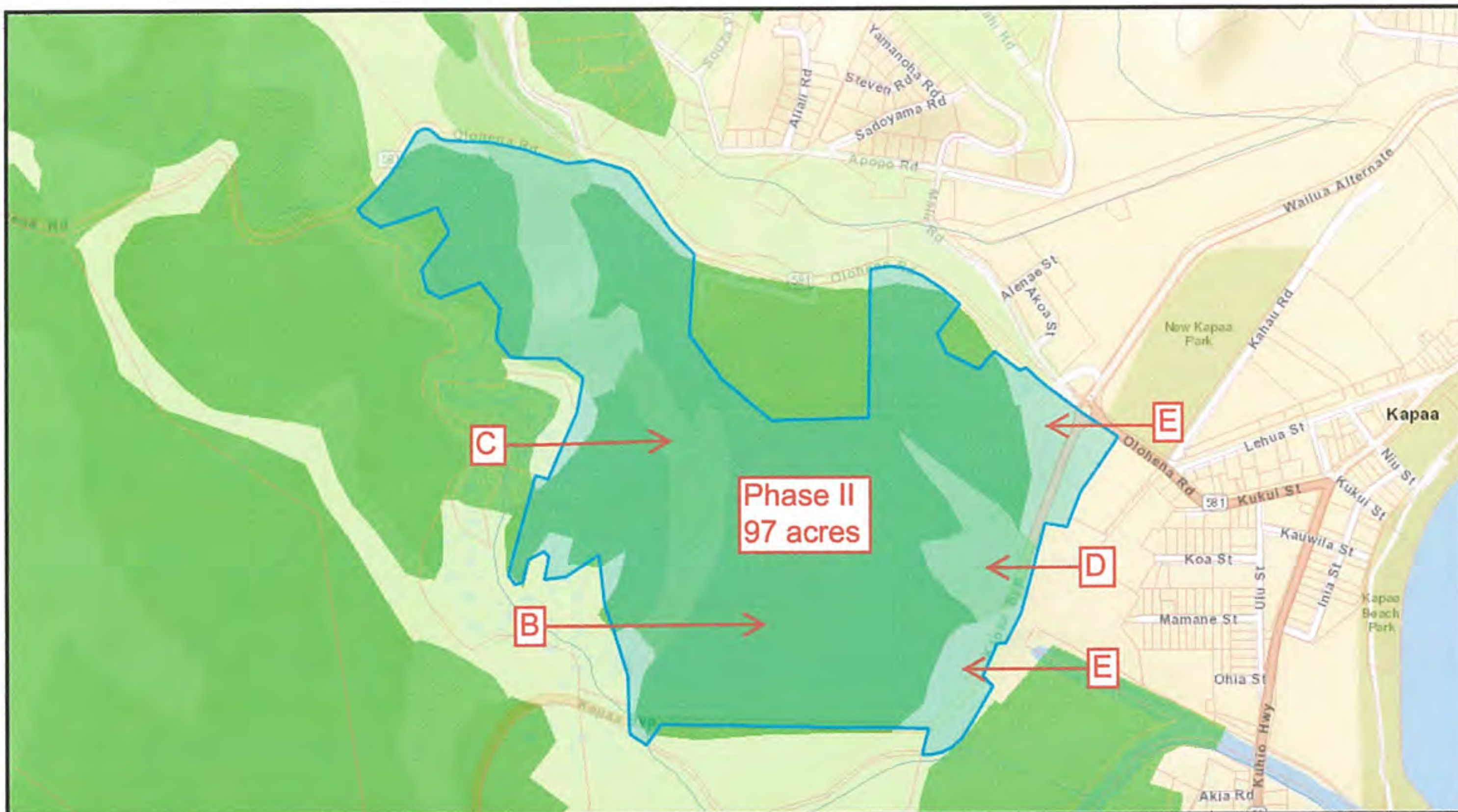
2. The land has slopes less than 35%, is presently used for grazing or has grazing potential, and is not classified as PRIME or UNIQUE AGRICULTURAL LAND. The soils have:

    a. An aquic, udic, xeric, or ustic moisture regime in which the available water capacity is sufficient to produce fair to good yields of adapted forage.

    b. Less than 10% rock outcrops and coarse fragments coarser than 3 inches (7.6 cm) in the surface layer.

3. The soils are thin organic soils underlain by aa lava (typic tropofolists) having aquic, udic, xeric, or ustic moisture regimes and Isohyperthemic (greater than 72 degrees F) or Isothermic (59 - 72 degrees F) soil temperature regimes.

Contact: Joan Delos Santos, Office of Planning, State of Hawaii,
PO Box 2359, Honolulu, Hi. 96804; (808) 587-2895.
email: JDelos_Santos@dbedt.hawaii.gov



Renewable EnerGIS Parcel Report - (4) 4-3-003:001

0 600 ft

SITE DESCRIPTION

Parcel Area (acres): **163.420**
County Zoning: **No data**
County Address: **Olohena Rd**
State Land Use District: **Agriculture; Urban**

LAND ECOLOGY

Critical Habitat: **No**
Special Management Area (SMA): **No**
Thermal Springs Potential: **No data**
High Temperature Resource Areas: **No data**
Reserves: **No**

LAND USE / LAND COVER

Ag Land Use (2011-2015): **Pasture**
Ag Land Use (ALUM 1980): **Grazing; S**
Ag Lands of Importance (ALISH): **Unclassified; Prime; Other**
LSB Soil Rating: **B; C; D; E**
Important Ag Land (IAL): **No data**

INFRASTRUCTURE

Ditches: **DITCH**
Studied Hydro Projects: **No**

HYDROLOGY

Flood Zone: **X**
Streams: **Waikaea**

Point Details – Coordinates of Point: 22.07523, -159.32730

SOLAR RESOURCES

Solar Radiation (calories/cm2/day): **400-450**
DNI Annual (Wh/m2/day): **4,303**
GHI Annual (Wh/m2/day): **5,095**

TERRAIN

NOAA Elevation (m): **31**
USGS Slope (%): **2.81974**
USGS Aspect (degress from N): **219.137**

MARINE RESOURCES

Temp Avg Diff (degrees C): **No data**
Temp Amplitude Diff (degrees C): **No data**
3-Mile Ocean Boundary: **Not applicable**
12-Mile Ocean Boundary: **Not applicable**
Benthic Habitat: **No data**
Whale Sanctuary: **No data**
Marine Managed Area: **No data**
Annual Rainfall: **45.168198**

WIND RESOURCES

Wind Power Density at 50m (W/m2): **239.00**
Wind Speed at 30m (m/s): **No data**
Wind Speed at 50m (m/s): **No data**
Wind Speed at 70m (m/s): **No data**
Wind Speed at 100m (m/s): **No data**

DBEDT
STATE OF HAWAII

06/24/2018

Layer Name:	Land Study Bureau (LSB) Detailed Land Classification
Layer Type:	Polygon
Status:	Complete; currently being updated
Geog. Extent:	Main Hawaiian Islands
Projection:	Universal Trans Mercator, Zone 4, Meters, NAD 83 HARN
Description:	Land Study Bureau's Detailed Agricultural land productivity ratings for Kauai, Oahu, Maui, Molokai, Lanai and Hawaii.
Source:	Land Study Bureau's Detailed Land Classification Aerial Photos hand drafted onto paper overlays of the U.S.G.S., 1:24,000 topographic and orthophoto quads. Ratings were developed for both over-all productivity, and for specific crops. This layer represents only the over-all productivity ratings. Dates of LSB studies: Hawaii - 1965 Maui - 1967 Oahu - 1972 Kauai - 1967 Molokai - 1968 Lanai - 1967
History:	Digitized in Arc/Info version 7.1.1 using ArcEdit by the Office of Planning (OP), 1998. Note 1: Lands having the LSB rating of "U," which the Land Study Bureau assigned to built-up or urbanized areas (as of the date of the studies), were not digitized. Note 2: All classified lands falling within the State Land Use Urban District were deleted from the layer using the 1995 LUDB coverages. Note 3: Although LSB classification polygons falling within the 1995 LUDB Urban District were deleted from the GIS layer, the classifications themselves still exist – they simply are not represented in this GIS layer. Specifically, there is no provision in State law requiring the rescission of the soil ratings that apply to an area that has been reclassified by the Land Use Commission, e.g., from the Agricultural to Urban districts. Similarly, there is no provision in State law requiring the Detailed Land Classification (Land Study Bureau) bulletins to be reviewed and revised to reflect changes to the land areas for which urban development has occurred.

Attributes: Polygons:

AREA	area of polygon (sq. meters)
PERIMETER	perimeter of polygon (meters)
TYPE	Agricultural Productivity Rating
Island	Island
GISAcres	Acreage, as calculated by GIS software

TYPE	DEFINITION
A-E	Agricultural productivity rating, from A to E, with "A" having the highest rating.

Discussion:

From "A Report on the State of Hawaii Land Evaluation and Site Assessment System" February, 1986, Section IV, pp.23-25):

"Land Study Bureau's Overall Productivity Rating (LSB):

The Land Study Bureau of the University of Hawaii prepared an inventory and evaluation of the State's land resources during the 1960's and 1970's. The Bureau grouped all lands in the State, except those in the urban district**, into homogeneous units of land types; described their condition and environment; rated the land on its over-all quality in terms of agricultural productivity; appraised its performance for selected alternative crops; and delineated the various land types and groupings based on soil properties and productive capabilities.

**Office of Planning note: "urban district," in this context/document, does not refer to the State Land Use District Boundary "Urban District", but instead refers lands that were observed to have been "built areas" in the aerial photographs.

These properties included:

a. Texture-which refers to the proportion of sand, silt and clay in a particular soil. Medium-textured soils which have nearly equal proportions of sand, silt and clay are generally the most desirable for agriculture because of good tillability and water retention.

b. Structure-which refers to the cohesion of soil material into aggregates or clumps. The size, shape and amount of these clumps affect the pore spaces which contain the air and moisture necessary for growth.

c. Depth-which refers to the distance to which roots can penetrate. Generally, the deeper the rooting depth, the more desirable the soil because more moisture can be stored and more soil volume is available from which nutrients can be obtained.

d. Drainage-refers to the frequency and duration of soil saturation with moisture.

e. Parent material-refers to the geologic material from which a soil has developed. Soils formed from coral have neutral to alkaline reactions and are high in calcium. Most of the soils have developed from volcanic material and under tropical conditions of high temperature and rainfall. These soils tend to be acid and fertility levels are relatively low.

f. Stoniness-affects the productivity of land by limiting the use of machinery and the selection of crops.

g. Topography-refers to slope and surface configuration. Lands with flat terrain are better suited for a wider variety of agricultural uses than lands having steeper slopes. Cultivated lands generally have slopes of less than 20 percent. Lands with slopes between 20 to 35 percent usually are not machine-tilled, but are still suitable for certain uses such as orchards and grazing.

h. Climate-with its elements of temperature, sunlight and rainfall constitutes the exterior environment of land, unlike the soil properties which constitute the interior segment.

i. Rain-is the basic source of irrigation. Ideally, it should fall at the place, in the quantity and at the time when it is needed.

The interaction of particular soil properties, topography and climate served to differentiate land types and provided a basis for correlating and establishing productivity ratings. A five-class productivity rating system was developed with "A" representing the class of highest productivity and "E" the lowest."

From "Detailed Land Classification - Island of Kauai," December, 1967, Land Study Bureau, pp. 25-27:

"Over-all (Master) Productivity Rating:

The Over-all Productivity Rating evaluates each Land Type in its over-all or general productive capacity and not for any specific crop. Two independent methods were utilized in ascertaining and checking this over-all rating: averaging the Selected Crop Productivity Ratings and application of the Modified Storie Index (6) (7).

....The Modified Storie Rating Index is a formula whereby the productivity index of the land is developed by multiplying the several factors in the formula. The higher the product, the better suited the Land Type is for agricultural uses.

Modified Storie Rating Index = A x B x C x X x Y

A = percentage rating for the general character of the soil profile
B = percentage rating for the texture of the surface horizon
C = percentage rating for the slope of the land
X = percentage rating for such factors as salinity, soil reaction, damaging winds, erosion, etc.
Y = percentage rating for rainfall

The percentage rating for each factor (A, B, C, X and Y) increases as the favorableness of the factor increases. Therefore, it follows that as the land productivity index approaches 100 percent, the agricultural quality of the land increases. Conversely, less desirable lands have low value indexes. The following are the Modified Storie Index percentages and their associated Over-all Productivity Ratings.

Modified Storie Index Percentages	Over-all Productivity Rating
85-100	A
70-84	B
55-69	C
30-54	D
0-30	E

.....each factor is discussed briefly to indicate its role in determining land quality for agricultural purposes:

The ratings for factor A take drainage and depth of the soil profile into consideration. Deep and shallow soils are recognized and differentiated. The nature of the surface soil and subsoil are considered. Parent material and degree of soil development are recognized as they affect fertility, structure, depth, aeration and moisture-holding capacity of the soil.

Factor B, which expresses the texture of the surface soil, reflects the relative workability of the soil as well as its composition of silt, sand and clay. Stony lands, including lava lands, are placed in special categories. The soils are separated into textural groups. Soils are usually expected to react quite similarly when of similar textural groups. Texture is closely associated with moisture-holding capacity and workability of the soil.

Factor C accounts for the variations in the slope of the land. The slope classes are designed to differentiate ease of irrigation and use of mechanical equipment, susceptibility to erosion, amount of surface runoff, and suitability for commercial forest production. In general, slopes exceeding 35 percent are considered too steep for cultivated crops, and slopes greater than 80 percent are assumed impractical for commercial forest production.

Factor X includes the miscellaneous land characteristics such as soil fertility, soil reaction, soil salinity, and presence of strong winds.

Factor Y accounts for rainfall and associated climatic feature. As a general rule, lands in the higher rainfall zones are cloudy and therefore lower in productivity; irrigated lands are rated 100 because the moisture requirement is adequately met. It is the general assumption that where irrigation is required, climate is usually satisfactory for crop production."

Note: For more detailed explanations of the Land Rating criteria, refer to the Land Study Bureau's publications for each island:

Detailed land classification: island of Hawaii. , Honolulu: Land Study Bureau, University of Hawaii, Nov. 1965.
Detailed land classification - island of Kauai. , Honolulu: University of Hawaii, Land Study Bureau, Dec. 1967.
Detailed land classification - island of Lanai. , Honolulu: University of Hawaii, Land Study Bureau, May 1967.
Detailed land classification: Island of Maui. , Honolulu: Land Study Bureau, University of Hawaii, May 1967.
Detailed land classification: Island of Molokai. , Honolulu: Land Study Bureau, University of Hawaii, June 1968.
Detailed land classification: Island of Oahu. , Honolulu: Land Study Bureau, University of Hawaii, Jan. 1963.

Note: The Detailed Land Classification and the Hawaii Land Evaluation and Site Assessment System publications referenced above can be found at the Hawaii Legislative Reference Bureau (http://lrbhawaii.org/, 808-587-0690), and at Hawaii State Public Libraries (http://www.librarieshawaii.org/, 808-586-3500).

Contact : Statewide GIS Program, Office of Planning, State of Hawaii,
PO Box 2359, Honolulu, Hi. 96804; (808) 587-2846.
email: gis@hawaii.gov

Appendix C
2015 Crop Summary by Acreage

2015 Crop Summary by Acreage							
Crop Types	Hawai'i	Kaua'i	Maui	Moloka'i	Lāna'i	O'ahu	State Total
Aquaculture	165	183	-	28	-	274	*651*
Banana	536	26	62	-	-	345	*969*
Coffee	5,525	3,788	545	123	-	168	*10,149*
Commercial Forestry	21,061	1,743	33	-	-	26	*22,864*
Dairy	1,855	-	-	-	-	-	*1,855*
Diversified Crop	3,266	1,199	1,582	937	54	9,865	*16,904*
Flowers / Foliage / Landscape	1,612	165	134	26	10	484	*2,432*
Macadamia Nuts	21,359	-	186	-	-	-	*21,545*
Papaya	2,566	-	-	93	-	166	*2,824*
Pineapple	-	-	1,094	-	-	3,414	*4,508*
Seed Production	-	13,299	754	2,342	-	7,333	*23,728*
Sugar	-	-	38,810	-	-	-	*38,810*
Taro	61	443	54	2	-	51	*612*
Tropical Fruit	3,144	463	104	43	-	227	*3,980*
Crop Total:	***61,149***	***21,310***	***43,360***	***3,593***	***65***	***22,354***	***151,831***
Pasture	554,324	41,934	108,447	38,261	-	18,464	761,429
Total Agriculture	***615,473***	***63,244***	***151,808***	***41,854***	***65***	***40,818***	***913,261***

Appendix D
Resources

RESOURCES

County of Kauai Office of Economic Development, Kauai Economic Development Board. Kauai Economic Development Plan 2005-2015. Lihue, Kauai, Hawaii. Pages 65 – 73.

County of Kauai Planning Department. Kauai General Plan 2018. Lihue, Kauai. Pages 4-20 to 4-26.

Hawaii Land Use Law and Policy. How Much Agricultural Land Does Hawaii Need? @HILandUseLaw. March 11, 2008.

Kauai Coffee Company, LLC. Kalaheo, Hawaii.

Melrose, Jeffrey, Perroy R., Cares S. Statewide Agricultural Land Use Baseline Study 2015. Hawaii Department of Agriculture. University of Hawaii at Hilo Spatial Data Analysis & Visualization Research Lab, Hilo, Hawaii.

State of Hawaii Office of State Planning. Hawaii Statewide GIS Program June 2018. Honolulu, Hawaii.

United States Department of Agriculture Natural Resource and Conservation Service, Pacific Islands Area. Lihue Service Center, Lihue, Kauai.

Economics for Goats
01-Jun-07

General Assumptions:	Ratio	Units
Acreage		102
Animal units per acre		3.5
Total animal units (AU)		357
Breeding herd :		206
Bucks (1)	3%	6
Does (30)	97%	200
Kids per doe per year	1.5	300
Total animal units (AU)		356

Note: Bucks & Does = 1 AU each, Kids = 1/2 AU each.

Annual Revenue from Goat Sales:	Ratio	Units	Unit Price	Annual Revenue
Local Kauai Sales	75%	225	$ 180	$ 35,968
Honolulu Sales (FOB Lihue)	25%	75	$ 140	$ 10,491
Totals		300		$ 46,458

Expense:	Units	Unit Cost	Fixed Cost	Annual Cost
Labor:				
Part-time labor (hours)	520	$ 15.00		$ 7,800
Feed:				
Barley-Corn (per head)	206	$ 2.90		$ 597
Minerals:				
Mineral block (per head)	206	$ 12.00		$ 2,472
Veterinary Supplies:				
Worming (per head)	206	$ 1.20		$ 247
Water:				
Annual requirement (3 gallons per head per day)	206	$ 2.03		$ 417
Repair & Maintenance:				
Repair fences, gates, water system			$ 1,200	$ 1,200
Vehicle - Repair , Maintenance and Fuel			$ 2,000	$ 2,000
Hauling Goats (per head):	206	$ 0.70		$ 144
Total Direct Costs				$ 14,878
Overhead:				
Lease Rent (unit cost per acre per year)		$ 35.00		$ 3,570
Administration			$ 500	$ 500
Management			$ 5,000	$ 5,000
Other			$ 250	$ 250
Total Overhead				$ 9,320
Net Operating Profit (Loss)				$ 22,260

Exhibit D

Department of Water, Kaua'i County
Manager's Report 12-10

EXHIBIT "D"

MANAGER'S REPORT 12-10:

July 21, 2011

Re: Kapaa Highland Request

RECOMMENDATION:

Your concurrence is requested to allow the staff to enter into an agreement in accordance with Part III Section XII of the rules with Kapaa Highland subject to county attorney concurrence. This exchange should be on a dollar for dollar basis not gallon for gallon.

BACKGROUND:

The developer is proposing the following exchange: the developer will give the DOW undeveloped water and in return, the DOW will provide the developer with storage for the developer's project; both will be built to department standards.

The project has a large portion of land that shows in the community plan to be affordable housing though not currently zoned as such. I have checked with the county housing department and the Mayor's office and both want to see the affordable housing go forward. This concurrence is verbal.

The planned storage for planned water exchange will allow this project to move forward when other developments have been stopped due to inadequate storage. There appears to be an overall county benefit and the implementation would be subject to finally getting the storage and source completed.

Our storage project is scheduled to be completed in 3-4 years. The source development could be sooner. The issue with this proposal is wells in different locations have different yields and DOW storage is only subject to available funds.

The developer has drilled a well and tested it. The well is too crooked to be used as a normal source of water and have to be redrilled in another location. The next one may not provide the same yield. It is low enough risk that this is being recommended.

Respectfully submitted,

David R. Craddick, P.E.
Manager and Chief Engineer

Department of Water
County of Kaua'i

Water has no substitute.......Conserve it

August 22, 2011

Mr. Gregg Allen
161 Wailua Road
Kapaa, HI 96746

Dear Mr. Allen:

Subject: Water Master Plan for the Kapa'a Highlands Project on TMK: 4-3-03:001

At the Department of Water, Water Board July 28th 2011 meeting, via Managers Report 12-10, in response to your letters of April 22, 2011 and May 11, 2011, accepted the proposed exchange of source for storage on a dollar for dollar basis. This acceptance is based on your commitment to proceed with zoning changes in your development to match the county zoning. That zoning change requires affordable housing in certain portions of your proposed development.

This acceptance is based on building permits and County water meter service not being issued if the source and storage requirements have not been completed as of the date of requested building permit approval. We ask that you submit a proposed draft of an agreement to memorialize this action. We would expect that this agreement runs with the land.

If you have any questions, please contact Mr. Gregg Fujikawa at (808) 245-5416.

Sincerely,

David R. Craddick, P.E.
Manager and Chief Engineer

GF/WE:bdm
Bill/Gregg Allen Response Letter/July Board Mtg.

4398 Pua Loke St., P.O. Box 1706, Lihue, HI 96766 Phone: 808-245-5400
Engineering and Fiscal Fax: 808-245-5813, Operations Fax: 808-245-5402, Administration Fax: 808-246-8628

Exhibit E

Irrigation Supply for
HoKua Place Agricultural Subdivision
(Formerly Kapa'a Highlands II)

Water Master Plan

EXHIBIT "E"

TNWRE
Tom Nance Water
Resource Engineering

No. of pages: 8
Email: gallen@harbormall.net

Original ☑ will ☐ will not
be mailed to you.

October 27, 2006
06-281 (05-41)

MEMORANDUM

TO:	Greg Allen
FROM:	Tom Nance
SUBJECT:	Irrigation Supply for the Kapaa Highlands Agricultural Subdivision

Introduction

This memo report assesses the feasibility of developing an onsite well (or wells) to provide the necessary irrigation supply for the Kapaa Highlands Agricultural Subdivision. The total area of the project is 163 acres. Wagner Engineering Services, Inc. has determined that up to 113 acres of the site is suitable for agricultural use (Figure 1). The Kauai Department of Water (DOW) standards require an average supply for irrigation for 2500 GPD/acre. For 113 acres, this translates to a year-round average of 0.283 MGD. Applying a maximum seasonal use factor of 1.5 results in a required summertime supply capability of 0.424 MGD (equivalent to 295 GPM operating continuously).

Results of an Onsite Exploratory Borehole

To investigate the possibility of providing the irrigation supply with an onsite well or wells, an exploratory borehole was drilled and pump tested. The location of this exploratory borehole is shown on Figures 1 and 2. Ground elevation at the well site is 25 feet. It was drilled to a depth of 260 feet or 235 feet below sea level. During the course of drilling, two separate aquifers were encountered. The upper aquifer has a static water level of about 19 feet above sea level (MSL) and it extends to a depth of about 80 feet (ie. to 55 feet below sea level). It has very limited yield (less than 30 GPM) as it is essentially a collection of water in the soil mantle perched on poorly permeable Koloa lavas beneath it.

The strata between 80- and 210-foot depth are poorly permeable and function as an aquiclude separating the upper and lower aquifers. The lower aquifer, which starts at 210-foot depth and extends below the 260-foot depth of the exploratory borehole, has a static water level about 13 feet (MSL). This lower aquifer is quite productive.

A pump test was run at my direction to define the potential yield and quality of water from the lower aquifer. Using a combination of casing and grout, water from the upper aquifer was sealed off for this test. Results of the 12-hour test conducted on October 19, 2006 are presented on Figures 3, 4, and 5. A series of flowrate steps were run initially to define hydraulic performance (Figure 3). Using a curve fitting technique, these results define expectable drawdown for a range of pumping rates (Figure 4). For example, at 500 GPM, the drawdown would be 7.5 feet.

The remainder of the 12-hour test was run at 550 GPM to see if any salinity change would occur. These results are shown on Figure 5 and Table 1. The salinity (as measured by conductivity) actually decreased for the first two hours and stabilized after that. Chlorides of just 53 MG/L demonstrate that the water is quite fresh and obviously suitable for irrigation use.

Conclusions and Recommendations Regarding the Irrigation Supply

1. Results of the exploratory borehole demonstrate that an adequate irrigation supply for the Agricultural Subdivision can be developed from a single onsite well located in the near proximity of the exploratory borehole.

2. The finished dimensions of the production well should be based on the following:

   a. A 17-inch borehole should be drilled to 300-foot depth.

   b. 220 feet of 8-inch solid casing and 80 feet of 8-inch perforated casing should be installed in the borehole.

   c. The annular space from 220 feet to the ground surface should be sealed with cement grout.

   d. Final pump testing at rates up to 550 GPM should be conducted to confirm the well's yield.

3. A companion report by ITC Water Management describes the delivery components of the irrigation system based on the following:

   a. A 7.5 horsepower, 450 GPM submersible pump and motor should be installed in the well at a depth of 30 to 40 feet.

   b. The well pump should deliver water to an adjacent storage tank of at least 30,000 gallons in size. Well pump cycles would be controlled by a level switch in the tank.

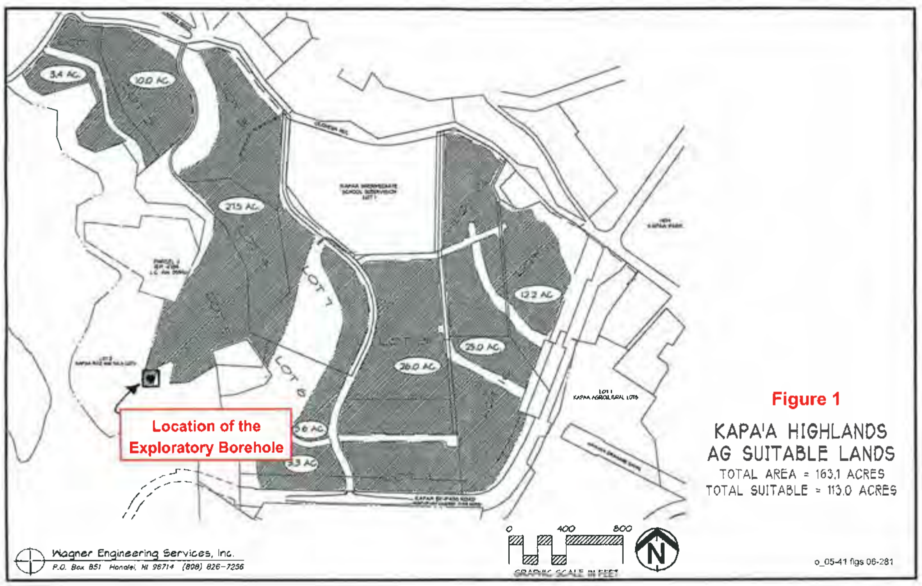
   c. An on-demand pump station of up to 600 GPM capacity should be installed next to the tank to draw water from the tank and deliver it to users in the agricultural subdivision.

Attachments

Specific Conductance and Chlorides of Samples
Collected During the 12-Hour Pump Test on October 19, 2006

Sample Time	Pumping Rate (GPM)	Specific Conductance (µS/cm @ 25° C.)	Chlorides (MG/L)
10:05	317	468	55
10:30	317	449	54
11:00	438	440	54
11:30	529	436	53
12:00	528	432	53
13:00	527	430	53
14:00	527	429	53
15:00	527	429	53
16:00	528	429	53
17:00	529	428	53
18:00	531	429	53
19:00	532	430	53
20:00	533	431	53
21:00	533	431	53
22:00	533	431	53

Notes:
1. Specific conductance measured in the TNWRE office using a HACH Sension5 meter calibrated with a 12.88 mS/cm standard.
2. Chlorides determined by mercuric nitrate titration in the TNWRE office. Samples were diluted 10 fold.


Location of the
Exploratory Borehole
Figure 1
KAPA'A HIGHLANDS
AG SUITABLE LANDS
TOTAL AREA = 163.1 ACRES
TOTAL SUITABLE = 113.0 ACRES
Wagner Engineering Services, Inc.
GRAPHIC SCALE IN FEET

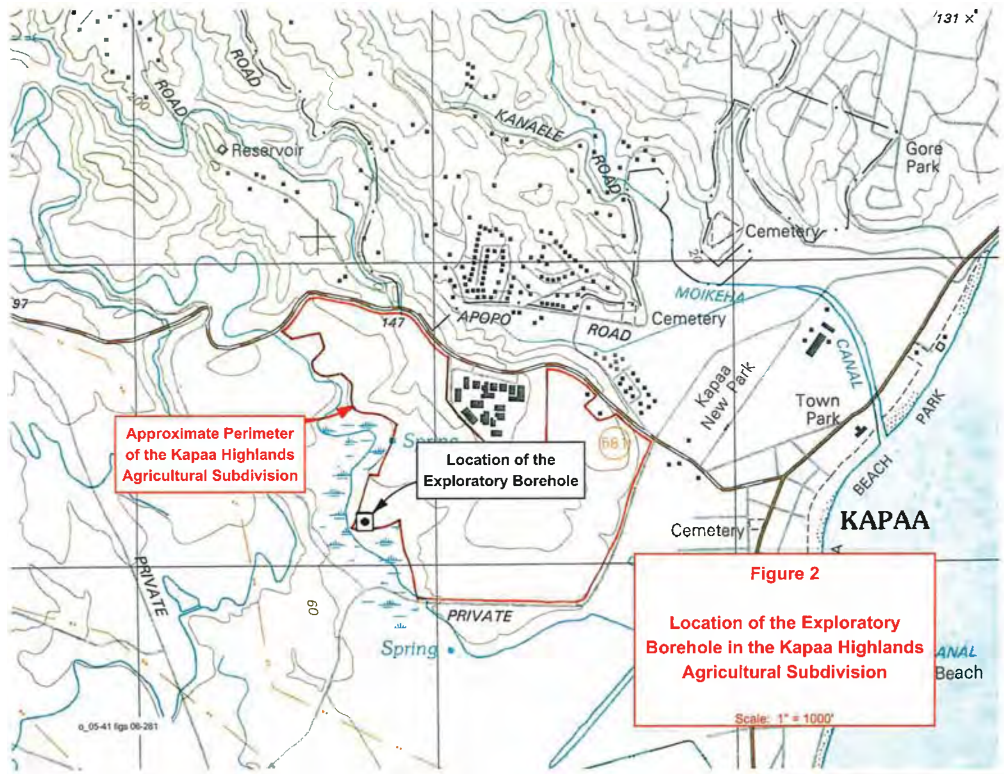

Approximate Perimeter
of the Kapaa Highlands
Agricultural Subdivision
Location of the
Exploratory Borehole
Reservoir
KANAELE
ROAD
APOPO
Cemetery
Gore
Park
MOIKEHA
Kapaa
New Park
Town
Park
CANAL
BEACH
PARK
KAPAA
PRIVATE
Spring
Beach
Figure 2
Location of the Exploratory
Borehole in the Kapaa Highlands
Agricultural Subdivision
Scale: 1" = 1000'

Figure 3. Pumping Rate and Water Level During the 12-Hour Test

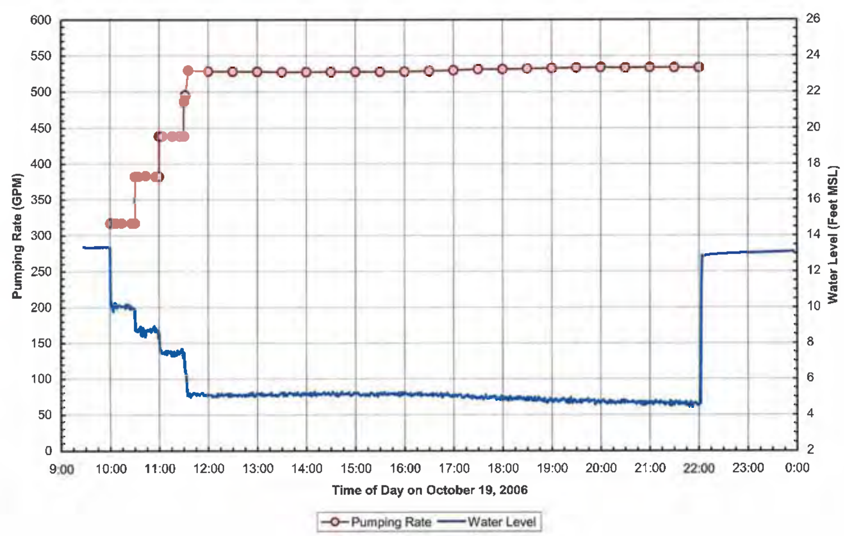


Figure 4. Hydraulic Performance of the Well Based on Step Test Data

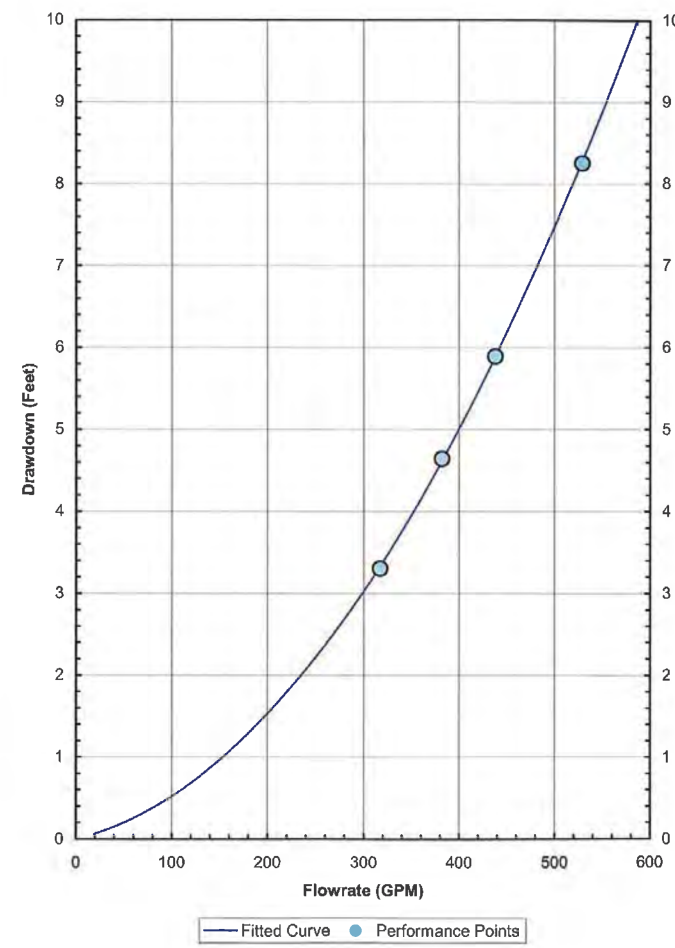
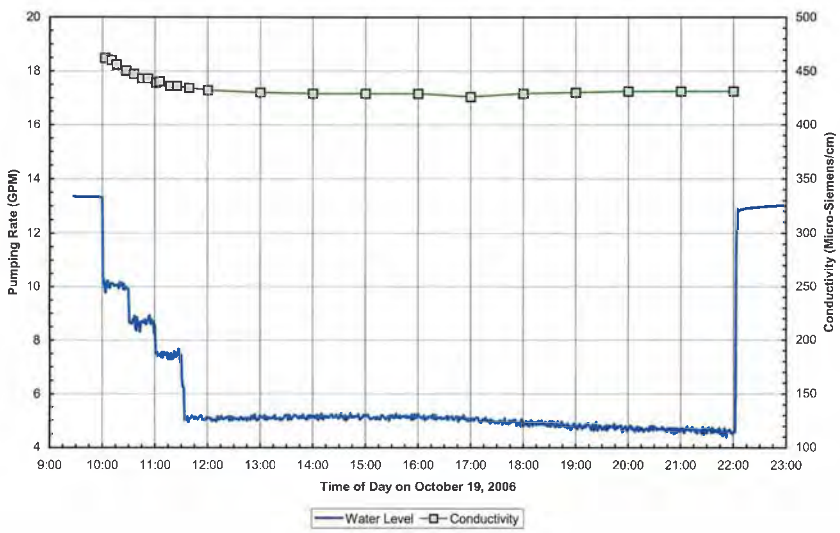


Figure 5. Pumped Water Conductivity through the 12-Hour Test



ExhibitEPart2

PrivateWaterSystem

BELLES GRAHAM PROUDFOOT
WILSON & CHUN, LLP
ATTORNEYS AT LAW

MICHAEL J. BELLES
MAX W.J. GRAHAM, III
DONALD H. WILSON
JONATHAN J. CHUN

Federal I.D. No. 99-0317663

OF COUNSEL
DAVID W. PROUDFOOT

COUNSEL
LORNA A. NISHIMITSU

WATUMULL PLAZA
4334 RICE STREET, SUITE 202
LIHUE, KAUAI, HAWAII 96766-1388

TELEPHONE NO: (808) 245-4705
FACSIMILE NO: (808) 245-3277
E-MAIL: mail@kauai-law.com

October 2, 2012

Mr. David R. Craddick
Manager & Chief Engineer
Department of Water
County of Kauai
P. O. Box 1706
Lihue, Kauai, Hawaii 96766

VIA EMAIL & HAND DELIVERY

Re: **Kapaa Highlands Subdivision (S-99-45)**
(fna Kūlana Kai/Kauai Highlands)
Subdivision Of Parcel 1 Being A Portion Of
Grant 5266 To Rufus P. Spalding Into Lots 1 To 18, Inclusive
Kapaa and Waipouli, Kauai, Hawaii
Kauai Tax Map Key No. (4) 4-3-003:001 (por.)
Owner: Allen Family LLC; Moloaa Bay Ventures, LLC; and The Three Stooges LLC

Dear Mr. Craddick:

I am writing to you on behalf of the above-identified applicants ("Applicants") in the Kapaa Highlands Subdivision matter ("Subdivision"). In lieu of obtaining water for the Subdivision from the public water system operated by the Department of Water ("Department"), the Applicants have decided to construct an on-site private water system ("PWS").

The PWS is described in an enclosed Memorandum dated September 12, 2012 prepared by Tom Nance of Tom Nance Water Resource Engineering ("Nance Report"). The essential design specifications are described below.

A. Private Water System.

1. The Applicants will construct a well ("Well") and two storage tanks ("Tanks") on-site.

2. The Well will be located along the south boundary of Lot 5, as shown in Figure 3 of the Nance Report.

3. The Storage Tanks will be located on the north boundary of Lot 3, as shown in Figure 3 of the Nance Report.

4. The Well design is shown on Figure 2 of the Nance Report. The Well will be twelve (12) inches in diameter and operated by two identical 100 gallons per minute ("GPM") pumps, each driven by 7.5 horsepower motors. The first pump will supply the needs of the Subdivision, which is 97,310 gallons per day ("GPD") maximum day use, and the second will serve as a standby pump.

5. Based on the water needs for 50 farm dwelling units, the total maximum day demand is 93,750 GPD. The two 50,000 gallon Tanks will be adequately sized to provide necessary storage plus fire flowrate protection. The Tanks will be lined with bolted steel with reinforced concrete base and passive cathodic protection (zinc anode rods).

6. The pipelines ("Pipelines") for the PWS will be sized to provide: fire flowrate with coincident maximum day demand and a minimum residual pressure of 20 psi (velocities not exceeding 10 fps); and peak flowrate with minimum residual pressure of 40 psi (maximum velocity in Pipelines of 6 fps). NSF-approved, high density polyethylene (HPDE), pipes will be used for the PWS. The Pipeline system is shown on Figure 3 of the Nance Report.

7. Pursuant to the Agricultural Master Plan submitted in this matter, the agricultural activities in the Subdivision will be limited to a goat raising operation ("Goat Project"). The Goat Project will require minimal water (at the most, 3,560 GPD), which will be supplied by the PWS.

8. The on-site Tank elevations will not provide adequate gravity pressure to meet the Department's delivery pressure requirements. Providing the necessary pressure would be done with parallel domestic and fire flowrate pumping systems with a generator to provide back power. These pump systems would provide up to 70 GPM for peak domestic use and 500 GPM for the fire flowrate condition. Both pumping systems would be sized to produce a total dynamic head of 110 feet, in effect creating a single, 270-foot service pressure zone across the entire project site.

B. Modification Of Requirements.

The Applicants are requesting the Department and/or the Board of Water Supply ("Water Board") to grant a modification from the Department's Water System Standards for the PWS as follows:

1. DOW Rule Part 3, Section XII, provides as follows:

"**SECTION XII – MODIFICATION OF REQUIREMENTS**

When conditions pertaining to any subdivision are such that the public may be properly served with water and with fire protection without full and strict compliance with these rules and regulations, or where the subdivision site or layout is such that the public interest will be adequately protected, such modification thereof as is reasonably necessary or expedient, and not contrary to law or the intent and purposes of these rules and regulations, may be made by the Department."

2. As part of the Subdivision in this case, the Applicants propose to have water for potable, fire, and agricultural uses for the Subdivision supplied by the PWS.

3. The PWS does not comply strictly with all of the Department's Water System Standards ("DOW Standards") which typically apply to the DOW's public water systems. These differences are set forth in the enclosed Comparison Of Kapaa Highlands PWS With DOW Water System Standards.

4. The Applicants are requesting the Department and/or the Water Board to find that the PWS: will properly serve the water and fire protection needs of the Subdivision without full and strict compliance with the DOW Standards; that, given the fact that the Subdivision will be served by the PWS, the public interest will be adequately protected by the PWS; that the differences between the PWS and the DOW Standards are, under all of the circumstances of this case, reasonably necessary and expedient; and that such differences are not contrary to the law or the intent or purposes of the DOW Rules.

Based on the above, the Applicants are requesting the Department and/or the Water Board to approve the proposed PWS for the Subdivision, together with the requested modifications. In the event this matter needs to be referred to the Water Board, then I am requesting that it be placed on the next available agenda of the Water Board. For these purposes, I have enclosed a Supporting Information For The Board Of Water Supply, County of Kauai in compliance with the Department's requirements for persons wishing to testify at Water Board Meetings.

Thank you very much for your consideration of this request.

Sincerely yours,

BELLES GRAHAM PROUDFOOT
WILSON & CHUN, LLP

Max W. J. Graham, Jr.

MWJG:jgm
Enclosures
cc: Mr. Greg Allen, Jr., w/encls. (via email only)
Andrea A. Suzuki, Esq., w/encls. (via email only)
Mr. William Eddy, DOW, w/encls. (via email only)
Mr. Gregg Fujikawa, DOW, w/encls. (via email only)
Mr. Dale A. Cua, Staff Planner, w/encls. (via email only)

TNWRE
Tom Nance Water
Resource Engineering

No. of pages: 7
Email: gallen@harbormall.net
mwg@kauai-law.com
greg@tnwre.com

Original ☑ will ☐ will not be mailed to you.

September 10, 2012
12-177 | 09-12

MEMORANDUM

To: Greg Allen

From: Tom Nance

Subject: Sizing and Layout of a Private Water System to Supply the Kapaa Highlands Project

Introduction

This memo and its attachments present the sizing and layout of major infrastructure elements of a private water system that would be developed to supply the Kapaa Highlands project. The basis of the water system sizing assumes the project would be developed in two phases. Phase 1 would consist of 16 residential units on five lots in an agricultural subdivision. Phase 2 would consist of an urban residential development comprised of 86 SF residential units, 683 MF residential units, and parks (3.1 ac.), church (0.8 ac.), commercial (0.4 ac.), roads (9.4 ac.), and unirrigated open space (14.3 ac.). In the event that land use entitlements are not obtained for the residential development, Phase 2 would consist of 34 residential units on seven lots in an agricultural subdivision.

Required Water Supply

Due to the size of the residential lots in the agricultural subdivision, which vary from 1.47 to 6.67 acres in size for the Phase 1 development, an allocation of 2000 GPD as the average demand per residential lot is recommended, a rate which is four times greater than the Kauai Department of Water (DOW) design standard for single family residential units. For the residential subdivision in Phase 2, use of DOW's design criteria is recommended. Based on these recommendations, Tables 1 and 2 are tabulations of the average and maximum day demands for the private water system. Maximum day demand is defined as 1.5 times the average demand, also in accord with DOW design standards.

Required Water System Capacities

Well Supply. DOW's design criterion for well pumping capacity is to provide the maximum day demand in a 24-hour pumping day with the largest well pump out of service. For Phase 1, this requirement amounts to 48,000 GPD, equivalent to 33 GPM. With the addition of the Phase 2 residential development, this requirement becomes 496,275 MGD, equivalent to 345 GPM. If Phase 2 was limited to the agricultural subdivision, the ultimate well supply requirement would be 150,000 GPD or 104 GPM.

A test well, identified as State No. 0419-05, was drilled and pump tested in October 2006. Over its 260-foot drilled depth, two aquifers were encountered. The upper aquifer can not provide a sufficient source of supply and it is also potentially subject to contamination due to its shallow depth. The lower and confined aquifer was reached at a depth of about 215 feet or 190 feet below sea level. Its piezometric head was about 13 feet above sea level or about 10 feet below ground. Pump testing showed that a properly designed well to exclusively tap this lower aquifer could develop up to 500 GPM of low salinity (chlorides of 55 MG/L), potable quality water. At its depth and overlying confining layers, it is not subject to contamination.

The low ground elevation (about 20 feet), high piezometric head (about 13 feet above sea level), and modest drawdown (3 feet or less at 350 GPM) provide the opportunity to develop one well configured with a pump sump that would enable two pumps to draw from the same well, thereby providing the necessary standby pumping capacity for a stand-alone system with a single well. The recommendation herein is to drill a new 12-inch well to 300-foot depth, complete it with a pump sump as shown on Figure 1, and outfit it with two, 25 horsepower, 350 GPM submersible pumps. Either of the 350 GPM pumps would provide the ultimate maximum demand requirement with the other providing full back-up capacity.

Reservoir Storage. With regard to the reservoir storage volume, DOW's two design criteria are appropriate for the private water system: (1) provide the maximum day demand with no credit for well inflow; and (2) provide the fire flowrate with coincident maximum day demand for the duration of the fire with the largest well pump out of service and the reservoir 3/4 full at the start of the fire. For the Phase 1 fire flowrate, DOW's standards require only 250 GPM for one hour. A stricter criterion of 500 GPM for two hours is used herein. Application of the two sizing criteria results in the required storage volumes tabulated below. In all cases, the maximum day sizing criterion governs.

Summary of Computed Required Reservoir Storage Volumes*

Design Criteria	Phase 1 Ag Subd.	Phase 2 Residential	Phased 2 Ag Subd.
(1) Maximum Day Demand (Gallons)	48,000	496,275	150,000
(2) Fire Flowrate			
• Fire Flowrate (GPM)	500	2000	500
• Fire Duration (Hours)	2	2	2
• Coincident Max. Demand (GPM)	33	345	104
• Well Inflow Credit (GPM)	350	350	350
• Required Storage Volume (Gallons)	29,280	319,200	40,640

*Phase 2 storage volumes include the Phase 1 requirement.

Based on the foregoing calculations, the recommended reservoir storage is as follows:

- For Phase 1, a 50,000-gallon storage tank would be installed.
- For the Phase 2 residential project, a second tank of 500,000-gallon capacity would be installed.
- In the event that Phase 2 consists of the 34 SF residential units in an agricultural subdivision, the second tank would be 100,000 gallons.
- All storage tanks would be lined and bolted steel with a concrete floor and passive cathodic protection.
- The tanks would be located at the project's highest elevation which is adjacent to residential Lot 7 in Phase 1. The Phase 1 and Phase 2 tanks would have identical floor and spillway elevations of 142 and 160 feet, respectively.
- Except at the project's lowest elevations, pumped delivery from the storage tanks will be necessary to provide adequate delivery pressures and fire flowrates. These pumping requirements are described in the section following.

Pumped Delivery for the Distribution System. DOW's design criteria for required delivery pressures are appropriate for this private water system. These are: (1) to provide a minimum of 40 psi residual pressure during the peak flowrate condition, with peak flowrate defined as three times the average demand; and (2) to provide a minimum 20 psi residual pressure at the critical hydrant during fire flowrate at that hydrant and coincident maximum day demand throughout the system.

The onsite storage reservoir elevations will not provide adequate gravity pressure to meet either of these criteria. In each development phase, this will require parallel domestic and fire flowrate pumping systems with a generator to provide back up power. For Phase 1, the pump systems would provide up to 70 GPM for peak domestic use and a 500 GPM fire pump. For the Phase 2 residential development, the domestic pumping capacity would be increased to 700 GPM and the fire pump to 2000 GPM. All pumping systems would be sized to produce a total dynamic head of 110 feet, in effect creating a single, 270-foot service pressure zone across the entire project site.

Water System Layout

Figure 2 illustrates all of the water system components described above with the assumption that Phase 2 would consist of the 769-unit residential development. By development phase, these would consist of:

Phase 1

- 12-inch, 300-foot deep well, pump sump, and two 350 GPM pumps in the pump sump located at the makai end of the Phase 1 development area.
- A dedicated 8-inch transmission pipeline from the well pumps to the storage reservoir.
- A 50,000-gallon storage tank.
- Parallel domestic and fire flowrate pump systems at the storage tank with backup generator power.
- A distribution pipeline loop consisting of 12-inch for the section that will also serve Phase 2 and 6-inch for the remainder of the loop.

Phase 2

- No change or additions to the well, well pumps, or transmission pipeline.
- Second storage tank of 500,000-gallon capacity.
- Substantial capacity increases for the parallel domestic and fire pumping systems and generator backup power.
- Distribution pipelines of 12-, 8-, and 6-inch size.

cc: Max Graham [Email Only]
greg@tnwre.com

Attachments

Table 1

Average and Maximum Day Demands for the
Phase 1 Agricultural Subdivision and Phase 2 Residential Development

Development Phase	Land Use	Design Criterion (GPD / Unit)	Average Demand (GPD)	Maximum Demand (GPD)
1	16 SF Residential	2,000	32,000	48,000
2	86 SF Residential	500	43,000	64,500
	683 MF Residential	350	239,050	358,575
	3.1 Ac. Parks	4,000	12,400	18,600
	0.8 Ac. Church	4,000	3,200	4,800
	0.4 Ac. Commercial	3,000	1,200	1,800
	Total for Phase 2		298,850	448,275
Total for Both Phases			330,850	496,275

Table 2

Average and Maximum Day Demands for Development of
Phases 1 and 2 as Agricultural Subdivisions

Development Phase	Land Use	Design Criterion (GPD / Unit)	Average Demand (GPD)	Maximum Demand (GPD)
1	16 SF Residential	2,000	32,000	48,000
2	34 SF Residential	2,000	68,000	102,000
Total for Both Phases			100,000	150,000

m_12-177 | 09-12

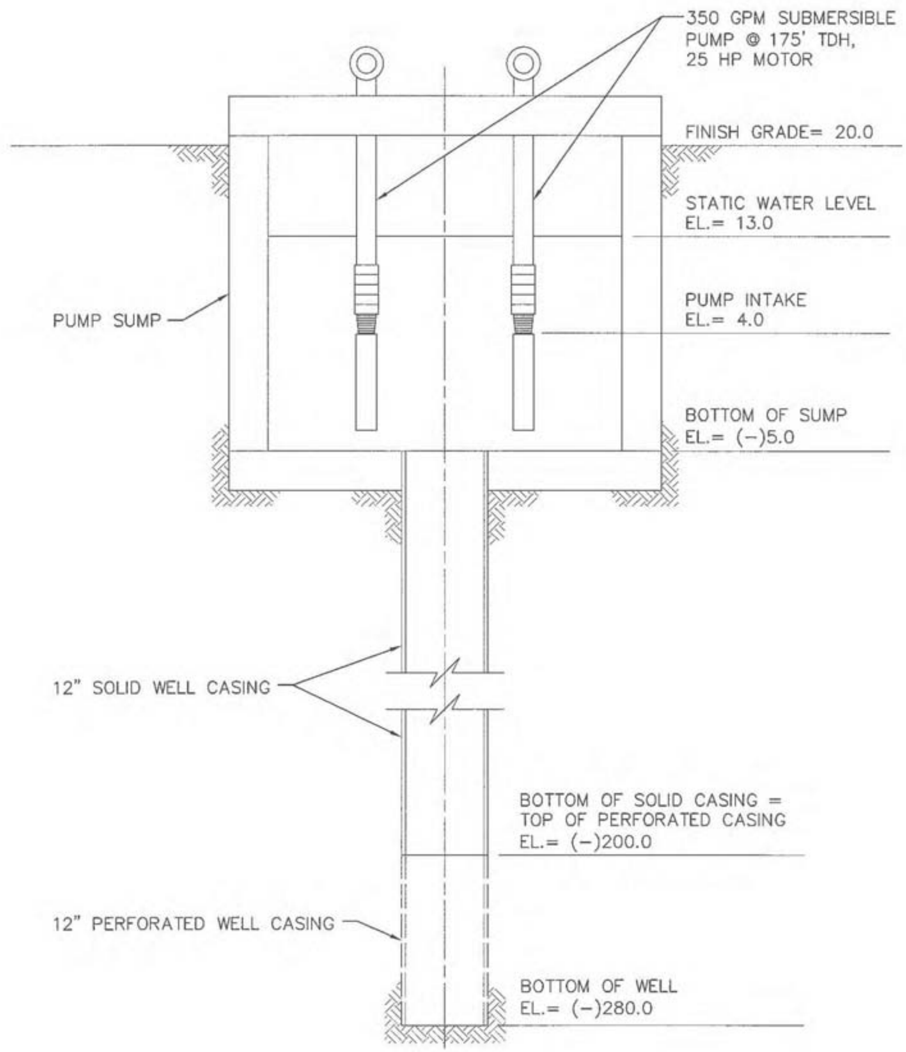


FIGURE 1
RECOMMENDED WELL DEVELOPMENT AND PUMP INSTALLATION
FOR THE KAPAA HIGHLANDS PROJECT
NOT TO SCALE

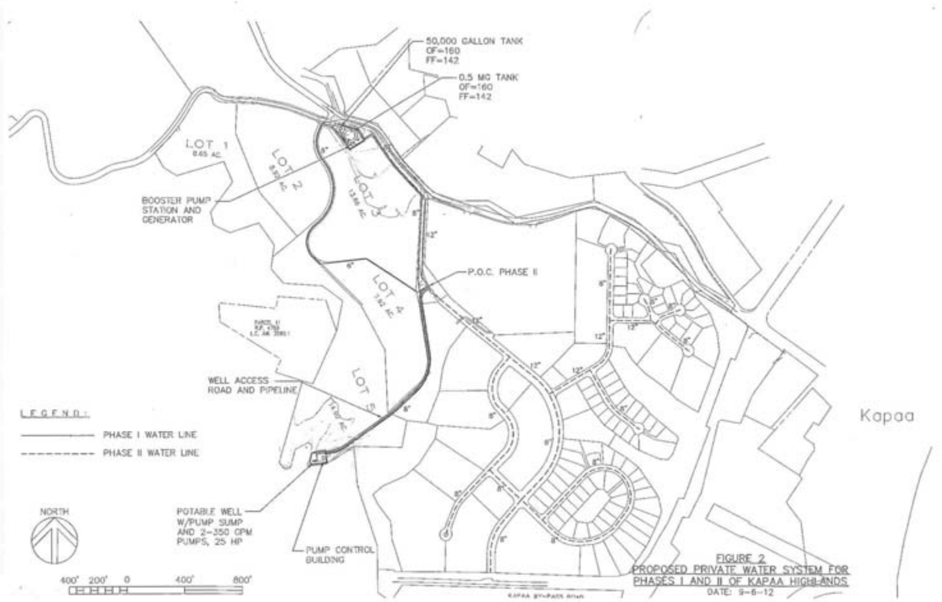


FIGURE 2
PROPOSED PRIVATE WATER SYSTEM FOR PHASES I AND II OF KAPAA HIGHLANDS
DATE: 9-6-12

TNWRE
Tom Nance Water
Resource Engineering

No. of pages: 7
Email: gallen@harbormail.net
mwg@kauai-law.com
greg@tnwre.com

Original ☑ will ☐ will not be mailed to you.

September 12, 2012
12-183 | 09-12

MEMORANDUM

To: Greg Allen

From: Tom Nance

Subject: Basis of Design of the Private Water System for the Kapaa Highlands Agricultural Subdivision

Introduction

This memo and its attachments describe the basis of design for a private water system to serve the 12-lot Kapaa Highlands Agricultural Subdivision. Figure 1 depicts the 12-agricultural lots and the 50-half acre homesites that ultimately would be developed on the 12 lots. The water system would consist of: one 12-inch, 300-foot deep well outfitted with two 100 GPM pumps, one of which would provide back-up capacity; two side-by-side and identical 50,000-gallon storage reservoirs located next to Homesite 7, the highest elevation on the property; two parallel pumping systems to provide pressure and flowrates for peak and fire flowrate conditions; and 8- and 6-inch distribution pipelines.

As described herein, there are differences between the standards used for the private system's design and the standards of the Kauai Department of Water (DOW). These differences are noted and discussed as appropriate in the sections following.

Required Water Supply

The agricultural use in the subdivision will be for raising goats for which no specific water allocation is made. An average demand of 1250 GPD for each of the 50-half acre homesites is recommended, a use rate which is 2.5 times DOW's standard for single family residential units. The higher use rate is an appropriate allowance due to the larger than typical size of the homesites.

For the 50 homesites, the total average demand is 62,500 GPD. In conformance with DOW's standards, maximum day use is defined as 1.5 times the average demand. For the 50 homesites, the total maximum day demand is 93,750 GPD.

560 N. Nimitz Hwy. - Suite 213 • Honolulu, Hawaii 96817 • Phone: (808) 537-1141 • Fax: (808) 538-7757 • Email: tom@tnwre.com

Required Well Supply

Well Configuration. A test well, identified as State No. 0419-05, was drilled and pump tested at the makai end of the project site in October 2006. Over its 260-foot drilled depth, two aquifers were encountered. The upper aquifer can not provide a sufficient source of supply and it is also potentially subject to contamination due to its shallow depth. The lower and confined aquifer was reached at a depth of about 215 feet or 190 feet below sea level. Its piezometric head was about 13 feet above sea level or about 10 feet below ground. Pump testing showed that a properly designed well to exclusively tap this lower aquifer could develop up to 500 GPM of low salinity (chlorides of 55 MG/L), potable quality water. At its depth and due to the presence of the overlying and poorly permeable confining layers, this lower aquifer is not subject to contamination.

The low ground elevation (about 20 feet), high piezometric head (about 13 feet above sea level), and modest drawdown provide the opportunity to develop one well configured with a pump sump that would enable two pumps to draw from the same well, thereby providing the necessary standby pumping capacity for a stand-alone system with a single well. The recommendation herein is to drill a new 12-inch well to 300-foot depth and complete it with a pump sump and two pumps as shown on Figure 2. This will enable one pump to provide the required supply and the other pump to provide full back up capacity.

Required Well Pumping Capacity. DOW's design criteria of having the well pumping capacity capable of delivering the maximum day use in a 24-hour pumping day with the largest well pump out of service is adopted for the private water system. The project's 93,750 GPD maximum day use translates to a required well pump capacity of 65 GPM. The proposal herein is to install two identical 100 GPM pumps, each driven by 7.5 horsepower motors. Either pump would provide the required capacity with the other as standby.

Reservoir Storage

DOW's two reservoir storage sizing criteria are appropriate for the private water system. The first, to provide the maximum day use with no credit for well inflow, translates to a required storage volume of 93,750 gallons. The second is to provide the fire flowrate plus the coincident maximum day demand for the duration of the fire with the reservoir 3/4 full at the start of the fire. There is credit for well inflow with the largest well pump considered to be out of service.

For an agricultural subdivision, DOW standards require a fire flowrate of 250 GPM for one hour. A stricter standard of 500 GPM for two hours is adopted for the private water system. With one of the two 100 GPM well pumps on, this higher fire flowrate and longer duration translates to reservoir storage of 74,417 gallons (calculation below). The first criterion governs.

$$\frac{4}{3}(120\text{ min})\left(500+\frac{93{,}750}{1{,}440}-100\right)=74{,}417\text{ gallons}$$

Proposed reservoir storage consists of two, side-by-side and identical 50,000-gallon tanks with 142- and 160-foot floor and spillway elevations, respectively. The storage tanks would be lined and bolted steel with reinforced concrete base and passive cathodic protection consisting of zinc anode rods suspended in the water. DOW's standards require storage tanks to be constructed of reinforced concrete. However, lined and bolted steel tanks have a successful operating history in Hawaii. With two side-by-side tanks, one can be taken offline when necessary for maintenance with no interruption of service to customers.

Pumping Systems for Peak and Fire Flowrate Design Conditions

DOW's design criteria for required delivery pressures are appropriate for this private water system. These are: (1) to provide a minimum of 40 psi residual pressure during the peak flowrate condition, with peak flowrate defined as three times the average demand; and (2) to provide a minimum 20 psi residual pressure at the critical hydrant during fire flowrate at that hydrant and coincident maximum day demand throughout the system.

The onsite storage reservoir elevations will not provide adequate gravity pressure to meet either of these delivery pressure requirements. Providing the necessary pressure would be done with parallel domestic and fire flowrate pumping systems with a generator to provide back up power. These pump systems would provide up to 70 GPM for peak domestic use and 500 GPM for the fire flowrate condition. Both pumping systems would be sized to produce a total dynamic head of 110 feet, in effect creating a single, 270-foot service pressure zone across the entire project site.

Distribution Pipelines

The design criteria used for pipeline sizing for the private system are equivalent to DOW's standards. Pipelines shall be sized to provide: (1) fire flowrate with coincident maximum day demand and a minimum residual pressure of 20 psi at the critical hydrant with velocities not exceeding 10 fps; and (2) peak flowrate with a minimum residual pressure of 40 psi and a maximum velocity in pipelines of 6 fps.

DOW's standards require pipelines to be of ductile iron or PVC, the latter conforming to ASTM C-900. However, NSF-approved, high density polyethylene (HPDE) pipes will be used for the private water system. SDR (pressure ratings) of the HDPE pipe will be selected so as not to exceed 80 percent of the recommended working pressure rating. Hazen-Williams "C" values of 130 will be used for all

HDPE pipes. This is less (ie. more conservative) than manufacturer's suggested values of 140 to 150 but greater than DOW's standards for ductile iron and PVC pipes.

Water System Layout

Figure 3 illustrates the water system components as described above. There would be a dedicated 6-inch pipeline from the well to the storage tanks. Distribution pipeline sizing, driven by the fire flowrate sizing criterion, would be 8- and 6-inch to the last hydrants and 4-inch beyond the last hydrants.

cc: Max Graham [Email Only]
greg@tnwre.com

Attachments

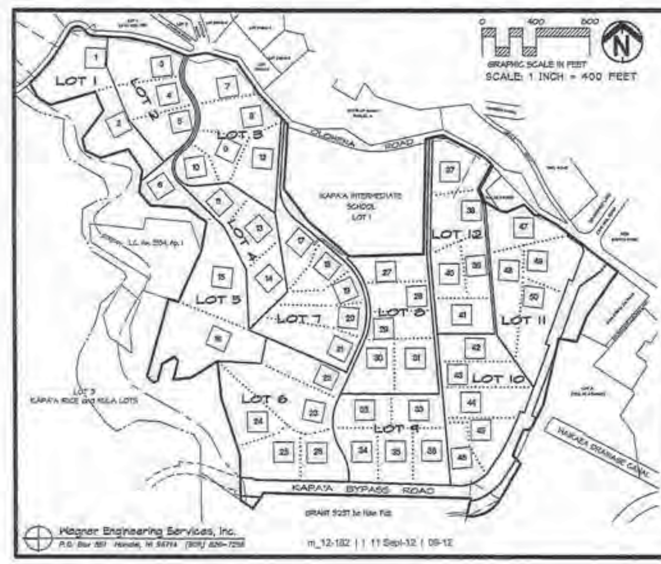


Figure 1
Kapaa Highlands
Agricultural Subdivision

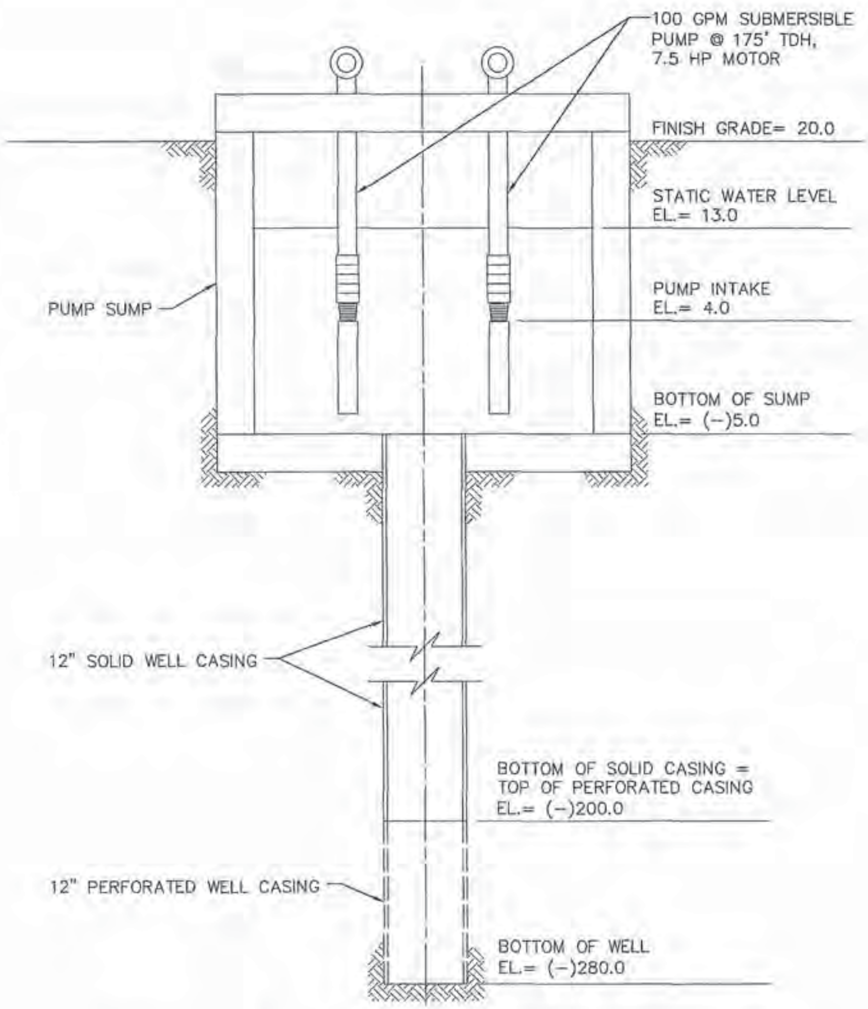


FIGURE 2
RECOMMENDED WELL DEVELOPMENT AND PUMP INSTALLATION FOR THE KAPAA HIGHLANDS AGRICULTURAL SUBDIVISION
NOT TO SCALE

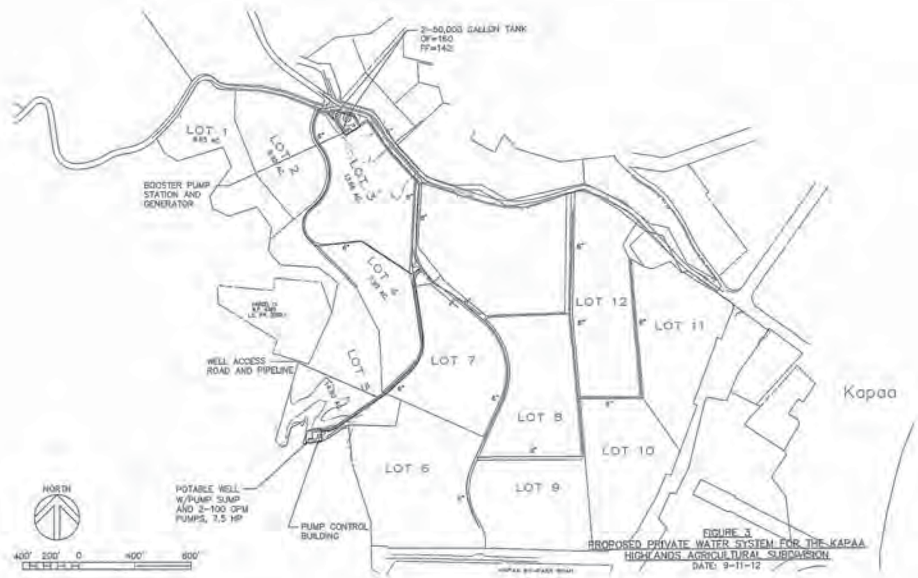


FIGURE 3
PROPOSED PRIVATE WATER SYSTEM FOR THE KAPAA HIGHLANDS AGRICULTURAL SUBDIVISION
DATE: 9-11-12

Table 1

Cost Estimate of the Major Water System Components for Kapaa Highlands Phase I

Item Description	Quantity	Unit	Unit Price	Amount	Total
Drill, Case, and Pump Test Supply Well					
Mobilization		LS		15,000	
Drill 12-Inch Pilot Hole	300	LF	150	45,000	
Video Log Pilot Hole	1	EA	2,500	2,500	
Test Pump Pilot Hole	1	EA	12,500	12,500	
Ream Pilot Hole to 19 Inches	300	LF	125	37,500	
12" Solid Casing	220	LF	175	38,500	
12" Perforated Casing	80	LF	200	16,000	
Furnishing and Installing grout	215	LF	60	12,900	
Plumbness and Alignment Test	1	EA	3,000	3,000	
Furnishing and Installing Test Pump	1	EA	15,000	15,000	
Development and Test Pumping	72	HRS	250	18,000	
Demobilization		LS		5,000	
Total					$220,900
Well Site Work and Pump Outfitting					
Site Earthwork	450	CY	50	22,500	
Site Basecourse	805	SY	20	16,100	
Site Fencing	348	LF	35	12,180	
Site Gate	1	EA	2,500	2,500	
Site Drainage System		LS		15,000	
Wet Well Sump and Cover at Well Casing		LS		60,000	
Submersible Pump (350 GPM, 4-Pole, 25 HP)	2	EA	45,000	90,000	
Discharge Unit, includes Support Pads and Piping		LS		25,000	
Pump Control Building		LS		35,000	
Chlorination System		LS		25,000	
Control Building Mechanical		LS		15,000	
Pump and Building Electrical		LS		50,000	
KIUC Transformer Pad and Ducts		LS		35,000	
Metering, Motor Control Center, SCADA System		LS		150,000	
Back Generator with Fuel Tank (60 KW)		LS		40,000	
Transfer Switch for Generator		LS		3,000	
KIUC Facility Charge for Service (OH Service Available)		LS		50,000	
Total					$646,280
New Well Access Road (from existing culdesac)					
Access Road Excavation and Preparation	1,530	LF	50	76,500	
Basecourse	3,400	SY	25	85,000	
Drainage and Erosion Control		LS		30,000	
Total					$191,500

Table 1

Cost Estimate of the Major Water System Components for Kapaa Highlands Phase I

Item Description	Quantity	Unit	Unit Price	Amount	Total
0.05 MG Tank					
Site Earthwork	1,935	CY	40	77,400	
Basecourse	1,890	SY	20	37,800	
Gravel Fill	452	SY	15	6,780	
Site Fencing	590	LF	35	20,650	
Site Gate	1	EA	2,500	2,500	
Site Drainage System		LS		20,000	
Tank Drainage System		LS		25,000	
Pipe Valves and Fittings		LS		15,000	
0.05 MG Steel Tank With Concrete Floor		LS		150,000	
Tank Level Transmitter System		LS		15,000	
Pipe and Tank Testing		LS		15,000	
Erosion and Dust Control		LS		10,000	
Construction Survey		LS		5,000	
Total					$400,130
Booster System					
Sitework for Booster Pump Station		LS		25,000	
Booster Station Connection Piping & Valves		LS		30,000	
Domestic Booster Pump Station (VFD 25 to 70 gpm, 5 HP)		LS		25,000	
Fire Pump Station (500 GPM at 110-ft TDH, 20 HP)		LS		80,000	
Power and Control Connections		LS		30,000	
MCC for both station with SCADA Controls		LS		125,000	
Back Generator with Fuel Tank (60 KW)		LS		50,000	
Transfer Switch for Generator		LS		3,000	
Total					$368,000
Pipeline in Phase I Subdivision (includes 8-inch well feed line)					
Main Installation Access and Site Preparation		LS		50,000	
12" HDPE Pipe	1,500	LF	85	127,500	
8" HDPE Pipe	3,115	LF	55	171,325	
6" HDPE Pipe	2,256	LF	40	90,240	
12" GV w/VB	2	EA	3,000	6,000	
8" GV w/VB	3	EA	2,500	7,500	
6" GV w/VB	2	EA	2,000	4,000	
12" DI Fittings	5	EA	1,800	9,000	
8" DI Fittings	6	EA	1,200	7,200	
6" DI Fittings	4	EA	800	3,200	
Fire Hydrant w/GV	5	EA	3,500	17,500	
Pipe Testing and Chlorination		LS		25,000	
Erosion and Dust Control		LS		30,000	
Construction Survey		LS		15,000	
Total					$563,465
Total for Construction					**$2,390,275**
Engineering Design (8%)					**190,725**
Construction Management (3%)					**73,000**
Total Cost					**$2,654,000**

Table 2

Cost Estimate of the Major Water System Components
for Kapaa Highlands Phase 2 Residential Project

Item Description	Quantity	Unit	Unit Price	Amount	Total
0.50 MG Tank and Booster Station					
Tank Foundation Earthwork	504	CY	40	20,160	
Basecourse	980	SY	20	19,600	
Tank Drainage System		LS		35,000	
Pipe Valves and Fittings		LS		30,000	
0.50 MG Steel Tank With Concrete Floor		LS		750,000	
Tank Level Transmitter System		LS		15,000	
Pipe and Tank Testing		LS		20,000	
Erosion and Dust Control		LS		15,000	
Construction Survey		LS		5,000	
Total					$909,760
Booster System (Upgrade both Booster Pump Stations)					
Modify Booster Pump Station		LS		40,000	
Booster Station Connection Piping & Valves		LS		45,000	
Domestic Booster Pump Station (VFD 200 to 625 gpm, 25 HP)		LS		120,000	
Fire Pump Station (2000 GPM at 110-ft TDH, 75 HP)		LS		125,000	
Power and Control Connections		LS		30,000	
Modify Existing MCC for New Pump Stations		LS		80,000	
New Back Generator with Fuel Tank for Fire Pump (175kw)		LS		75,000	
Transfer Switch for Generator		LS		6,000	
Total					$521,000
Pipeline in Phase 2 Subdivision					
Main Installation Access and Site Preparation		LS		60,000	
12" HDPE Pipe	2,100	LF	85	178,500	
8" HDPE Pipe	6,830	LF	50	341,500	
12" GV w/VB	3	EA	3,000	9,000	
8" GV w/VB	10	EA	2,500	25,000	
12" DI Fittings	6	EA	1,800	10,800	
8" DI Fittings	15	EA	1,200	18,000	
Fire Hydrant w/GV	14	EA	3,500	49,000	
Pipe Testing and Chlorination		LS		40,000	
Erosion and Dust Control		LS		30,000	
Construction Survey		LS		15,000	
Total					$776,800
Total for Construction					**$2,207,560**
Engineering Design (8%)					**176,440**
Construction Management (3%)					**66,000**
Total Cost					**$2,450,000**

o_09-12

Exhibit F

Preliminary Engineering Report Drainage Improvements
HoKua Place
(Formerly Kapa'a Highlands II)

EXHIBIT "F"

Exhibit F

Preliminary Engineering Report Drainage Improvements
HoKua Place
(Formerly Kapa'a Highlands II)

Prepared for:
Greg Allen
161 Wailua Rd.
Kapa'a, HI 96746

Prepared by:
Honua Engineering, Inc.
P. O. Box 851
Hanalei, HI 96714

Project Description

The Kapa'a Highlands Subdivision is on former cane lands situated on a bluff adjacent to the coastal plain of Kapa'a Town. It is bordered by Olohena Road to the north and the Kapa'a Bypass Road on the south and east sides of the project. Kapa'a Intermediate School is near the middle of the north portion of the property. Phase I of the development will consist of five agricultural lots on the west side of the property. The remainder of the property to the south and east of the school are proposed to be developed during Phase II of the subdivision. The proposed Phase II development will consist of 86 single and 683 multi-family units, plus a neighborhood commercial site, parks, and a church site as shown on Exhibit 1. Ground elevation of the development ranges from 20 to 180 feet above mean sea level.

Per the County of Kauai's "Storm Water Runoff System Manual" 2001, all developments of this scope are required to maintain the existing stormwater flows and patterns as feasibly possible so that downstream properties are not subject to any additional stormwater flows that are created by the increases in impervious surfaces of the watershed by the proposed development. The report examines the existing drainage conditions of the property and the proposed measures to control the stormwater from the proposed Phase II development.

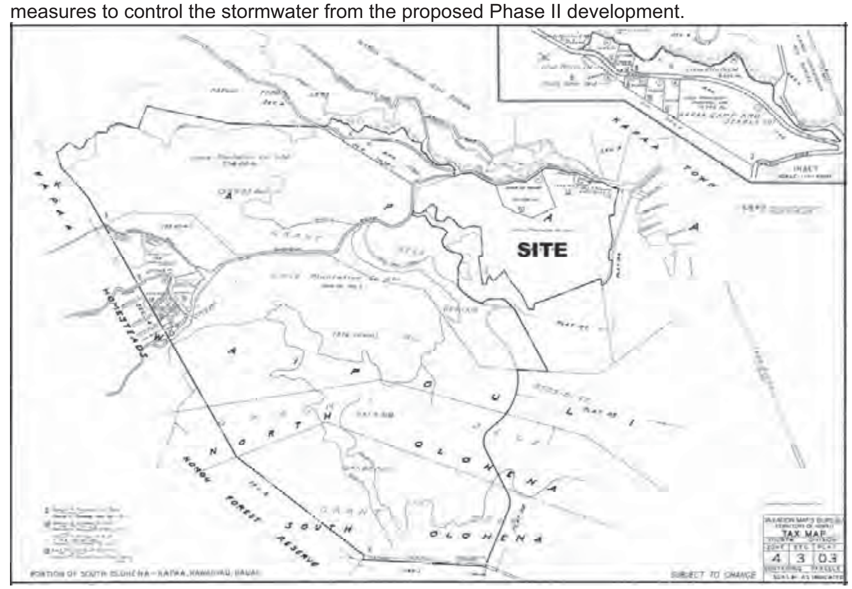


Figure 1: Tax Map Key 4-3-03 (4th Division)

Existing Conditions:

The property is located along Olohena Road about ½ mile mauka of Kapaa Town. The property rises from the coastal flat lands of Kapaa to an elevation of about 140 feet above mean sea level (msl). The Temporary Kapaa Bypass Road passes through a portion of the property along the east and south sides of the property. An unnamed stream flows along the west side of the property. The stream flows along the boundary, passes under a bridge on the By-Pass Road at the southwest corner of the property, and empties into the Waikaea drainage canal about 800' downstream from the property. Near the middle of the property on the north side, along Olohena Road, is the Kapaa Intermediate School site.

The Lihue Plantation had planted a majority of the 163-acre property in sugar cane, which since the property-changed owners has been allowed to go fallow. The Phase II portion of the property is approximately 97-acres. The fallow lands are presently overgrown with grass and remnant cane. A portion of the property on the northwest side near the unnamed stream is being used for cattle pasture. There are numerous abandoned irrigation ditches on the property that will be filled or rendered inoperable as the property is developed. There is also a small amount of the property that is overly steep for farming and is presently covered in brush and trees.

According to the Natural Resource Conservation Service (NRCS) soil survey the soils on the property are Ioleau and Puhi silt clay loams. The NRCS hydrologic classification for these soils is Group C for the Ioleau soils and Group B for the Puhi soils. Group B soils have a moderately low runoff potential, while the Group C soils have a moderately high runoff potential. Both soils are in Group I erosion resistance classification, which is the least erodible of the NRCS classifications.

The topography of the site varies from gently sloping, bluff top property, to steep areas that drop off into drainage gullies that lead to the unnamed stream and to the Bypass Road. The topography is illustrated on Exhibit 1 from aerial mapping done in 1975 for the County of Kauai.

Proposed Phase II:

The proposed Phase II development will consist of 86 single and 683 multi-family units, plus a neighborhood commercial site, parks, and a church site as shown on Exhibit 1. Stormwater generated from each of the Phase II lots will be directed to the nearest downstream street or natural drainageway. A drainage system along the streets will collect the stormwater and convey it to the detention basins shown on Exhibit 1. The detentions basins moderate the storm flows and allow infiltration back into the soil. They are sized so that the outlet peaks flows match or lower the existing stormwater flows prior to the development for both small rainfall events and the 100 year storm event.

.

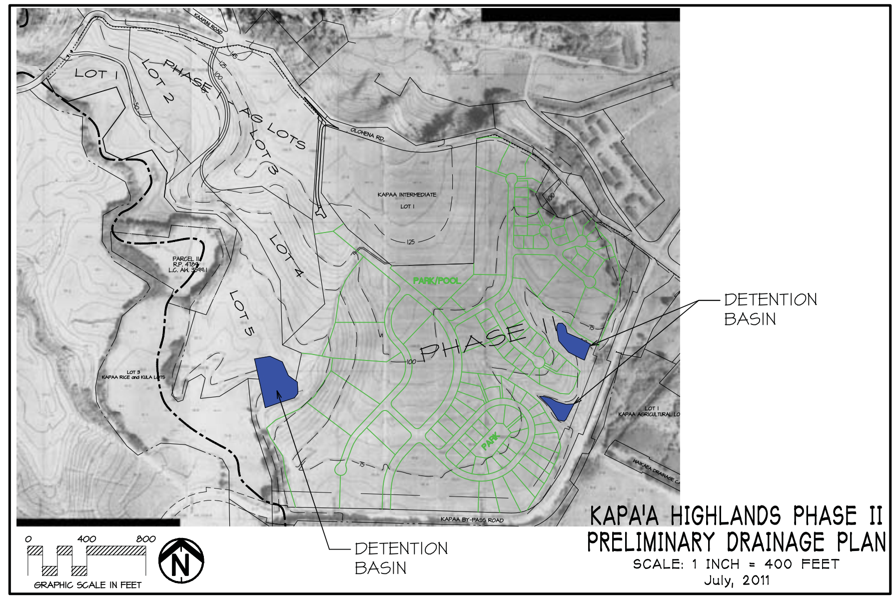


Exhibit G

Preliminary Engineering Report
WasteWater Improvements
HoKua Place
(Formerly Kapa'a Highlands II)

Preliminary Engineering Report
WasteWater Improvements
HoKua Place
(Formerly Kapa'a Highlands II)

Prepared for:
Greg Allen
161 Wailua Rd.
Kapa'a, HI 96746

Prepared by:
Honua Engineering, Inc.
P. O. Box 851
Hanalei, HI 96714

EXHIBIT "G"

July 11, 201i
Project No: 1892

Project Description

The Kapa'a Highlands Subdivision is on former cane lands situated on a bluff adjacent to the coastal plain of Kapa'a Town. It is bordered by Olohena Road to the north and the Kapa'a Bypass Road on the south and east sides of the project. Kapa'a Intermediate School is near the middle of the north portion of the property. Phase I of the development will consist of five agricultural lots on the west side of the property. The remainder of the property to the south and east of the school are proposed to be developed during Phase II of the subdivision. The proposed Phase II development will consist of 86 single and 683 multi-family units, plus a neighborhood commercial site, parks, and a church site as shown on Exhibit 1. Ground elevation of the development ranges from 20 to 180 feet above mean sea level. Due to it's high density the Phase II development will require connection to the Wailua-Kapa'a Sewer System. The following report reviews the anticipated wastewater flows, the adequacy of the existing sewer collection system, and the proposed improvements needed to provide service for the development of Phase II.

Basis of Design

The *Sewer Design Standards, 1973* by the County of Kauai, Department of Public Works, together with the *Wailua Facility Plan, September 2008* by Fukunaga and Associates were the primary references for this report and will be abbreviated as SDS and WFP, respectively, when quoted in the report.

The WFP is a detailed study of the entire Wailua to Kapa'a wastewater system completed in 2008 to guide the County with the necessary expansion and management of the system through the year 2025. It broke down projected flows to the Wailua Treatment Plant in three phases, the current and near term flows up to the year 2010, middle term flows for the 2010-2015 period, and far term flows for the years 2015 to 2025.

Wailua-Kapa'a Average Daily Wastewater Flows[1]	
Planning Interval	Average Wastewater Flow (mgd)
Current	0.70
Near Term (2010)	0.98
Middle Term (2015)	1.39
Far Term at Wailua WWTP(2025)	1.72
Kapaa Start-Up (2025)	0.40

The need for the WFP was partially based upon the rapid development that was occurring in the Wailua-Kapaa area during 2004-2007 period. Development has slowed considerably since this time and several of the developments anticipated in the WFP calculations have been put on hold or are no longer proposed. Of the proposed developments, the Coco Palms Hotel will be removed from the near term anticipate flows and be considered part of the middle term flows. The Coconut Beach Resort and Coconut Plantation Village will be removed from the middle term flows and be considered for the far term flows.

The proposed Kapa'a Highlands development is not expected to be at total capacity by 2015, but for the purposes of this report, it will be considered to be completed in the middle term planning period of the WFP. The table below is the adjusted Average Daily Flows (ADF) based upon the current flow to the Wailua Treatment Plant and adjustments due to slower development than anticipated by WFP.

Adjusted Wailua-Kapa'a Average Daily Wastewater Flows	
Planning Interval	Average Wastewater Flow (mgd)
Current	0.70
Near Term (2010)	0.98
Middle Term (2015)	1.39
Far Term at Wailua WWTP(2025)	1.72

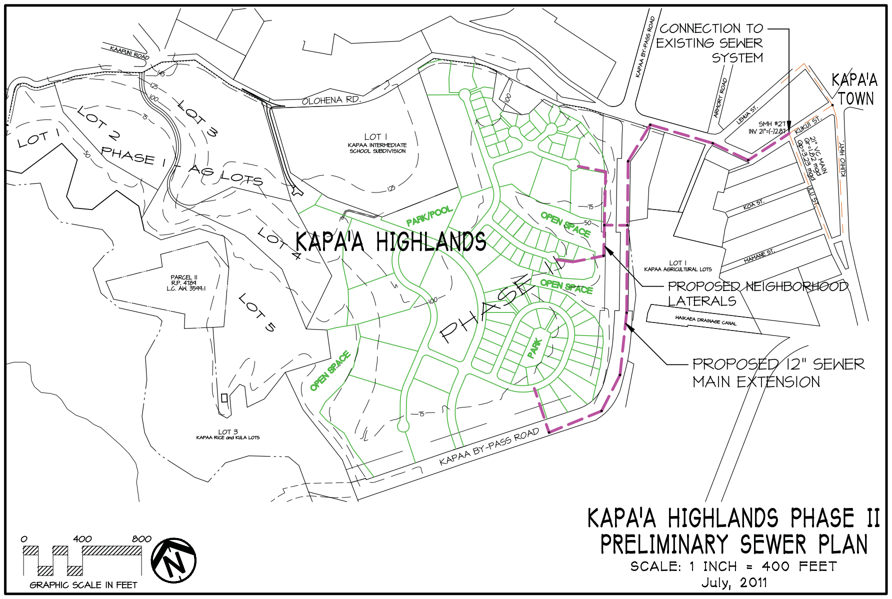
Kapa'a Highlands Phase II Wastewater Flow Estimates	
Item	Projected Wastewater Flow (gpd)
Single Family Homes	34,400
Multi-Family Homes	170,750
Neighborhood Commercial	4,800
Total	209,950

Note: Single Family Homes assumed to have 4 occupants/unit and Multi-Family Homes have 2.5 occupants/unit.

[1] Table ES-1, WFP, September 2008

Preliminary Design

Based upon the projected flow of 209,950 gpd (0.21 mgd), with a max load factor of 4.1, a 12" sewer main would be required to serve the development. The location of the main is shown on Exhibit 1. It would begin along the Kapa'a By-pass Road and terminate at an existing manhole near the intersection of Ulu and Kukui Streets. The length of the main within the existing public Right-of-Ways would be about 3,400 linear feet. At the existing manhole connection the existing main downstream of the connection is a 21" main with a capacity of 3.2 mgd. The 21" main currently has a peak flow of about 0.6 mgd, therefore the proposed flow is well within the capacity of the existing sewer system, including allowances for the future increases anticipated in the "Final Wailua Facility Plan", September 2008.



COMPUTATION OF SANITARY SEWAGE FLOW

SEWER: Kapaa
DISTRICT: Kawaihau
YEAR: 2010
REFERENCE MAPS:
PAGE: 1 of 1
COMPUTED BY: BH
DATE: 3-9-10

SEWER LOCATION			SANITARY SEWAGE (MGD)											SEWER DESIGN				
DISTRICT ZONE OR STREET	FROM	TO	TRIBUTARY AREA (ACRES) INCREMENT	TOTAL	TRIBUTARY POPULATION INCREMENT	TOTAL	AVERAGE FLOW	SUMMATION AVERAGE FLOW	MAX FLOW FACTOR	MAX FLOW	INFILTRATION @ 1,250 or 2,750 GAD	SUMMATION INFILTRATION	PEAK FLOW	SIZE (in.)	SLOPE (ft/100 f)	CAPACITY (mgd)	AVERAGE VELOCITY (fps)	PEAK VELOCITY (fps)
Kapaa Highlands				67				0.21	4.1	0.86	1,250	0.08	0.94	12	1	2.3	2.6	4.2

Remarks:

EXHIBIT "H"

Updated Traffic Impact Report (TIAR)

By Traffic Management Consultant

Response to State DOT Comments

Comments by State DOT

Response to County DPW Comments

Comments by County DPW

THE TRAFFIC MANAGEMENT CONSULTANT

Randall S. Okaneku, P.E., Principal * 1188 Bishop Street, Suite 1907 * Honolulu, Hawaii 96813
Telephone: (808) 536-0223 * Facsimile: (808) 537-2985 * Email: TMCHawaii@aol.com

TMC Job No. 201708
October 3, 2017

State of Hawaii
Department of Transportation
Highways Division-Kauai District
1720 Haleukana Street
Lihu`e, Kauai, Hawai`i 96766

Attn.: Mr. Larry Dill, P.E., District Engineer

Dear Mr. Dill:

Subject: Traffic Impact Analysis Report Update
For the Proposed Hokua Place
Tax Map Key: (4) 4-3-003: Portion of 001
Kapa`a, Kauai, Hawaii

Thank you for the review comments in your letter, dated September 29, 2017, on the subject traffic study. Our responses follow:

Comment No. 1

Noted.

Comment No. 2

Noted.

Comment No. 3

The AM and PM Peak Hour Traffic Without Project rows of Table 6 summarize the capacity analysis under existing roadway conditions. The AM and PM Peak Hour Traffic With Project rows of Table 6 summarize the capacity analysis with the recommended site access improvements under Section V.B. of the TIAR Update. The AM and PM Peak Hour Traffic With Project – Improved rows in Table 6 summarize the capacity analysis of the recommended traffic improvements under Section V.A. of the TIAR Update.

Comment No. 4

Noted.

Comment No. 5

Noted.

If you require clarification on any of the above material or have any other questions, please do not hesitate to call me.

Very truly yours,

The Traffic Management Consultant

By 

Randall S. Okaneku, P. E.
Principal

DAVID Y. IGE
GOVERNOR

FORD N. FUCHIGAMI
DIRECTOR

Deputy Directors
JADE T. BUTAY
ROSS M. HIGASHI
EDWIN H. SNIFFEN
DARRELL T. YOUNG

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
KAUAI DISTRICT
1720 HALEUKANA STREET
LIHUE, HAWAII 96766

IN REPLY REFER TO:

HWAY-K 4.170445

September 29, 2017

Randall S. Okaneku, P.E.
The Traffic Management Consultant
1188 Bishop Street, Suite 1907
Honolulu, Hawaii 96813

Dear Mr. Okaneku:

Subject: Traffic Impact Analysis Report Update
Hokua Place
Kapa'a, Kawaihau District, Island of Kaua'i
TMK: (4) 4-3-03: Por. 001

Thank you for submitting the updated Traffic Impact Analysis Report(TIAR) update that was transmitted via email on June 15, 2017. We have circulated the TIAR for comment through the Highways Division Planning Branch as well as the Traffic Branch. We have also reviewed the comments provided by the County of Kauai Department of Public Works Engineering Division on September 1, 2017.

The combined comments for the Hawaii Department of Transportation Highways Division are as follows:

1. The report discussed the projects that are proposed in the Kapaa Transportation Solutions Report dated August 2015. It should be noted that these projects may not be completed on schedule. Therefore, they should not be considered in this report.
2. It is understood that the proposed Road A will be funded and constructed by the developer.
3. Please clarify the scenarios in Table 7, Summary of Capacity Analysis. What assumed improvements are completed for AM/PM peak hour traffic without project, with project, and with project-improved.
4. Section V of the TIAR recommends traffic improvements without the project. Although these recommendations are appreciated, they are not a consideration for this development.
5. We concur with the comments provided by the County of Kauai Department of Engineering Division.

Please contact Raymond McCormick at 808-241-3015 by telephone or by email at Raymond.j.mccormick@hawaii.gov if you have comments or questions regarding this letter.

Sincerely,

Larry Dill, P.E.
District Engineer
For

THE TRAFFIC MANAGEMENT CONSULTANT

Randall S. Okaneku, P.E., Principal * 1188 Bishop Street, Suite 1907 * Honolulu, Hawaii 96813
Telephone: (808) 536-0223 * Facsimile: (808) 537-2985 * Email: TMCHawaii@aol.com

TMC Job No. 201708
October 3, 2017

Department of Public Works
County of Kauai
4444 Rice Street, Suite 275
Lihu`e, Kauai, Hawai`i 96766

Attn.: Mr. Michael Moule, P.E., Chief, Engineering Division

Dear Mr. Moule:

Subject: Traffic Impact Analysis Report Update
For the Proposed Hokua Place
Tax Map Key: (4) 4-3-003: Portion of 001
Kapa`a, Kauai, Hawaii

Thank you for the thorough review comments in your letter, dated September 1, 2017, on the subject traffic study. Our responses follow:

Comment No. 1 – Introduction, Project Description

a. Concur. The design of the intersection between the Phase 1 access road and Olohena Road, mauka of its intersection with Ka`apuni Road, will include the appropriate vertical and horizontal sight distances in accordance with the AASHTO A Policy on Geometric Design of Highways and Streets and the Hawaii Statewide Uniform Design Manual for Streets and Highways.

Comment No. 2 – Existing Roadways

a. Concur. The stated speed limits are intended to provide guidance to the design of the intersection of Road A and the Kapa`a Bypass Road.

b. Concur.

c. Concur.

Comment No. 3 – Existing Peak Hour Traffic Volumes and Operation Conditions

a. Noted. The traffic impact analysis is based upon the methodology presented in the Highway Capacity Manual (HCM). The HCM methodology consists of a series of mathematical calculations to determine roadway capacity, vehicle delay, vehicle queuing, etc. The LOS concept was defined in the HCM to translate the results of the complex calculations into a simplified "A" through "F" grading system.

b. Corrected. The second sentence in the last paragraph on Page 10 should read "South of Ulu Street, Kuhio Highway carried over 1,700 vph…".

c. Corrected. The revised Figure 6 is attached. The PM peak hour of traffic from 3:45 PM to 4:45 PM on March 15, 2015 was selected for the intersection of Kuhio Highway and the Kapa`a Bypass Road because it corresponded with of the commuter PM peak hour traffic at the intersections in Kapa`a Town. The revised traffic data sheets for the intersection of Kuhio Highway and Kapa`a Bypass Road also are attached.

d. LOS, by definition, is the result of a series of mathematical calculations. For the purpose of the traffic impact analysis, the HCM methodology provides a common basis for comparing future traffic conditions without the proposed project and future traffic conditions with the proposed project.

Comment No. 4 – Kapa`a Transportation Solutions

a. Noted. The Kapa`a Transportation Solutions, cited in the TIAR Update, is dated August 2015. Please transmit the latest version of the Kapa`a traffic study.

b. Noted.

Comment No. 5 – Trip Generation Characteristics

a. Noted. The revised Table 6 is shown below:

Table 1. Hokua Place Trip Generation Characteristics

Land Use (ITE Code)	Units	AM Peak Hour (vph)			PM Peak Hour (vph)		
		Enter	Exit	Total	Enter	Exit	Total
Single-Family Phase 1 (265)	16 DU	5	16	21	13	7	20
Single-Family Phase 2 (265)	100 DU	20	60	80	66	38	104
Condominium/ Townhouse (230)	700 DU	52	256	308	244	120	364
Retail Center (820)	8,000 SFGFA	21	13	34	53	57	110
	Pass-By	0	0	0	(-)45	(-)45	(-)90
Total External Trips		**98**	**345**	**443**	**331**	**177**	**509**

b. The ITE Trip Generation Handbook cites a 9,000-square foot retail center, where 20 percent of the trip generation were primary trips. Comparing the retail center to smaller convenience markets, the Trip Generation Handbook listed sites where the primary trip percentages ranged from 8 percent to 28 percent of the PM peak period trip generation. The retail center is described in the DEIS as a neighborhood-oriented commercial center. Therefore, it is reasonable to assume that a significant portion of the retail trips will be generated from within the proposed project, which can be defined as "internal capture" or "diverted trips".

Comment No. 6 – Site Access Improvements

a. Noted. The AM and PM peak hour traffic demands at the Olohena Road intersections at the Phase 1 Driveway and at Road A do not meet the AASHTO left-turn lane guidelines. During the AM peak hour of traffic, the advancing (mauka bound) volumes on Olohena Road do not meet the AASHTO minimum requirements. The left-turn demands at Road A and at the Phase 1 Driveway do not meet the AASHTO minimum left-turn volumes, during the PM peak hour of traffic. The Olohena Road intersections at Road A and the Phase 1 Driveway are expected to operate at satisfactory LOS during the AM peak hour of traffic. The Phase 1 Driveway also is expected to operate at satisfactory LOS at Olohena Road, during the PM peak hour of traffic. Road A is expected to operate at LOS "D", during the PM peak hour of traffic. However, the average delay of 26.7 seconds/vehicle on Road A is in the upper range of LOS "D". Therefore, a median refuge lane at Road A was not recommended at this time. Furthermore, separate left-turn and right-turn lanes on Road A would not improve the LOS.

Comment No. 7 – Traffic Assignment

a. The traffic assignment for the proposed project was primarily based upon the direction of peak hour traffic at the roundabout intersection of the Kapa`a Bypass Road and Olohena Road, where only about one third of Olohena Road traffic turns to/from the south leg of the Kapa`a Bypass Road. The Phase 2 development is concentrated on the makai half of the project site. Only the trips generated from the mauka-most portion of the site and the estimated AM peak hour school trips are expected to use the mauka access of Road A at Olohena Road.

b. The peak hour trip destinations, mauka of the Ka`apuni Road/Olohena Road intersection, are virtually nil, as observed in mauka bound/makai bound directional splits on Olohena Road. The retail trips generated from the mauka neighboring communities are represented in the "pass-by" trips using Road A.

Comment No. 8 – Figures 11 through 14 (Traffic Assignment)

a. The diverted peak hour trips on Road A are depicted on the attached Figures 12.1 and 14.1.

b. The revised Figure 11 is attached.

c. The revised Figure 13 is attached.

d. The revised Figure 14 is attached.

Comment No. 9 – PM Peak Hour Traffic Analysis With Project

a. The recommendation of extending the median refuge lane/two-way left-turn lane in Section V.A.7. of the TIAR Update is expected to mitigate the "bottle-neck" on Kuhio Highway, north of Lehua Street. Ultimately, the improvement of the north leg of the Kapa`a Bypass Road from a one-way roadway to a two-way bypass road is expected to improve traffic operations in Kapa`a Town.

Comment No. 10 – Recommendation of Traffic Improvements Without Project

a. Noted.

Comment No. 11 – Recommendation of Traffic Improvements With Project

a. Noted. While the MUTCD does not provide warrants for roundabout intersections, it does advise that a roundabout intersection can be considered as an alternative to traffic signal control. Based upon the TIAR Update, the intersection of Olohena Road and Road A is not expected to warrant all-way stop controls or traffic signals. Therefore, a roundabout intersection was not considered. However, a reassessment of the traffic operations at the Road A intersection at Olohena Road may be considered after the project is fully built out and occupied. A roundabout intersection was considered at the intersection of Olohena Road, Ka`apuni Road, and Kaehulua Road. However, based upon a preliminary assessment of the horizontal and vertical alignments of the intersecting roadways, it was determined that a roundabout intersection would not be feasible. The realignment of Kaehulua Road to form a four-legged intersection with the Olohena Road and Ka`apuni Road was recommended in Section V.A.6.

If you require clarification on any of the above material or have any other questions, please do not hesitate to call me.

Very truly yours,

The Traffic Management Consultant

By

Randall S. Okaneku, P. E.
Principal

Attachments:
Figure 6-Revised
Kuhio Hwy Kapa`a Bypass Rd Traffic Count Data-Revised
Figure 12.1
Figure 14.1
Figure 11-Revised
Figure 13-Revised
Figure 14-Revised

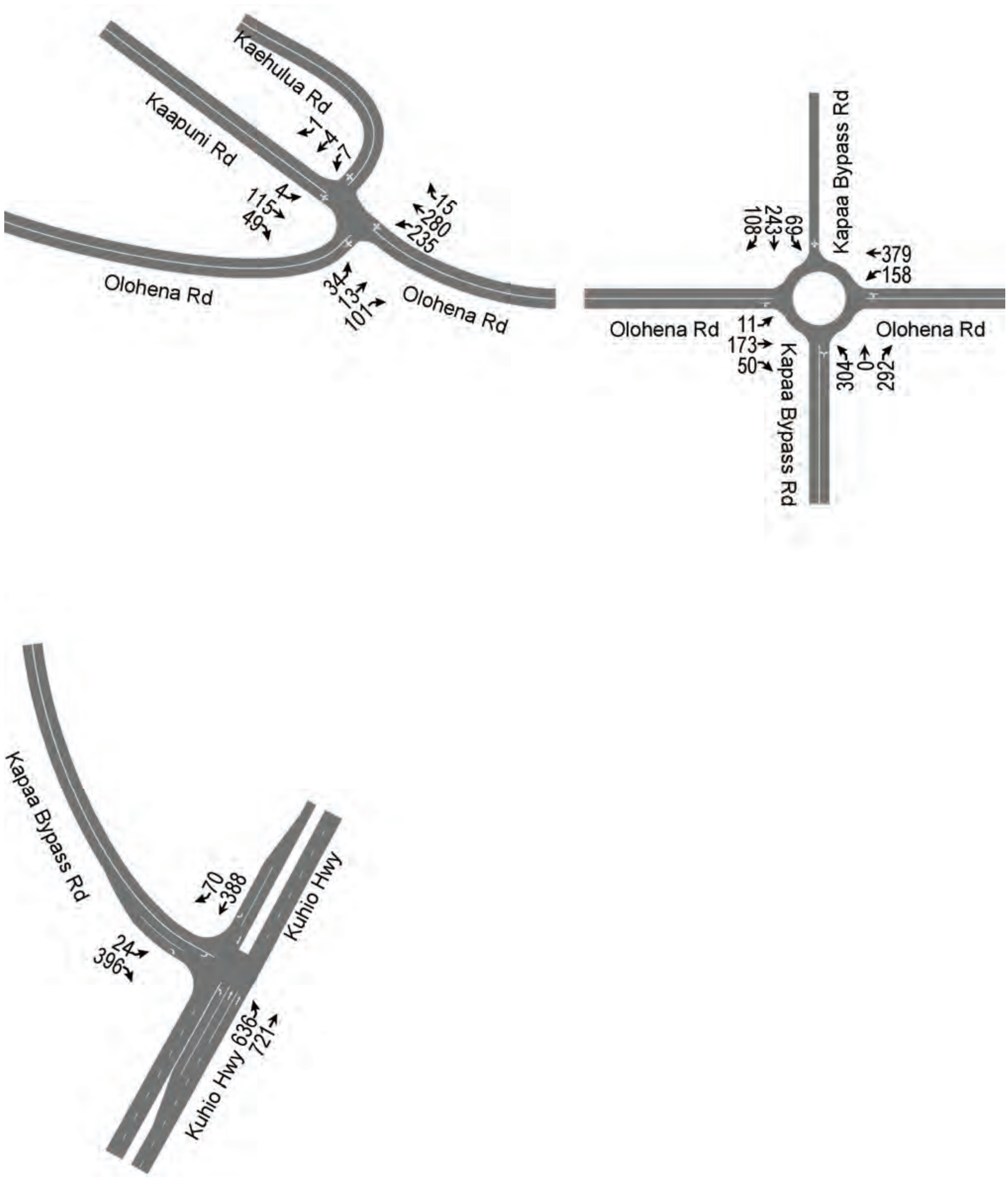


Figure 6. Existing PM Peak Hour Traffic (Cont'd.)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Data

	Kapaa Bypass Rd				Kuhio Hwy				Kuhio Hwy					
	Koko Head Bound				Mauka Bound				Makai Bound					
Start Time	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
3:00 PM	1	105	0	106	99	191	0	290	0	106	5	0	111	507
3:15 PM	3	100	0	103	122	210	0	332	0	88	7	0	95	530
3:30 PM	8	93	0	101	120	207	0	327	0	73	8	0	81	509
3:45 PM	8	104	0	112	148	201	0	349	0	88	21	0	109	570
Hourly Total	20	402	0	422	489	809	0	1298	0	355	41	0	396	2116
4:00 PM	1	108	0	109	168	161	0	329	0	91	16	0	107	545
4:15 PM	9	94	0	103	154	172	0	326	0	97	14	0	111	540
4:30 PM	6	90	0	96	166	187	0	353	0	112	19	0	131	580
4:45 PM	2	95	0	97	146	176	0	322	0	112	15	0	127	546
Hourly Total	18	387	0	405	634	696	0	1330	0	412	64	0	476	2211
5:00 PM	5	88	0	93	149	232	0	381	0	138	27	0	165	639
5:15 PM	2	91	0	93	149	192	0	341	0	152	25	0	177	611
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	7	179	0	186	298	424	0	722	0	290	52	0	342	1250
6:30 AM	0	78	0	78	14	124	0	138	0	203	0	0	203	419
6:45 AM	2	116	0	118	8	124	0	132	0	190	1	0	191	441
Hourly Total	2	194	0	196	22	248	0	270	0	393	1	0	394	860
7:00 AM	1	161	0	162	20	129	0	149	0	233	0	0	233	544
7:15 AM	1	184	0	185	25	155	0	180	0	200	1	0	201	566
7:30 AM	2	152	0	154	24	152	0	176	0	167	0	0	167	497
7:45 AM	1	155	1	156	33	180	0	213	0	135	0	0	135	504
Hourly Total	5	652	1	657	102	616	0	718	0	735	1	0	736	2111
8:00 AM	0	150	0	150	24	187	0	211	0	132	1	0	133	494
8:15 AM	3	131	0	134	21	177	0	198	0	165	0	0	165	497
8:30 AM	3	130	0	133	33	191	0	224	0	161	1	0	162	519
8:45 AM	1	108	0	109	25	209	0	234	0	189	0	0	189	532
Hourly Total	7	519	0	526	103	764	0	867	0	647	2	0	649	2042
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	5	103	0	108	97	217	0	314	0	96	6	0	102	524
3:15 PM	8	117	0	125	131	156	0	287	0	84	9	0	93	505
3:30 PM	6	83	0	89	138	227	0	365	1	76	8	0	85	539
3:45 PM	2	87	1	89	119	182	0	301	0	76	7	0	83	473
Hourly Total	21	390	1	411	485	782	0	1267	1	332	30	0	363	2041
4:00 PM	2	122	0	124	126	152	0	278	0	96	7	0	103	505
4:15 PM	6	109	1	115	136	158	0	294	0	95	6	0	101	510
4:30 PM	6	96	1	102	143	174	0	317	0	78	2	0	80	499
4:45 PM	5	93	0	98	138	181	0	319	0	83	6	0	89	506
Hourly Total	19	420	2	439	543	665	0	1208	0	352	21	0	373	2020
5:00 PM	2	98	0	100	146	204	0	350	0	85	3	0	88	538
5:15 PM	4	113	0	117	121	159	0	280	0	92	2	0	94	491
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	6	211	0	217	267	363	0	630	0	177	5	0	182	1029
6:30 AM	0	82	0	82	11	115	0	126	0	185	0	0	185	393
6:45 AM	0	89	0	89	10	126	0	136	0	164	3	0	167	392
Hourly Total	0	171	0	171	21	241	0	262	0	349	3	0	352	785
7:00 AM	1	131	0	132	17	133	0	150	0	219	1	0	220	502
7:15 AM	3	168	0	171	32	158	0	190	0	182	3	0	185	546
7:30 AM	1	125	0	126	40	146	0	186	0	166	2	0	168	480
7:45 AM	1	123	0	124	30	165	0	195	0	138	0	0	138	457
Hourly Total	6	547	0	553	119	602	0	721	0	705	6	0	711	1985
8:00 AM	4	116	0	120	20	169	0	189	0	150	0	0	150	459
8:15 AM	1	125	0	126	28	158	0	186	0	133	2	0	135	447
Grand Total	116	4313	4	4429	3131	6537	0	9668	1	5030	228	0	5259	19356
Approach %	2.6	97.4	-	-	32.4	67.6	-	-	0.0	95.6	4.3	-	-	-
Total %	0.6	22.3	-	22.9	16.2	33.8	-	49.9	0.0	26.0	1.2	-	27.2	-
Lights	114	4214	-	4328	3083	6353	-	9436	1	4901	225	-	5127	18891
% Lights	98.3	97.7	-	97.7	98.5	97.2	-	97.6	100.0	97.4	98.7	-	97.5	97.6
Mediums	2	91	-	93	47	171	-	218	0	115	3	-	118	429
% Mediums	1.7	2.1	-	2.1	1.5	2.6	-	2.3	0.0	2.3	1.3	-	2.2	2.2
Articulated Trucks	0	8	-	8	1	13	-	14	0	14	0	-	14	36
% Articulated Trucks	0.0	0.2	-	0.2	0.0	0.2	-	0.1	0.0	0.3	0.0	-	0.3	0.2
All Pedestrians	-	-	4	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Count Name: Kuhio Hwy Kapaa Bypass 3-15-17 to 3-17-17
Site Code: Hokua Place
Start Date: 03/15/2017

Kuhio Hwy [Makai]

Exit	Enter	Total
6467	5127	11594
173	118	291
13	14	27
0	0	0
6653	**5259**	**11912**

RT	Th	LT	Ped
225	4901	1	0
3	115	0	0
0	14	0	0
0	0	0	0
228	**5030**	**1**	**0**

Kapaa Bypass Rd [KKHD]

Exit	Enter	Total
3308	4328	7636
50	93	143
1	8	9
0	0	0
3359	**4429**	**7788**

LT	RT	Ped
114	4214	0
2	91	0
0	8	0
0	0	4
116	**4313**	**4**

03/15/2017 3:00 PM
Ending At
03/17/2017 8:30 AM

Lights
Mediums
Articulated Trucks
All Pedestrians

Fake Approach [Ewa]

Exit	Enter	Total
1	0	1
0	0	0
0	0	0
0	0	0
1	**0**	**1**

LT	Th	Ped
3083	6353	0
47	171	0
1	13	0
0	0	0
3131	**6537**	**0**

Exit	Enter	Total
9115	9436	18551
206	218	424
22	14	36
0	0	0
9343	**9668**	**19011**

Kuhio Hwy [Mauka]

Turning Movement Data Plot

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (3:45 PM)

Start Time	Kapaa Bypass Rd Koko Head Bound				Kuhio Hwy Mauka Bound				Kuhio Hwy Makai Bound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
3:45 PM	8	104	0	112	148	201	0	349	0	88	21	0	109	570
4:00 PM	1	108	0	109	168	161	0	329	0	91	16	0	107	545
4:15 PM	9	94	0	103	154	172	0	326	0	97	14	0	111	540
4:30 PM	6	90	0	96	166	187	0	353	0	112	19	0	131	580
Total	24	396	0	420	636	721	0	1357	0	388	70	0	458	2235
Approach %	5.7	94.3	-	-	46.9	53.1	-	-	0.0	84.7	15.3	-	-	-
Total %	1.1	17.7	-	18.8	28.5	32.3	-	60.7	0.0	17.4	3.1	-	20.5	-
PHF	0.667	0.917	-	0.938	0.946	0.897	-	0.961	0.000	0.866	0.833	-	0.874	0.963
Lights	24	390	-	414	633	712	-	1345	0	377	69	-	446	2205
% Lights	100.0	98.5	-	98.6	99.5	98.8	-	99.1	-	97.2	98.6	-	97.4	98.7
Mediums	0	6	-	6	3	9	-	12	0	11	1	-	12	30
% Mediums	0.0	1.5	-	1.4	0.5	1.2	-	0.9	-	2.8	1.4	-	2.6	1.3
Articulated Trucks	0	0	-	0	0	0	-	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	-	0.0	0.0	0.0	-	0.0	-	0.0	0.0	-	0.0	0.0
All Pedestrians	-	-	0	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Peak Hour Data

03/15/2017 3:45 PM
Ending At
03/15/2017 4:45 PM

Lights
Mediums
Articulated Trucks
All Pedestrians

Kuhio Hwy [Makai]

Exit	Enter	Total
736	446	1182
9	12	21
0	0	0
0	0	0
745	**458**	**1203**

RT	Th	LT	Ped
69	377	0	0
1	11	0	0
0	0	0	0
0	0	0	0
70	**388**	**0**	**0**

Kapaa Bypass Rd [KKHD]

Exit	Enter	Total
702	414	1116
4	6	10
0	0	0
0	0	0
706	**420**	**1126**

Ped	RT	LT
0	390	24
0	6	0
0	0	0
0	0	0
0	**396**	**24**

Fake Approach [Ewa]

Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

LT	Th	Ped
633	712	0
3	9	0
0	0	0
0	0	0
636	**721**	**0**

Exit	Enter	Total
767	1345	2112
17	12	29
0	0	0
0	0	0
784	**1357**	**2141**

Kuhio Hwy [Mauka]

Turning Movement Peak Hour Data Plot (3:45 PM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (7:00 AM)

	Kapaa Bypass Rd				Kuhio Hwy				Kuhio Hwy					
	Koko Head Bound				Mauka Bound				Makai Bound					
Start Time	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
7:00 AM	1	161	0	162	20	129	0	149	0	233	0	0	233	544
7:15 AM	1	184	0	185	25	155	0	180	0	200	1	0	201	566
7:30 AM	2	152	0	154	24	152	0	176	0	167	0	0	167	497
7:45 AM	1	155	1	156	33	180	0	213	0	135	0	0	135	504
Total	5	652	1	657	102	616	0	718	0	735	1	0	736	2111
Approach %	0.8	99.2	-	-	14.2	85.8	-	-	0.0	99.9	0.1	-	-	-
Total %	0.2	30.9	-	31.1	4.8	29.2	-	34.0	0.0	34.8	0.0	-	34.9	-
PHF	0.625	0.886	-	0.888	0.773	0.856	-	0.843	0.000	0.789	0.250	-	0.790	0.932
Lights	4	635	-	639	100	600	-	700	0	711	1	-	712	2051
% Lights	80.0	97.4	-	97.3	98.0	97.4	-	97.5	-	96.7	100.0	-	96.7	97.2
Mediums	1	14	-	15	2	16	-	18	0	23	0	-	23	56
% Mediums	20.0	2.1	-	2.3	2.0	2.6	-	2.5	-	3.1	0.0	-	3.1	2.7
Articulated Trucks	0	3	-	3	0	0	-	0	0	1	0	-	1	4
% Articulated Trucks	0.0	0.5	-	0.5	0.0	0.0	-	0.0	-	0.1	0.0	-	0.1	0.2
All Pedestrians	-	-	1	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Kuhio Hwy [Makai]

Exit	Enter	Total
604	712	1316
17	23	40
0	1	1
0	0	0
621	**736**	**1357**

RT	Th	LT	Ped
1	711	0	0
0	23	0	0
0	1	0	0
0	0	0	0
1	**735**	**0**	**0**

Peak Hour Data

03/16/2017 7:00 AM
Ending At
03/16/2017 8:00 AM

Lights
Mediums
Articulated Trucks
All Pedestrians

Kapaa Bypass Rd [KKHD]

Exit	Enter	Total
101	639	740
2	15	17
0	3	3
0	0	0
103	**657**	**760**

Ped	RT	LT
0	635	4
0	14	1
0	3	0
1	0	0
1	**652**	**5**

Fake Approach [Ewa]

Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

LT	Th	Ped
100	600	0
2	16	0
0	0	0
0	0	0
102	**616**	**0**

Exit	Enter	Total
1346	700	2046
37	18	55
4	0	4
0	0	0
1387	**718**	**2105**

Kuhio Hwy [Mauka]

Turning Movement Peak Hour Data Plot (7:00 AM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Count Name: Kuhio Hwy Kapaa Bypass 3-15-17 to 3-17-17
Site Code: Hokua Place
Start Date: 03/15/2017
Page No: 7

Turning Movement Peak Hour Data (4:15 PM)

Start Time	Kapaa Bypass Rd Koko Head Bound				Kuhio Hwy Mauka Bound				Kuhio Hwy Makai Bound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
4:15 PM	6	109	1	115	136	158	0	294	0	95	6	0	101	510
4:30 PM	6	96	1	102	143	174	0	317	0	78	2	0	80	499
4:45 PM	5	93	0	98	138	181	0	319	0	83	6	0	89	506
5:00 PM	2	98	0	100	146	204	0	350	0	85	3	0	88	538
Total	19	396	2	415	563	717	0	1280	0	341	17	0	358	2053
Approach %	4.6	95.4	-	-	44.0	56.0	-	-	0.0	95.3	4.7	-	-	-
Total %	0.9	19.3	-	20.2	27.4	34.9	-	62.3	0.0	16.6	0.8	-	17.4	-
PHF	0.792	0.908	-	0.902	0.964	0.879	-	0.914	0.000	0.897	0.708	-	0.886	0.954
Lights	19	385	-	404	558	710	-	1268	0	337	17	-	354	2026
% Lights	100.0	97.2	-	97.3	99.1	99.0	-	99.1	-	98.8	100.0	-	98.9	98.7
Mediums	0	11	-	11	5	7	-	12	0	4	0	-	4	27
% Mediums	0.0	2.8	-	2.7	0.9	1.0	-	0.9	-	1.2	0.0	-	1.1	1.3
Articulated Trucks	0	0	-	0	0	0	-	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	-	0.0	0.0	0.0	-	0.0	-	0.0	0.0	-	0.0	0.0
All Pedestrians	-	-	2	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Peak Hour Data

03/16/2017 4:15 PM
Ending At
03/16/2017 5:15 PM

Lights
Mediums
Articulated Trucks
All Pedestrians

Kuhio Hwy [Makai]

Exit	Enter	Total
729	354	1083
7	4	11
0	0	0
0	0	0
736	**358**	**1094**

RT	Th	LT	Ped
17	337	0	0
0	4	0	0
0	0	0	0
0	0	0	0
17	**341**	**0**	**0**

Kapaa Bypass Rd [KKHD]

Exit	Enter	Total
575	404	979
5	11	16
0	0	0
0	0	0
580	**415**	**995**

LT	RT	Ped
19	385	0
0	11	0
0	0	0
0	0	2
19	**396**	**2**

Fake Approach [Ewa]

Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

LT	Th	Ped
558	710	0
5	7	0
0	0	0
0	0	0
563	**717**	**0**

Kuhio Hwy [Mauka]

Exit	Enter	Total
722	1268	1990
15	12	27
0	0	0
0	0	0
737	**1280**	**2017**

Turning Movement Peak Hour Data Plot (4:15 PM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (7:00 AM)

Start Time	Kapaa Bypass Rd Koko Head Bound				Kuhio Hwy Mauka Bound				Kuhio Hwy Makai Bound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
7:00 AM	1	131	0	132	17	133	0	150	0	219	1	0	220	502
7:15 AM	3	168	0	171	32	158	0	190	0	182	3	0	185	546
7:30 AM	1	125	0	126	40	146	0	186	0	166	2	0	168	480
7:45 AM	1	123	0	124	30	165	0	195	0	138	0	0	138	457
Total	6	547	0	553	119	602	0	721	0	705	6	0	711	1985
Approach %	1.1	98.9	-	-	16.5	83.5	-	-	0.0	99.2	0.8	-	-	-
Total %	0.3	27.6	-	27.9	6.0	30.3	-	36.3	0.0	35.5	0.3	-	35.8	-
PHF	0.500	0.814	-	0.808	0.744	0.912	-	0.924	0.000	0.805	0.500	-	0.808	0.909
Lights	5	535	-	540	113	569	-	682	0	688	6	-	694	1916
% Lights	83.3	97.8	-	97.6	95.0	94.5	-	94.6	-	97.6	100.0	-	97.6	96.5
Mediums	1	10	-	11	5	29	-	34	0	15	0	-	15	60
% Mediums	16.7	1.8	-	2.0	4.2	4.8	-	4.7	-	2.1	0.0	-	2.1	3.0
Articulated Trucks	0	2	-	2	1	4	-	5	0	2	0	-	2	9
% Articulated Trucks	0.0	0.4	-	0.4	0.8	0.7	-	0.7	-	0.3	0.0	-	0.3	0.5
All Pedestrians	-	-	0	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Peak Hour Data

03/17/2017 7:00 AM
Ending At
03/17/2017 8:00 AM

Lights
Mediums
Articulated Trucks
All Pedestrians

Kuhio Hwy [Makai]

Exit	Enter	Total
574	694	1268
30	15	45
4	2	6
0	0	0
608	**711**	**1319**

RT	Th	LT	Ped
6	688	0	0
0	15	0	0
0	2	0	0
0	0	0	0
6	**705**	**0**	**0**

Kapaa Bypass Rd [KKHD]

Exit	Enter	Total
119	540	659
5	11	16
1	2	3
0	0	0
125	**553**	**678**

LT	RT	Ped
5	535	0
1	10	0
0	2	0
0	0	0
6	**547**	**0**

Fake Approach [Ewa]

Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

LT	Th	Ped
113	569	0
5	29	0
1	4	0
0	0	0
119	**602**	**0**

Exit	Enter	Total
1223	682	1905
25	34	59
4	5	9
0	0	0
1252	**721**	**1973**

Kuhio Hwy [Mauka]

Turning Movement Peak Hour Data Plot (7:00 AM)

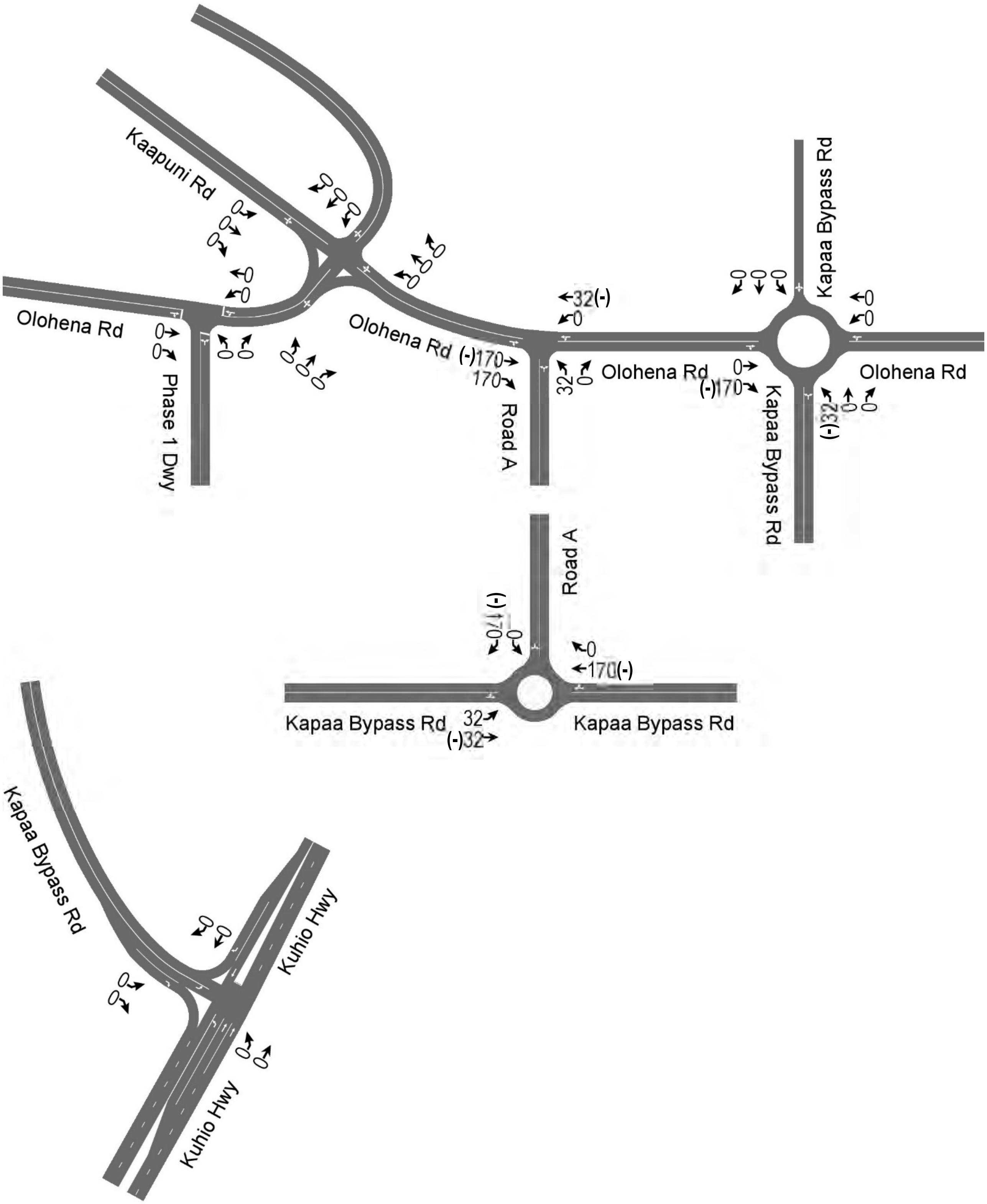


Figure 12.1 AM Peak Hour Diverted Traffic Assignment

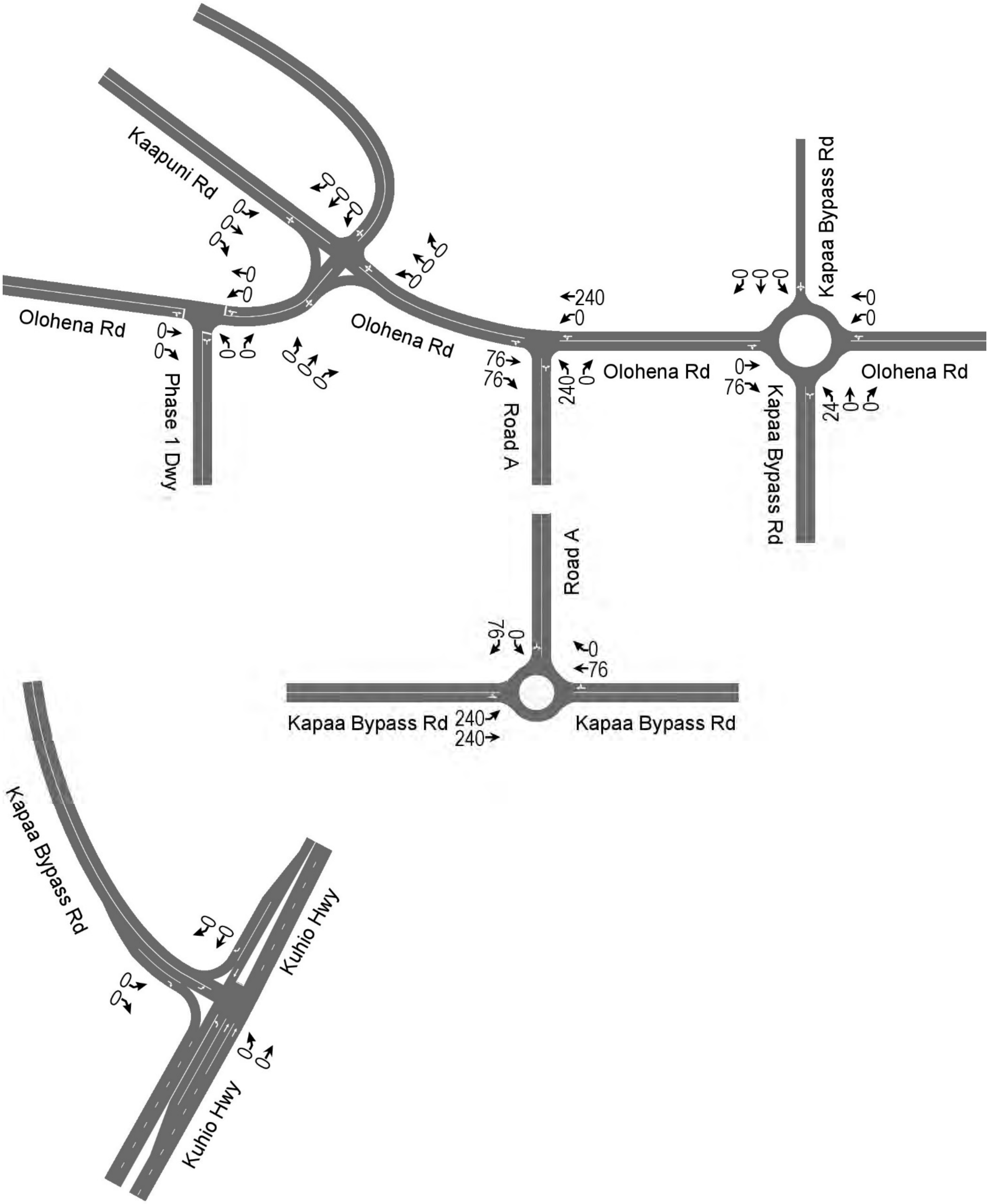


Figure 14.1 PM Peak Hour Diverted Traffic Assignment

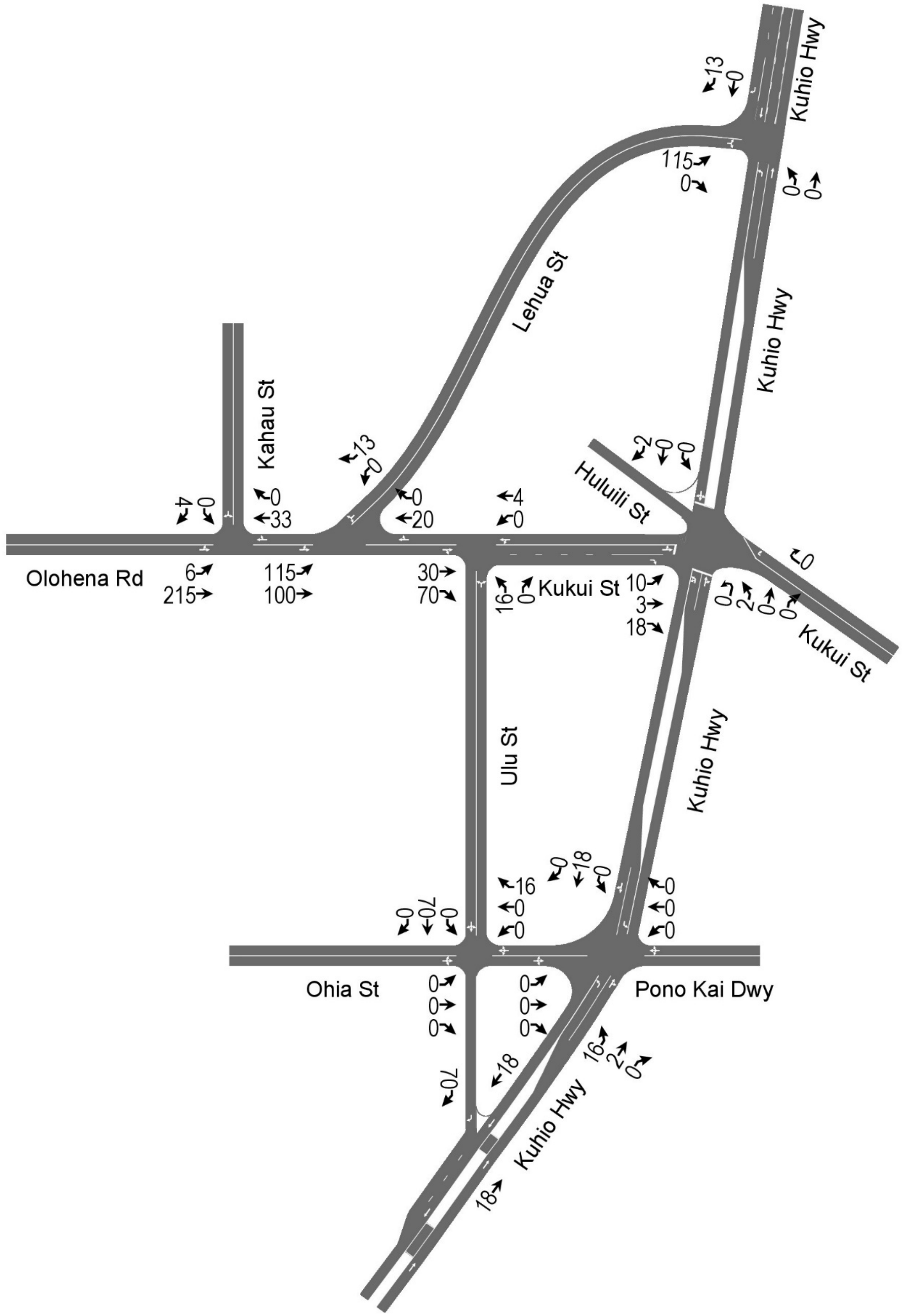


Figure 11. AM Peak Hour Site Traffic Assignment

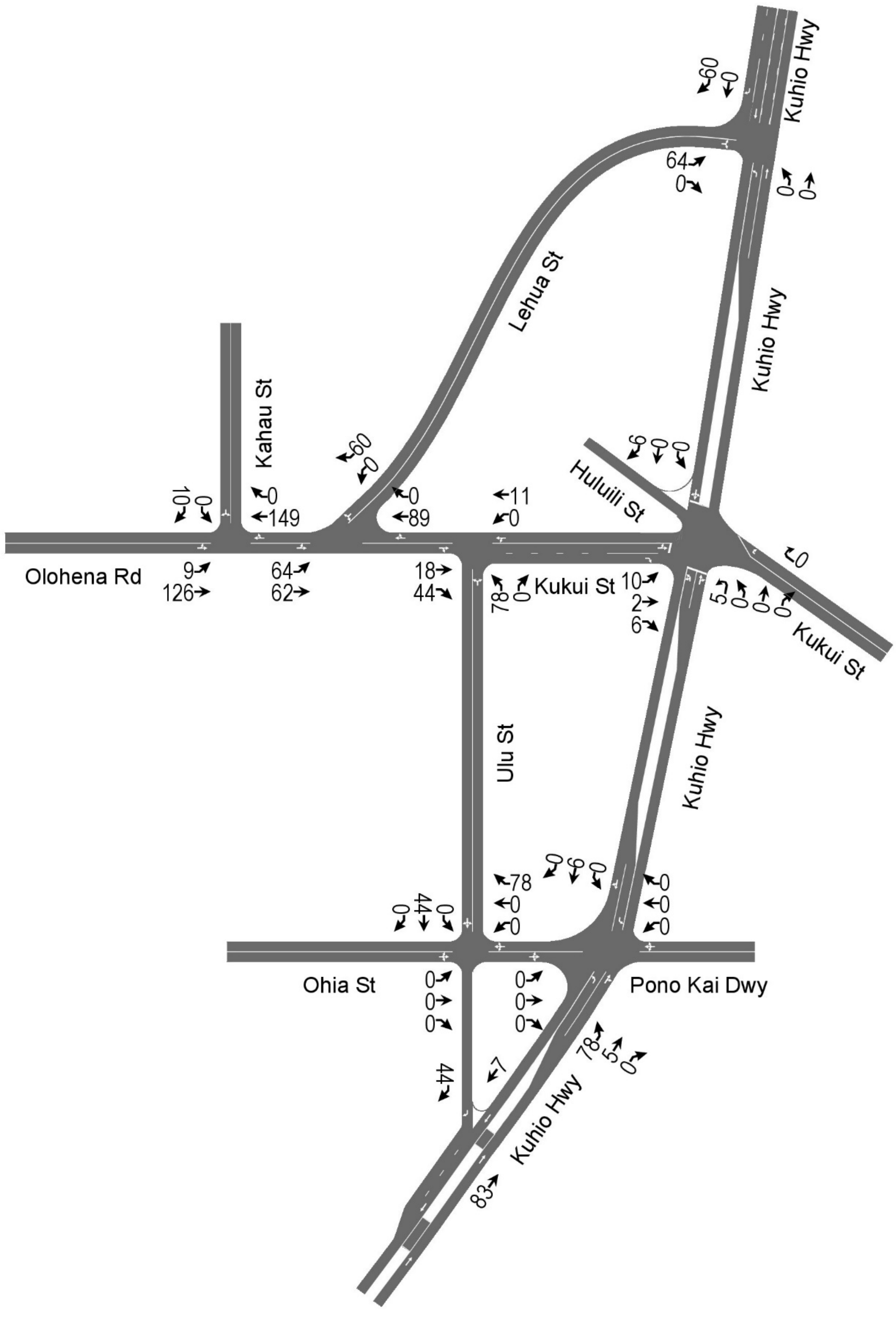


Figure 13. PM Peak Hour Site Traffic Assignment

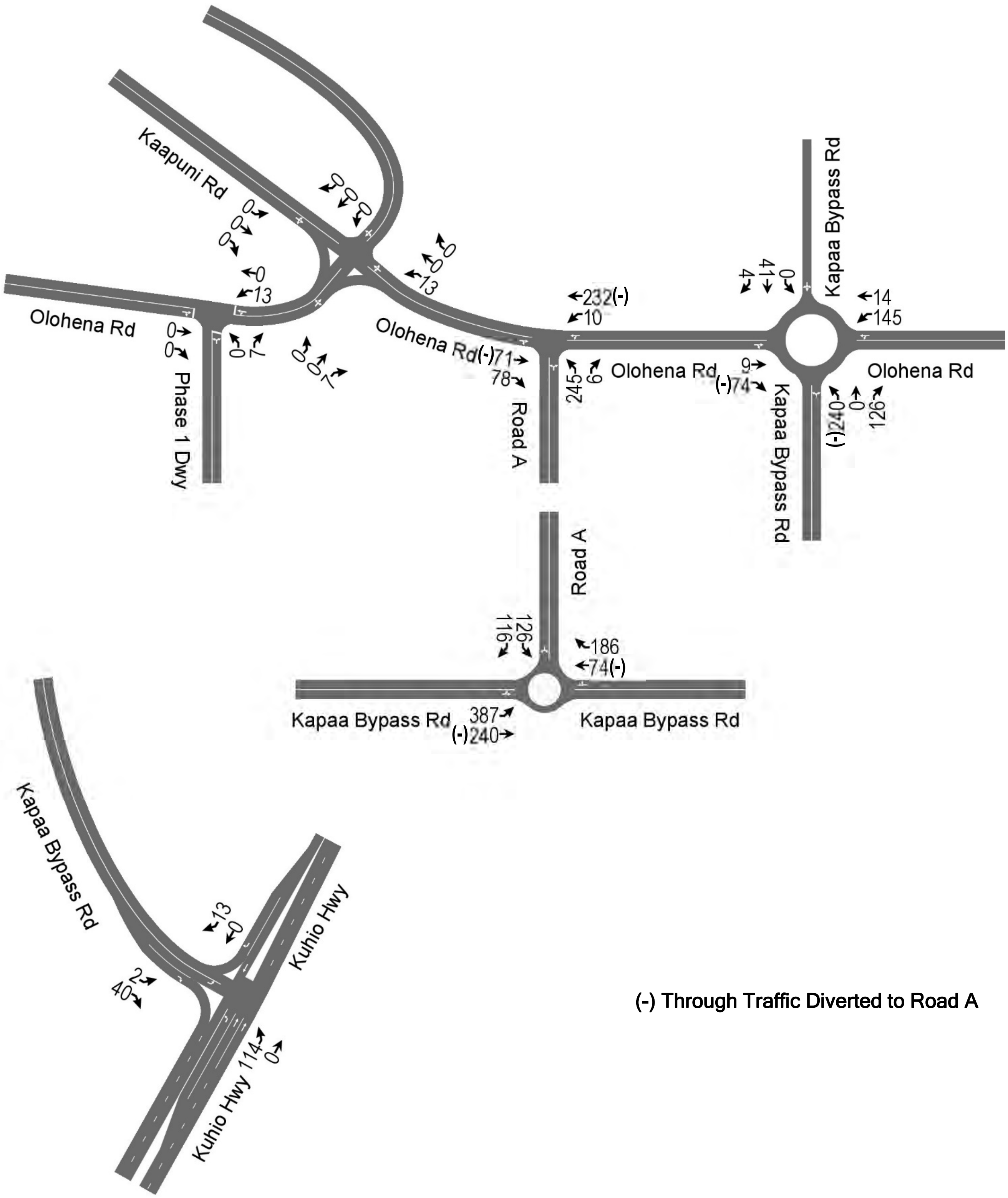


Figure 14. PM Peak Hour Site Traffic Assignment (Cont'd.)

Bernard P. Carvalho, Jr.
Mayor

Wallace G. Rezentes, Jr.
Managing Director

Lyle Tabata
Acting County Engineer

DEPARTMENT OF PUBLIC WORKS
County of Kaua'i, State of Hawai'i
4444 Rice Street, Suite 275, Līhu'e, Hawai'i 96766
TEL (808) 241-4992 FAX (808) 241-6604

September 1, 2017

Randall S. Okaneku, P. E.
The Traffic Management Consultant
1188 Bishop Street, Suite 1907
Honolulu, Hawaii 96813

SUBJECT: Traffic Impact Analysis Report Update
For the Proposed Hokua Place
Kapa`a, Kawaihau District, Island of Kaua'i
TMK: (4) 4-3-03: Por. 001

Dear Mr. Okaneku:

The Engineering Division of the Department of Public Works received the subject Traffic Impact Analysis Report (TIAR) Update that was transmitted via email on June 15, 2017. We appreciate the opportunity to review the TIAR and offer the following comments on the TIAR:

1. **Introduction, Project Description:**
   a. The TIAR indicates that the driveway for phase 1 is proposed to be located on Olohena Road mauka of its intersection with Ka'apuni Road. We have concerns with a proposed intersection at this location, including the proximity to the intersection of Ka'apuni Road as well as concerns about intersection sight distance due to nearby horizontal and vertical curves. Prior to approval of a driveway at this location, additional information will need to be provided about this driveway location, to show that appropriate sight lines can be achieved and that no safety or other problems will be created by the proximity to the intersection of Olohena Road and Ka'apuni Road.
2. **Existing Conditions, Roadways:**
   a. The report states that the Kapa'a Bypass Road speed limit is reduced to 25 mph south of the proposed intersection with Road A. The report should also mention that further south the speed limit is again increased to 35 mph.
   b. The report incorrectly indicates that the posted speed limit for Olohena Road is reduced to 15 mph as it approaches Kapa'a Middle School. The correct statement should be that there is a 15 mph school zone within the vicinity of Kapa'a Middle School during school hours.
   c. Kukui Street and Ulu Street should both be described as collector streets.

3. **Existing Conditions, Existing Peak Hour Traffic Volumes and Operating Conditions:**
    a. The language throughout this segment of the TIAR indicates that intersections "operated at LOS…." However, if we understand correctly, the LOS values given are based on the analysis of the traffic conditions, not actual empirical observations of delay for vehicles at these intersections. The TIAR should instead use language such as "calculated to operate at LOS …." This is an important distinction given that observations of Kūhiō Highway during peak hours of traffic appear to show LOS along the highway worse than the LOS A for movements along Kūhiō Highway as reported in the TIAR, potentially due to other factors than the control delay at the intersections.
    b. Check the traffic volume of 1,500 shown on page 10 for Kūhiō Highway south of Ulu Street in the PM Peak. The volumes shown in Figure 6 do not match.
    c. Figure 6 (Existing PM Peak Hour Traffic) has an error for the southbound through movement on Kūhiō Highway at the Kapa'a Bypass Road. The figure shows an hourly volume of 38, which is way too low for this through movement. The data shown for this intersection in figure 6 does not appear to match either of the two PM peak hour traffic count plots (or their average) in the appendix.
    d. Related to comment "a" above recommending different language for the calculated LOS values, we recommend that the TIAR include some statements comparing the observed traffic conditions with the calculated delays and level of service, ideally offering explanations for the difference in observed level of service and calculated level of service.
4. **Future Traffic Conditions, Kapa'a Transportation Solutions:**
    a. Page 17 of the TIAR refers to removal of on-street parking on Kūhiō Highway. The Kapa'a Transportation Solutions study rejected any potential solutions that removed parking on Kūhiō Highway, since such a change would be detrimental to the economic vitality, multimodal, and safety goals of the study. Removal of parking should not be discussed in the TIAR, as HDOT is not considering removal of parking to add travel lanes or turn lanes.
    b. With respect to a new connector road in the approximate location of Road A, page 18 of the TIAR states, "The construction cost of the connector road was estimated at $25,824,000." The costs in the Kapa'a Transportation Solutions report include right-of-way costs as well as construction cost; therefore it is misleading to state that the full cost shown in the study is the estimated construction cost.
5. **Traffic Impact Analysis, Trip Generation Characteristics:**
    a. The project description in the TIAR's introduction states that there are 700 multi-family dwelling units, but the trip generation calculations are based on 800 multi-family dwelling units. This discrepancy must be corrected, and the accurate trip generation should be reflected in the study.
    b. The pass-by trip percentage of 81.2% is too high, especially given the relatively small amount of traffic traveling through the development on Road A. The diverted volume of 45 vehicles represents approximately 15% of the estimated through vehicles on Road A during the PM Peak Hour. The 8,000 square feet of the Hokua Place shopping center is outside of the sample size in the pass-by trip

chart for shopping centers in the ITE Trip Generation Handbook. A pass-by trip percentage of approximately 30% or 40% would be more reasonable, given the data available in the Trip Generation Handbook. It would also be reasonable for the TIAR to include a calculation of an internal capture rate for trips between the retail portion and the residential portion of the Hokua Place development. However, the combination of the traffic reduction for internal capture and pass-by trips should still be less than 81%.

6. **Traffic Impact Analysis, Site Access Improvements:**
    a. The recommendations for the stop controlled Tee-intersections of Olohena Road with Road A and the phase 1 driveway do not include any statements regarding the recommended lane assignments for these new intersections. The methodologies section of the report describes the use of AASHTO Left-Turn Lane Guidelines, but no such analyses are included in the TIAR for left turn lanes on Olohena Road at these intersections. We believe that at a minimum, a left turn lane would be necessary on Olohena Road at Road A, but analyses must be provided for both intersections. A median refuge lane should also be included on Olohena Road to facilitate the left-turn movement from Road A to Olohena Road. In addition, we believe that Road A should have two approach lanes at Olohena Road, one for right turn movements and one for left turn movements.
7. **Traffic Impact Analysis, Traffic Assignment:**
    a. In the previous TIAR for this project, no traffic was assigned to the left turn movement from southbound Road A to eastbound Kapa'a Bypass (and likewise for the right turn from the Kapa'a Bypass to Road A). In our earlier comments, we recommended that some traffic be assigned to these movements. In almost a complete reversal, the current TIAR assigned nearly all of the traffic to these movements. In the current TIAR, only about 5% to 10% of the project traffic that goes through the existing Kapa'a Bypass roundabout is assigned to go through the intersection of Road A and Olohena Road. A more equitable distribution of traffic should be made, to accurately represent the traffic impact on Olohena Road.
    b. The TIAR assigns no traffic between the project and Olohena Road or Ka'apuni Road north of the project (Wailua Homesteads and Upper Kapahi area). There are relatively few destinations on those roads for the residential traffic from the project, but a small amount of residential traffic is likely to travel to those areas. In addition, much of the traffic generated by the retail portion of the development would have its origin or destination in the residential areas of Wailua Homesteads and Upper Kapahi area. A reasonable (albeit small) amount of traffic must be assigned to those areas.
8. **Figures 11 Through 14 (Traffic Assignment)**
    a. For clarity, the TIAR must show the reassignment of existing traffic on separate figures from the figures for traffic assignment from this project.
    b. On Figure 11, the 989 vehicles shown for northbound Kūhiō Highway at Ulu Street is incorrect. It appears that this volume should be 20.
    c. On Figure 13, the 1,274 vehicles shown for northbound Kūhiō Highway at Ulu Street is incorrect. It appears that this volume should be 92.
    d. On Figure 14, the 30 vehicles shown for the Kapa'a Bypass Road left turn and the

447 vehicles for the Kapa'a Byapss Road right turn appear to be incorrect.

9. Traffic Impact Analysis, PM Peak Hour Traffic Analysis With Project:

a. We recommend that the TIAR further analyze and discuss the impact of the project on the intersection of Kūhi'ō Highway and Lehua Street and recommend measures to mitigate this impact. The TIAR states that "Makai bound Lehua Street is expected to continue at LOS F at Kūhiō Highway during the PM peak hour of traffic with the proposed project." However, Table 7 shows the PM peak hour of traffic without the project to be LOS E. Additionally, while the AM peak hour of traffic with the project continues to be LOS F, the delay increases significantly.

10. Recommendations and Conclusions, Recommended Traffic Improvements Without Project:

a. Item number 3 recommends restricting parking along Kūhiō Highway within Kapa'a Town in order to provide additional through lanes or left turn lanes on Kūhiō Highway. This should not be recommended in the TIAR, because HDOT is not considering removal of parking to add travel lanes. Removal of parking has been determined to be detrimental to businesses and the economic vitality of Kapa'a Town. Discussion of parking removal on Kūhiō Highway in Kapa'a Town should also be removed from other sections of the report, including the conclusions.

11. Recommendations and Conclusions, Recommended Traffic Improvements With Project:

a. Our comments above include several concerns about the intersection of Road A and Olohena Road, including the possibility that additional traffic should be assigned to this intersection. We are concerned that the one-way stop control Tee-intersection proposed will not be sufficient to address traffic operations and safety at intersection. The installation of a roundabout at this intersection shall be evaluated as part of the TIAR, including traffic operations analysis for a roundabout as well as a safety comparison of a roundabout and a one-way stop control intersection. The federal Manual on Uniform Traffic Control Devices (MUTCD) does not include traffic warrants for roundabouts. However, evaluation of the MUTCD's multi-way stop control warrants and/or signal warrants would be instructive with respect to evaluating whether a one-way stop control intersection would be sufficient or if a roundabout is needed instead. Alternatively, we may also accept an evaluation of the need for a roundabout based on roundabout evaluation guidelines from another jurisdiction or research document.

Consideration should also be given to the construction of a roundabout that combines the intersections of Olohena Road with Ka'apuni Road and Road A (with Kaehulua Road designed as a T intersection with either Ka'apuni Road or Olohena Road). Traffic operations analysis of a roundabout that combines these intersections shall be included in the TIAR.

The comments in this letter should not be construed to be inclusive of all County of Kaua'i recommendations for road improvements required to be constructed as part of the Hokua Place project. Recommendations and requirements for road improvements will be included as part of future review phases for the project, such as zoning amendments, subdivision applications, and construction plan review. If you have any questions or need additional information, please contact me at (808) 241-4891 or Stanford Iwamoto at (808) 241-4896.

Very truly yours,

MICHAEL MOULE, P.E.
Chief, Engineering Division

MM/SI

Copies to: DPW-Design & Permitting
Lyle Tabata, Acting County Engineer
Larry Dill, HDOT Kauaʻi District Engineer

TRAFFIC IMPACT ANALYSIS REPORT UPDATE

FOR THE PROPOSED

HOKUA PLACE

KAPA`A, KAUAI, HAWAII
TAX MAP KEY: (4) 4-3-03: 01

PREPARED FOR

HG KAUAI JOINT VENTURE, LLC

MAY 22, 2017

PREPARED BY

TMC

THE TRAFFIC MANAGEMENT CONSULTANT

TRAFFIC IMPACT ANALYSIS REPORT UPDATE

FOR THE PROPOSED

HOKUA PLACE

KAPA`A, KAUAI, HAWAII
TAX MAP KEY: (4)4-3-03: 01

PREPARED FOR

HG KAUAI JOINT VENTURE, LLC

MAY 22, 2017

RANDALL S. OKANEKU
LICENSED PROFESSIONAL ENGINEER
No. 4922-C
HAWAII, U.S.A.

PREPARED BY

TMC

THE TRAFFIC MANAGEMENT CONSULTANT

RANDALL S. OKANEKU, P.E., PRINCIPAL * 1188 BISHOP STREET, SUITE 1907 * HONOLULU, HI 96813

Table of Contents

Table of Contents (Cont'd.)

List of Figures

EXECUTIVE SUMMARY

TRAFFIC IMPACT ANALYSIS REPORT UPDATE

FOR THE PROPOSED

HOKUA PLACE

Project Description

The proposed Hokua Place will be developed into an 816-unit residential subdivision in Kapa`a, Kauai, Hawaii. The project is situated immediately to the south of Kapa`a Middle School and to the west (mauka) of Kapa`a Town. The primary access will be provided by a new connector roadway between Olohena Road, immediately mauka of Kapa`a Middle School, and the Kapa`a Bypass Road, southwest of its roundabout intersection with Olohena Road.

The Draft Environmental Impact Statement for the Proposed Hokua Place (DEIS) was published in May 2015. The Traffic Impact Assessment Report Kapa`a Highlands Subdivision, dated December 9, 2013, was attached to the DEIS. The purpose of this Traffic Impact Analysis Report Update is to update the DEIS traffic study, and to respond to comments received from the State of Hawaii Department of Transportation and the County of Kauai Department of Public Works, during their review of the DEIS traffic study.

Existing Traffic Conditions

The field investigation was conducted in March 2017, to update the existing traffic conditions from the DEIS traffic study. The study area was expanded to include Lehua Street and Ulu Street. The field investigation indicated that Lehua Street and Ulu Street were used as alternate routes between Kuhio Highway and Olohena Road/Kukui Street to avoid the delays at the intersection of Kuhio Highway and Kukui Street.

Since the preparation of the DEIS traffic study, the peak hour traffic at the roundabout intersection of the Kapa`a Bypass Road and Olohena Road increased by about 12 percent and 22 percent, during the AM and PM peak hours of traffic, respectively.

Trip Generation

Hokua Place is expected to generate 487 vehicle trips per hour (vph) and 560 vph, during the AM and PM peak hours of traffic, respectively. The AM and PM peak hour trip generation characteristics for Hokua Place were increased by about 90± vph over the DEIS traffic study, primarily due to the use of the average peak hour trip rates for the multi-family dwelling units.

Traffic Impact Analysis

The construction of the connector roadway through Hokua Place, between Olohena Road and the Kapa`a Bypass Road, is expected to mitigate the project's traffic impacts at the roundabout intersection of the Kapa`a Bypass Road and Olohena Road. The other intersections in the study area will require the following traffic improvements to mitigate the traffic impacts without and with the proposed project.

Recommendations Without Project

1. Widen Kuhio Highway between the Kapa`a Bypass Road (South Junction) and Kuamoo Road to provide two through lanes in each direction.
2. Restripe the median on the north leg of Kuhio Highway at the Kapa`a Bypass Road (South Junction) to provide a median refuge lane.
3. Restripe parking and shoulder lanes on Kuhio Highway through Kapa`a Town to provide additional through and/or left-turn lanes.
4. Modify the traffic signal operations at the intersection of Kuhio Highway and Kukui Street to reduce queuing and delays.
5. Add a right-turn bypass lane from southbound Kapa`a Bypass Road to mauka bound Olohena Road at their roundabout intersection.
6. Realign Kaehulua Road to intersect Olohena Road and Kaapuni Road to create a four-legged, channelized intersection.
7. Extend the median refuge lane/two-way left-turn lane on the north leg of Kuhio Highway at Lehua Street.

Recommendations With Project

1. Construct Road A from Olohena Road to the Kapa`a Bypass Road.
2. Construct a roundabout at the intersection of Road A and the Kapa`a Bypass Road.

Conclusions

The existing traffic congestion on Kuhio Highway through Kapa`a Town can be mitigated by restricting on-street parking and restriping the shoulder lanes to provide for additional through lanes/median left-turn lanes. The existing southbound traffic demand through Kapa`a Town is reduced by the Kapa`a Bypass Road. Dedication of the Kapa`a Bypass Road right-of-way along the Hokua Place frontage would assure the continued usage of the existing Kapa`a Bypass Road.

The construction of the proposed Road A will provide additional mauka-makai roadway capacity between Kapa`a Valley and the Kapa`a Bypass Road. Road A is expected to mitigate the Hokua Place traffic impacts at the roundabout intersection of the Kapa`a Bypass Road and Olohena Road. The Hokua Place access intersections on Olohena Road and on the Kapa`a Bypass Road are expected to operate at satisfactory Levels of Service, during the AM and PM peak hours of traffic.

TRAFFIC IMPACT ANALYSIS REPORT UPDATE

FOR THE PROPOSED

HOKUA PLACE

KAPA`A, KAUAI, HAWAII
TAX MAP KEY: (4) 4-3-03: 01

I. Introduction

A. Project Description

Hokua Place is planned as an 816-unit residential development in Kapa`a, Kauai, Hawaii. Hokua Place will consist of 116 single-family detached units, 700 multi-family condominiums, a neighborhood retail center consisting of 8,000 square feet of gross floor area (SFGFA), and a community park and recreation center. The project site is located on the southwest quadrant of the roundabout intersection of the Kapa`a Bypass Road and Olohena Road. The project is situated immediately to the south of Kapa`a Middle School and to the west (mauka) of Kapa`a Town. Figure 1 depicts the project location and vicinity map.

Phase 1 of Hokua Place will consist of 16 single-family detached units, which will be located on the mauka portion of the project site. The Phase 1 access driveway is proposed on Olohena Road, mauka of its intersection with Kaapuni Road. Phase 2 will consist of the remaining 800 dwelling units. Phase 2 access is proposed via a collector street between Olohena Road, immediately mauka of Kapa`a Middle School, and the Kapa`a Bypass Road, about 3,000 feet southwest of its intersection with Olohena Road (hereinafter referred to as Road A). The project site is depicted on Figure 2.

The construction of Hokua Place is expected to begin by the Year 2020. For the purpose of this Traffic Impact Analysis Report Update, full occupancy is assumed to occur by the Year 2030.

B. 2015 Draft Environmental Impact Statement

The Draft Environmental Impact Statement for the Proposed Hokua Place (DEIS) was published in May 2015. Hokua Place was formerly known as the Kapa`a Highlands Subdivision. The Traffic Impact Assessment Report Kapa`a Highlands Subdivision was prepared by Phillip Rowell and Associates, dated December 9, 2013, and was attached to the DEIS as Exhibit H.

Figure 1. Location Map and Vicinity Map

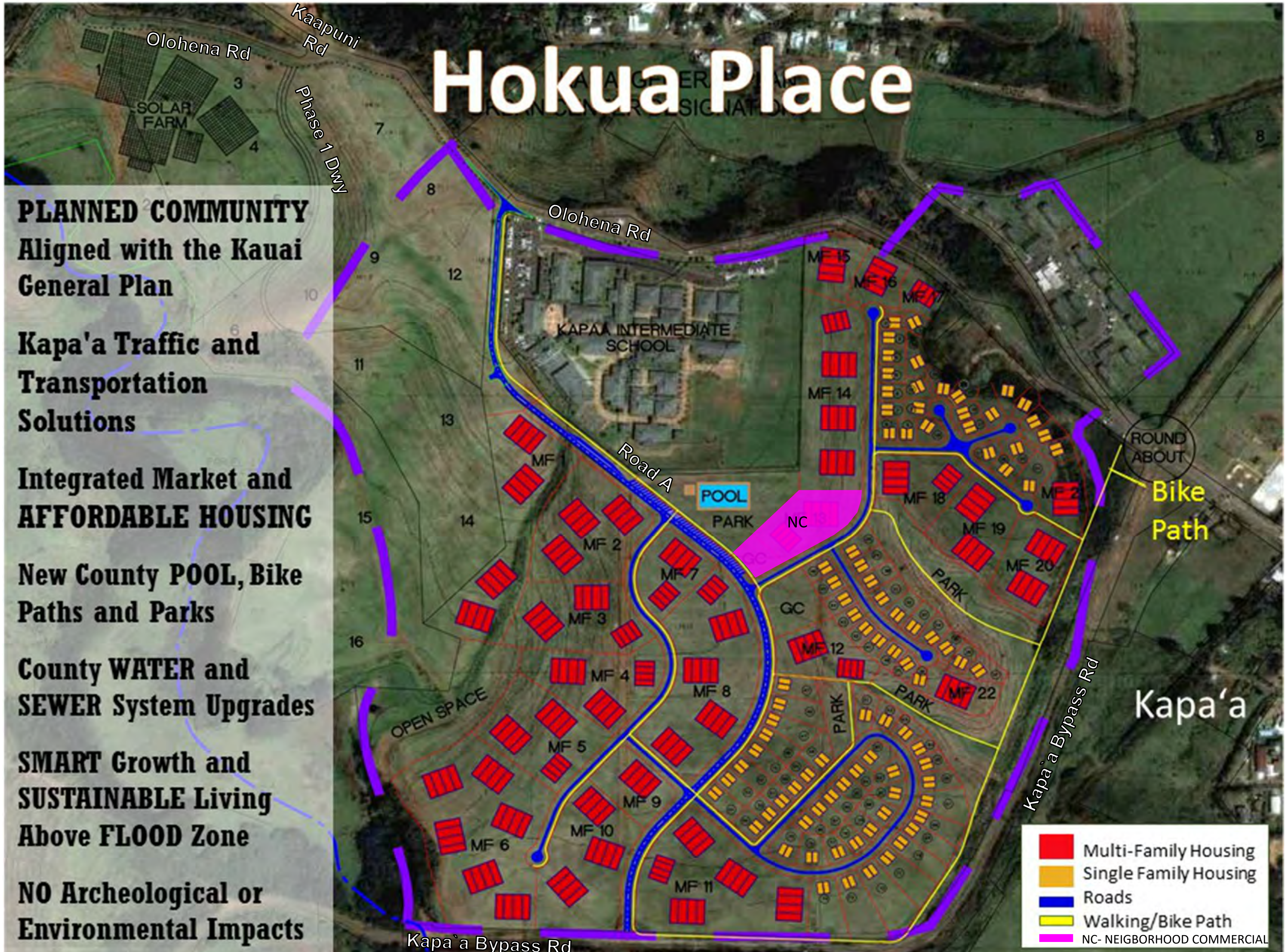


Figure 2. Proposed Site Plan

The State of Hawaii Department of Transportation (DOT) issued comments on the Rowell study in a letter dated March 26, 2014 (HWY-PS 2.6887). Responses to DOT's comments were transmitted via email from Mr. Greg Allen on April 9, 2014. The responses were acceptable to DOT per its letter, dated June 6, 2014 (HWY-PS 2.7311).

The County of Kauai Department of Public Works (DPW) issued its comments on the DEIS in its letter dated June 22, 2015. This TIAR addresses DPW's comments on the DEIS.

C. Purpose and Scope of the Study

The purpose of this study is to update the traffic impact analysis resulting from the development of the proposed Hokua Place. This report presents the findings and recommendations of the study, the scope of which includes:

1. A description of the proposed project.
2. An evaluation of existing roadways and traffic conditions.
3. The analysis of the future traffic conditions without the proposed project.
4. The development of trip generation characteristics of the proposed project.
5. The identification and analysis of the traffic impacts resulting from the development of the proposed project.
6. The recommendation of roadway improvements, which would mitigate the traffic impacts identified in this study.

D. Methodologies

1. Capacity Analysis

The highway capacity analysis, performed in this study, is based upon procedures presented in the Highway Capacity Manual 6th Edition (HCM), published by the Transportation Research Board. HCM defines the Level of Service (LOS) as "a quantitative stratification of a performance measure or measures representing quality of service." HCM defines the six (6) Levels of Service from the traveler's perspective, ranging from the best LOS "A" to the worst LOS "F". LOS translates the complex mathematical results of highway capacity analysis into an A through F system for the purpose of simplifying the roadway performance for non-technical decision makers.

The HCM 6th Edition has updated the highway capacity analysis since the HCM 2010 methodology, utilized in the DEIS traffic study. The most significant change in the HCM 6th Edition occurred in the analysis of roundabouts. The widespread construction of roundabouts throughout the United States, since the development of the HCM 2010, resulted in changes in driver behavior, entering and exiting a roundabout.

The data collected at United States roundabouts improved the HCM 6th Edition methodology for analyzing roundabouts, where the calculated delays were reduced by about one half, when compared with the previous HCM 2010 methodology.

LOS's "A", "B", and "C" are considered satisfactory Levels of Service. LOS "D" is generally considered a "desirable minimum" operating Level of Service. LOS's "E" and "F" are undesirable conditions. Intersection LOS is primarily based upon average delay (d) in seconds per vehicle (sec/veh). The delays at unsignalized intersections, which includes stop-controlled intersections and roundabouts, are generally longer than signalized intersections, due to the drivers' expectation and acceptance of longer delays at higher-volume signalized intersections. Table 1 summarizes the HCM LOS criteria.

Table 1. Intersection Level of Service Criteria (HCM)

LOS	Signalized Control	Unsignalized Control	Description
	Delay d (sec/veh)		
A	d≤10	d≤10	Control delay is minimal.
B	10<d ≤20	10<d≤15	Control delay is not significant.
C	20<d≤35	15<d≤25	Stable operation. Queuing begins to occur.
D	35<d≤55	25<d≤35	Less stable condition. Increase in delays, decrease in travel speeds.
E	55<d≤80	35<d≤50	Unstable operation, significant delays.
F	d>80	d>50	High delays, extensive queuing.

HCM utilizes a peak hour factor (PHF) to convert the peak 15-minute traffic into an hourly volume. For the purpose of this study, the peak hour traffic analysis is based directly upon the peak 15-minute traffic flows entering the study intersection, which is multiplied by four (4) to convert the 15-minute peak volumes into the peak hour volumes.

Synchro is a traffic analysis software that was developed by Trafficware Corporation. Synchro is an intersection analysis program that is based upon the HCM 6th Edition methodology. Synchro was used to calculate the Levels of Service for the intersections in the study area. Worksheets for the capacity analysis, performed throughout this report, are compiled in the Appendix.

2. Trip Generation

The trip generation methodology is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in Trip Generation Manual, 9th Edition, 2012. The ITE trip generation methodology has been updated since the Trip Generation, 7th Edition, utilized in the DEIS traffic study. The ITE trip rates were developed by correlating the total vehicle trip generation data with various land use activities/characteristics, such as the vehicle trips per hour (vph) per dwelling unit (DU).

A portion of the peak hour trips generated by a retail center is considered to be "pass-by" trips, i.e., traffic already on the roadway stopping by at a "secondary" destination enroute to its primary destination. The percentages of pass-by trips were compared with the gross leasable floor areas of the shopping centers, which were collected from traffic studies and compiled by ITE. The results of the analysis were published in the Trip Generation Handbook, 3rd Edition, dated August 2014. The percentage of pass-by trips is generally inversely proportional to the size of the shopping center, e.g., a regional shopping center is a primary destination with a low pass-by trip percentage, while a convenience store is a secondary destination with a high pass-by trip percentage. About 81.2 percent of the total PM peak hour trips generated by the proposed 8,000 square foot retail center are expected to be pass-by trips. The AM peak hour pass-by trip rate for a retail center was not published by ITE.

3. AASHTO Left-Turn Lane Guidelines

The left-turn lane assessment on a two-lane highway is based upon A Policy on Geometric Design of Highways and Streets, 2011, published by the American Association of State Highway and Transportation Officials (AASHTO). The AASHTO guide analyzes the combination of the left-turn volume (minimum 5%), the advancing volume (left-turn, through and right-turn volumes), the opposing volume (left-turn, through and right-turn volumes), and the operating speed. The AASHTO guide is based upon the "Volume Warrants for Left-Turn Storage Lanes at Unsignalized Grade Intersections", Highway Research Record 211, Highway Research Board, 1967, by M. D. Harmelink. The Harmelink left-turn volume warrant analyzes the probability of the arrival of an advancing vehicle slowing and/or stopping behind a vehicle, which is waiting to turn left from the through lane.

II. Existing Conditions

A. Roadways

Kuhio Highway is the primary arterial highway along the east coast of Kauai. Through Kapa`a Town, Kuhio Highway is a two-lane roadway with on-street parking on both sides of the roadway. Kuhio Highway is signalized at its intersection with Kukui Street.

Exclusive left-turn lanes are provided on Kuhio Highway at major intersections in Kapa`a Town. The posted speed limit on Kuhio Highway in Kapa`a Town is 25 miles per hour (mph).

The Kapa`a Bypass Road provides an alternative southbound route around Kapa`a Town. The Kapa`a Bypass Road is a one-lane, one-way, southbound roadway between its north junction at Kuhio Highway and Olohena Road, with a posted speed limit of 25 mph. The Kapa`a Bypass Road intersects Olohena Road at a single-lane roundabout. South of Olohena Road, the Kapa`a Bypass Road becomes a two-way, two-lane roadway, with a posted speed limit of 35 mph. A 3,700± foot section of the Kapa`a Bypass Road, south of Olohena Road, was constructed on a roadway easement, which is currently owned by the developer of Hokua Place. Hokua Place, LLC has a Memorandum of Understanding with the State of Hawaii Department of Transportation (DOT) to dedicate the roadway easement to State DOT upon the approval of the Hokua Place subdivision.

South of the proposed intersection with Road A, the posted speed limit on the Kapa`a Bypass Road is reduced to 25 mph. At its south junction, the Kapa`a Bypass Road intersects Kuhio Highway at an unsignalized Tee-intersection. The Kapa`a Bypass Road provides separate left-turn and right-turn lanes at its south junction with Kuhio Highway. Exclusive left-turn and right-turn lanes are provided on Kuhio Highway at the Kapa`a Bypass Road in the northbound and southbound directions, respectively. A median refuge lane is not delineated on the north leg of Kuhio Highway at the Kapa`a Bypass Road. However, the striped median provide sufficient refuge space for one vehicle turning left from the Kapa`a Bypass Road.

South of the Kapa`a Bypass Road, the center northbound lane of Kuhio Highway is coned to provide a southbound contra-flow lane, during the AM peak period of weekday traffic, resulting in two lanes in the southbound direction and one lane in the northbound direction. During the field investigation, the contra-flow operation occurred from 5:45 AM to 10:30 AM. The contra-flow lane provides a “free” right-turn movement from the Kapa`a Bypass Road onto southbound Kuhio Highway, during the AM peak period of weekday traffic.

Olohena Road is a two-way, two-lane collector roadway with a posted speed limit of 25 mph. The posted speed limit on Olohena Road is reduced to 15 mph as it approaches Kapa`a Middle School. Olohena Road intersects the Kapa`a Bypass Road at a single-lane roundabout. Makai of Lehua Street, Olohena Road continues as Kukui Street to Kuhio Highway.

Kaapuni Road is a two-way, two-lane, collector road which intersects Olohena Road at a stop-controlled, skewed Tee-intersection. The Kaapuni Road approach has a limited sight distance to the right, due to the vertical alignment of the mauka leg of Olohena Road. Immediately mauka of Olohena Road, the two-way, two-lane Kaehulua Road intersects Kaapuni Road at a stop-controlled, skewed Tee-intersection.

Kukui Street is a two-way, two-lane roadway between Kuhio Highway and Ulu Street with a posted speed limit of 15 mph. Kukui Street is signalized at its intersection with Kuhio Highway with a shared left-turn lane and exclusive right-turn lane.

Ulu Street is a two-way, two-lane local street between Kukui Street and Ohia Street. South of Ohia Street, Ulu Street becomes a one-lane, one-way southbound roadway to Kuhio Highway. Ohia Street is a local street, which intersects Ulu Street and Kuhio Highway at stop-controlled intersections. Exclusive left-turn lanes are provided in both directions on Kuhio Highway at Ohia Street/Pono Kai Driveway. Ulu Street provides an alternate route to the south between Kuhio Highway and Kukui Street.

Lehua Street is a two-way, two-lane local street between Olohena Road and Kuhio Highway. Lehua Street intersects Olohena Road at a stop-controlled Tee-intersection. Lehua Street intersects Kuhio Highway at a stop-controlled, channelized Tee-intersection. Lehua Street provides an alternate route to the north between Kuhio Highway and Olohena Road.

Kahau Street is a two-way, two-lane cul-de-sac street. Kahau Street intersects Olohena Road at a stop-controlled Tee-intersection, immediately mauka of Lehua Street.

B. Public Transit

The Kauai County Transportation Agency operates a public bus service in the region with a stop on Olohena Road at the Kapa`a New Town Park, between the Kapa`a Bypass Road and Kahau Street. The Kauai bus service also stops at Kapa`a Middle School. On Kuhio Highway, the Kauai Bus service stops at Lehua Street, at Ohia Street, and at the Coconut Marketplace near the Kapa`a Bypass Road (South Junction). The Kauai Bus service is provided at hourly intervals Monday through Friday from 6 AM to 9 PM and on weekends and holidays every two hours from 8 AM to 5 PM.

C. Existing Peak Hour Traffic Volumes and Operating Conditions

1. Field Investigation and Data Collection

Turning movement traffic count surveys were conducted at the following intersections in the study area, during the week of March 13, 2017:

a. Kapa`a Bypass Road and Olohena Road

b. Olohena Road and Kaapuni Road

c. Kaapuni Road and Kaehulua Road

d. Kuhio Highway and Kukui Street

e. Kuhio Highway and Kapa`a Bypass Road (South Junction)

f. Kuhio Highway and Lehua Street

g. Olohena Road and Lehua Street
h. Olohena Road and Kahau Street
i. Kukui Street and Ulu Street
j. Ulu Street and Ohia Street
k. Kuhio Highway and Ohia Street/Pono Kai Driveway
l. Kuhio Highway and Ulu Street

Each intersection was surveyed during the peak periods of traffic over a two-day period. On March 14, 2017, a stalled vehicle partially blocked the circulatory roadway of the roundabout intersection of Olohena Road and the Kapa`a Bypass Road from 3:00 PM to 4:00 PM. The blockage limited traffic flows, and this data were excluded from the analysis. Otherwise, the higher peak hour volumes on the survey days at each study intersection were selected for the analysis to establish the existing conditions. The peak hours of traffic varied from intersection to intersection and from day to day.

2. Existing AM Peak Hour Traffic

The existing AM peak hour of traffic in the study area generally occurred from 7:15 AM to 8:15 AM. Table 2 summarizes the changes in the AM peak hour traffic between the DEIS traffic study and the existing AM peak hour traffic data.

Table 2. AM Peak Hour Traffic Comparison

Study Intersection	Intersection Volumes (vph)		Increase (+) Decrease (-)
	2012-2013	2017	
Olohena Road/Kapa`a Bypass Road	1,447	1,628	+181
Kuhio Highway/Kukui Street	1,441	1,410	-31
Kuhio Hwy/Kapa`a Bypass Road	1,990	2,111	+121

In Kapa`a Town, Kuhio Highway carried about 1,400 vehicles per hour (vph), total for both directions, during the AM peak hour of traffic. South of Ulu Street, Kuhio Highway carried over 1,750 vph, total for both directions. The Kapa`a Bypass Road carried about 800 vph, total for both directions, south of Olohena Road. Mauka of the Kapa`a Bypass Road, Olohena Road carried about 1,000 vph, total for both directions. South of the Kapa`a Bypass Road (South Junction), Kuhio Highway carried about 2,100 vph.

The traffic signal timing cycle lengths at the intersection of Kuhio Highway and Kukui Street resulted in long delays on Kukui Street. Makai bound traffic on Olohena Road and Kukui Street were diverted to alternate routes to Kuhio Highway. About 54 percent of makai bound traffic on Olohena Road turned left onto Lehua Street to continue in the northbound direction. About 33 percent of makai bound traffic turned right onto Ulu Street to continue in the southbound direction. The remaining 13 percent of the makai bound traffic on Olohena Road continued onto Kukui Street to Kuhio Highway.

During the existing AM peak hour of traffic, the overall intersection of Kuhio Highway and Kukui Street operated at LOS “A”. However, the left-turn movement on makai bound Kukui Street operated at LOS “F”, with a relatively low traffic demand (32 vph). All the traffic movements in both directions on Kuhio Highway operated at LOS “A” at Kukui Street, during the existing AM peak hour of traffic.

The left-turn movement on makai bound Lehua Street operated at LOS “E” at Kuhio Highway, during the existing AM peak hour of traffic. Makai bound Ohia Street also operated at LOS “E” at Kuhio Highway at a very low volume.

Makai bound Olohena Road operated at LOS “D” at the Kapa`a Bypass Road. Kaapuni Road operated at LOS “D” at Olohena Road. The other intersections in the study area operated at satisfactory Levels of Service, i.e., LOS “C” or better, during the existing AM peak hour of traffic. Figures 3 and 4 depict the existing AM peak hour traffic data.

3. Existing PM Peak Hour Traffic

The existing PM peak hour of traffic in the study area varied between the hours of 3:00 PM and 6:00 PM. Table 3 summarizes the changes in the PM peak hour traffic between the DEIS traffic study and the existing (2017) PM peak hour traffic data.

Table 3. PM Peak Hour Traffic Comparison

Study Intersection	Intersection Volumes (vph)		Increase (+) Decrease (-)
	2012-2013	2017	
Olohena Rd/Kapa`a Bypass Rd	1,459	1,787	+328
Kuhio Hwy/Kukui St	1,370	1,295	-75
Kuhio Hwy/Kapa`a Bypass Rd	2,176	2,235	+62

During the existing PM peak hour of traffic, Kuhio Highway carried about 1,200 vph, total for both directions in Kapa`a Town. South of Ulu Street, Kuhio Highway carried over 1,500 vph, total for both directions. The Kapa`a Bypass Road carried over 1,000 vph, total for both directions, south of Olohena Road. Mauka of the Kapa`a Bypass Road, Olohena Road carried about 1,000 vph, total for both directions. Kuhio Highway carried over 2,100 vph, total for both directions, south of the Kapa`a Bypass Road.

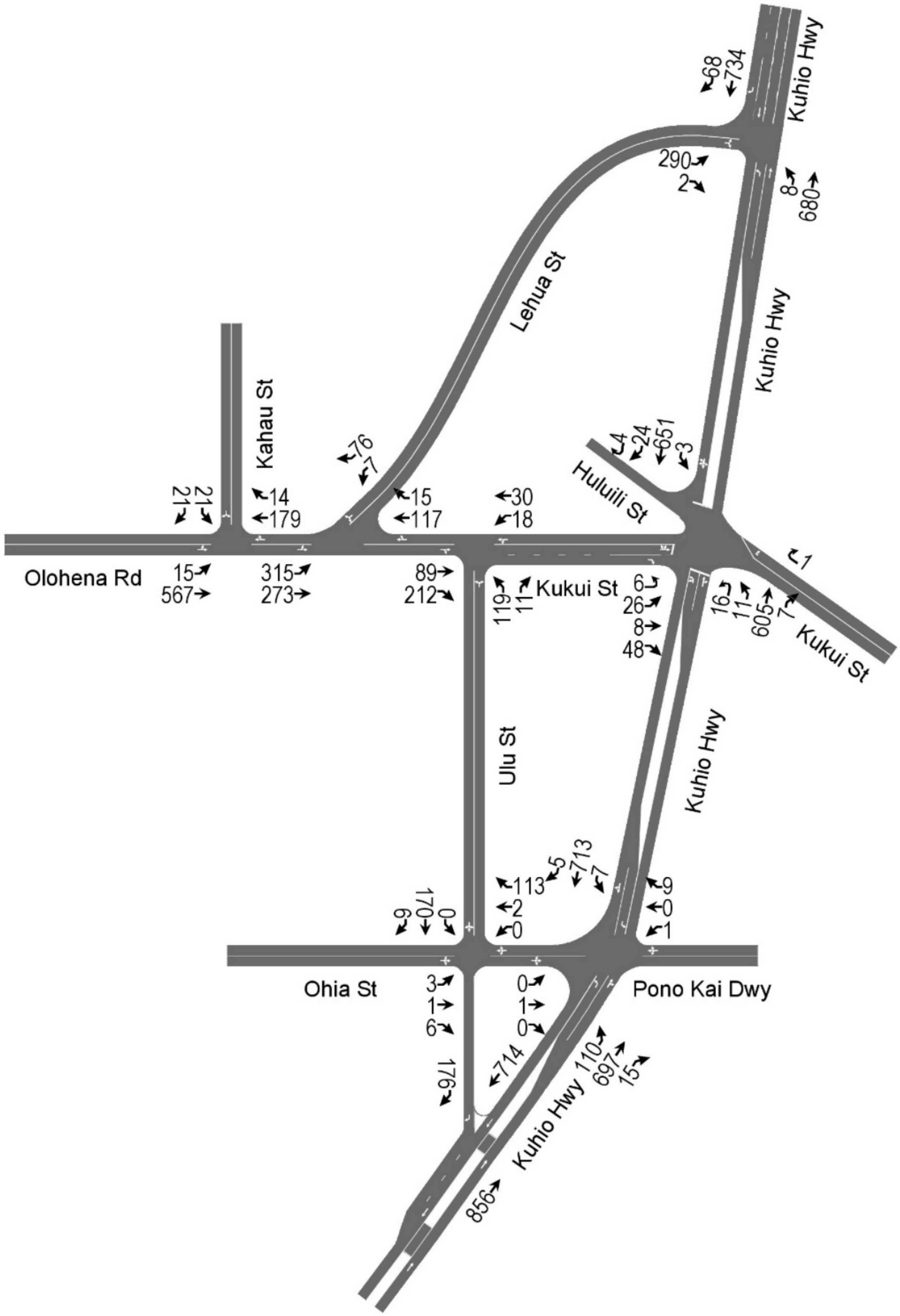


Figure 3. Existing AM Peak Hour Traffic

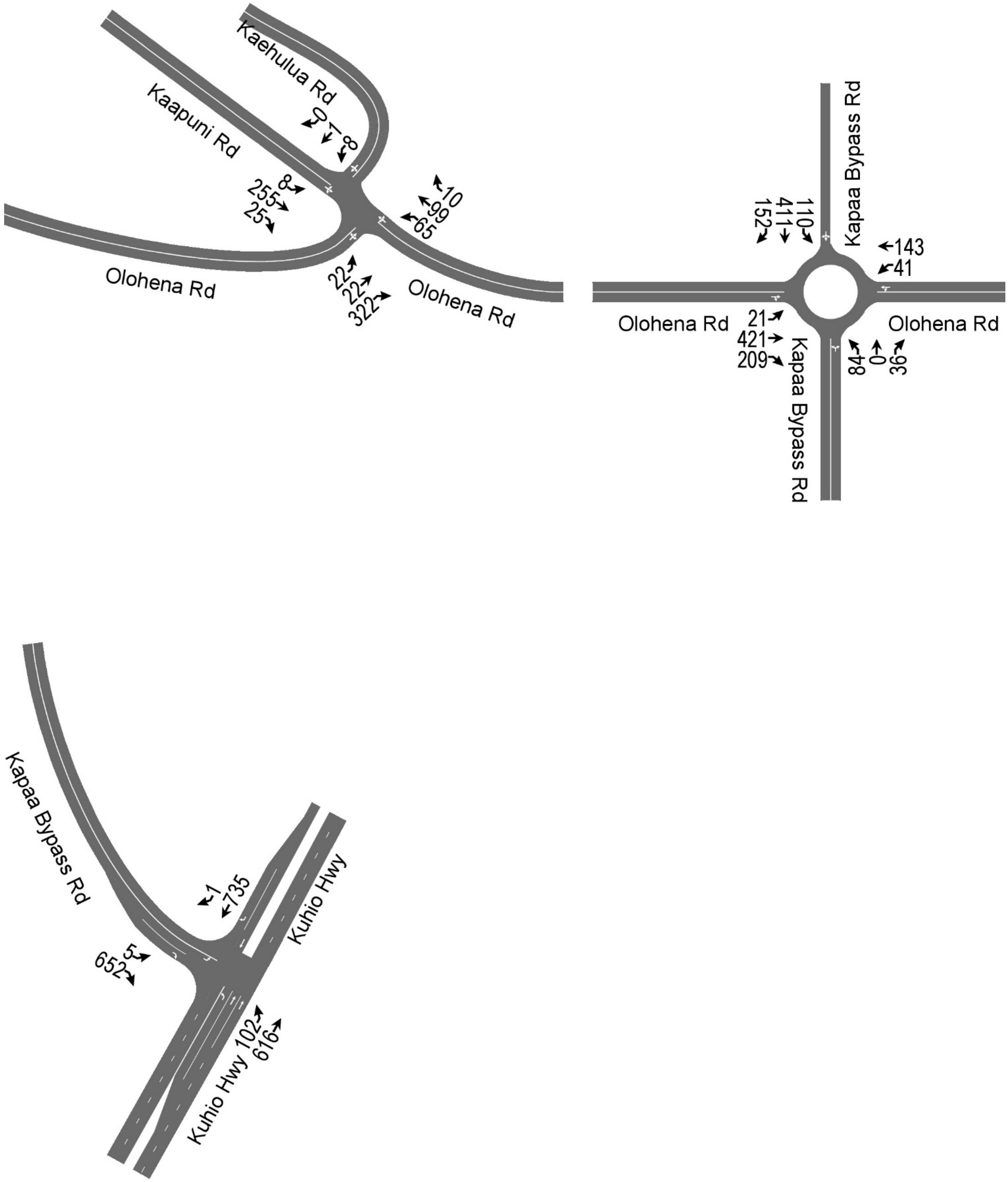


Figure 4. Existing AM Peak Hour Traffic (Cont'd.)

The northbound and southbound traffic on Kuhio Highway avoided the traffic signal delays at Kukui Street by diverting to alternate routes to Olohena Road. Less than 10 percent of the mauka bound traffic on Olohena Road at the Kapa`a Bypass Road turned from Kuhio Highway via Kukui Street. About 35 percent of the mauka bound traffic on Olohena Road turned right from Lehua Street to continue in the mauka bound direction, during the existing PM peak hour of traffic. About 55 percent of the mauka bound traffic turned left from Ulu Street onto Kukui Street to continue in the mauka bound direction on Olohena Road.

The overall intersection of Kuhio Highway and Kukui Street operated at LOS "A", during the existing PM peak hour of traffic. The left-turn movement on makai bound Kukui Street operated at LOS "E" with a relatively low traffic demand (36 vph). The other traffic movements at the intersection operated at LOS "A", during the existing PM peak hour of traffic.

The left-turn movement on makai bound Lehua Street operated at LOS "D" at Kuhio Highway, during the existing PM peak hour of traffic. Makai bound Ohia Street operated at LOS "F" at Kuhio Highway with a very low volume. The mauka bound Pono Kai Driveway operated at LOS "D", also with a very low volume.

Southbound Lehua Street operated at LOS "E" at Olohena Road, during the existing PM peak hour of traffic. Southbound Kapa`a Bypass Road operated at LOS "D" at Olohena Road. The other intersections in the study area operated at satisfactory Levels of Service, during the existing PM peak hour of traffic. The existing PM peak hour traffic data are depicted on Figures 5 and 6.

III. Future Traffic Conditions

A. Background Growth in Traffic

The Kauai Long-Range Land Transportation Plan (KLRLTP) was prepared by the State of Hawaii Department of Transportation (DOT), in cooperation with the Kauai County Department of Public Works and Planning Department. The KLRLTP developed long-range travel forecasts for the island of Kauai. The KLRLTP anticipated that traffic in the Kapa`a area would increase by over 30 percent between the Base Year 2007 and the Horizon Year 2035. For the purpose of this analysis, an average growth factor of 1.14 was uniformly applied to the existing (Year 2017) AM and PM peak hour traffic volumes to estimate the Year 2030 peak hour traffic without the proposed project.

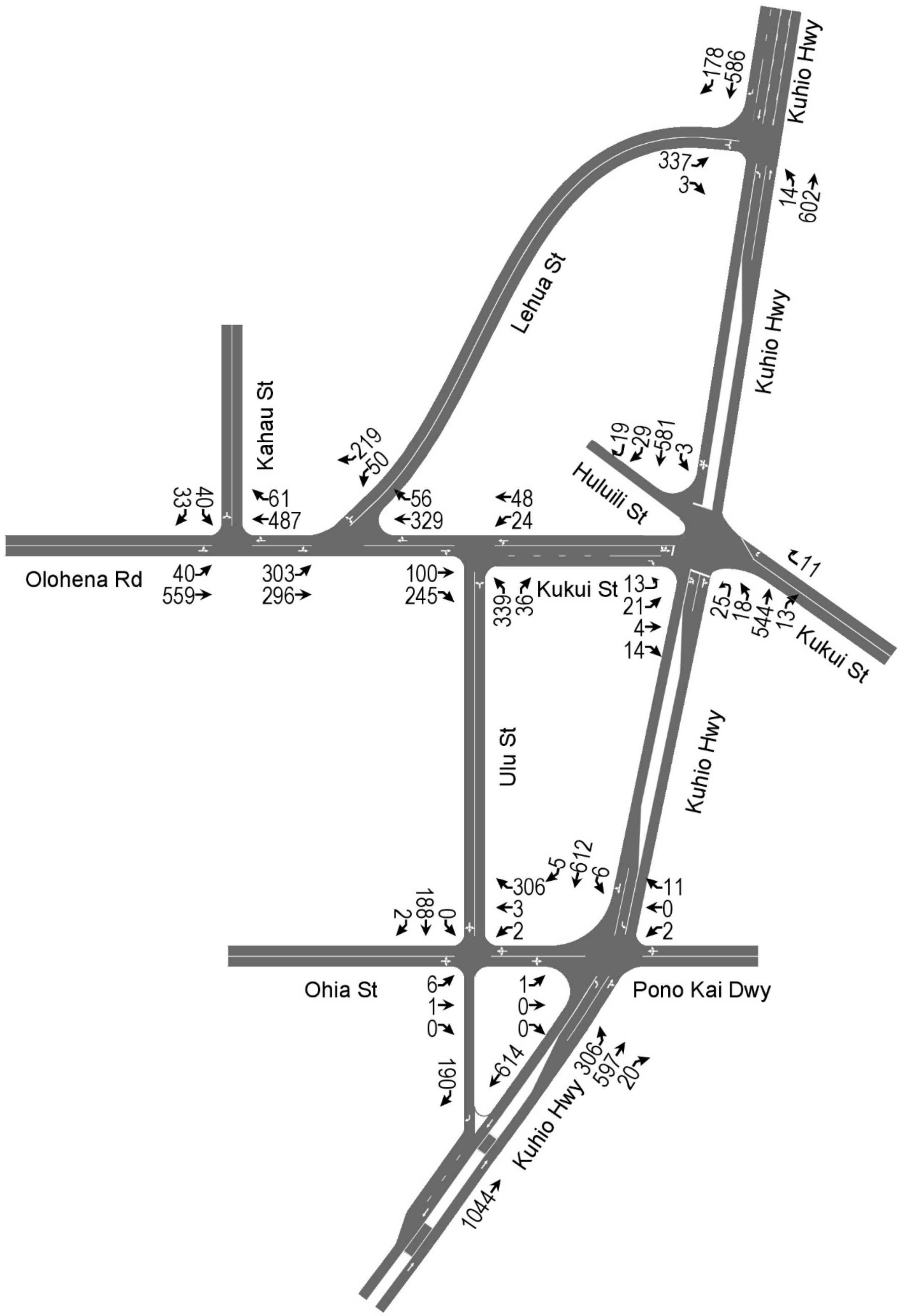


Figure 5. Existing PM Peak Hour Traffic

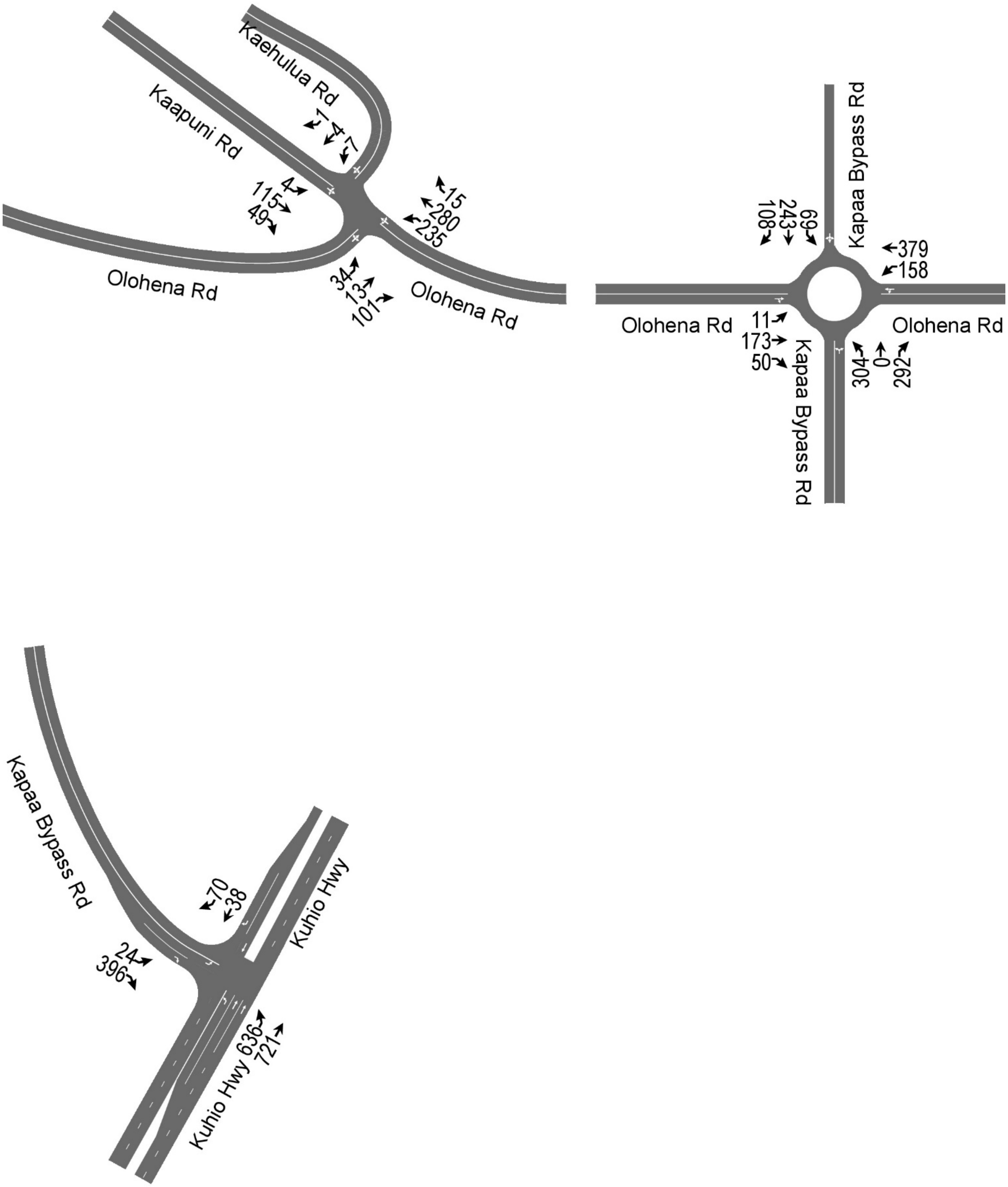


Figure 6. Existing PM Peak Hour Traffic (Cont'd.)

B. Daily and Seasonal Adjustment Factors

The existing peak hour traffic data were adjusted for the daily and seasonal variation in traffic in the region. The adjustment factors were based upon the 2016 traffic count data, which were collected at DOT's continuous traffic count station at Mile Post 2.4 on Kuhio Highway (Route 56) in Hanamaulu, which is located about 6 miles south of Kapa`a Town. Table 4 summarizes the adjustment factors, which were applied to the existing AM and PM peak hour traffic data, to account for the daily and seasonal variation in traffic from the annual average weekday traffic (AAWDT).

Table 4. Day of the Week and Seasonal Adjustment Factors

Date	Day	24-Hour Data	Adjustment Factors
3/14/2016	Monday	15,881	1.03
3/15/2016	Tuesday	15,824	1.03
3/16/2016	Wednesday	16,611	0.98
3/17/2016	Thursday	16,467	0.99
3/18/2016	Friday	16,652	0.98
	2016 AAWDT	16,301	1.00

C. Kuhio Highway Widening

The Final Environmental Assessment Kuhio Highway Short-Term Improvements Kuamoo Road to Temporary Bypass Road (Kuhio Highway EA), was prepared for DOT, by Wilson Okamoto Corporation, dated September 2009. The Kuhio Highway EA recommended the widening of Kuhio Highway from three lanes to four lanes to provide a permanent second southbound lane between the Kapa`a Bypass Road and Kuamoo Road. The additional lane will provide a "free" right-turn movement from the Kapa`a Bypass Road onto southbound Kuhio Highway throughout the day.

DOT is planning to complete the widening of Kuhio Highway by the Year 2019. The widening of Kuhio Highway from the Kapa`a Bypass Road to Kuamoo Road is included in this traffic impact analysis.

D. Kapa`a Transportation Solutions

The Kapa`a Transportation Solutions (KTS) was prepared for the State Department of Transportation, dated August 2015. The KTS was prepared for DOT in cooperation with the Kauai County Department of Public Works, Planning Department, and Transportation Agency, and the Federal Highways Administration. The KTS included input from the Kapa`a Citizens Advisory Committee, which is comprised of the Kapa`a Business Association, Kapa`a High School and Middle School, Wailua-Kapa`a Neighborhood Association, Kauai Visitors and Convention Bureau, and Kauai Path.

The KTS cited traffic congestion in the downtown/historic district of Kapa`a Town, which resulted from on-street parking in the curb lanes in both directions on Kuhio Highway. In addition, to the delays caused by vehicles maneuvering into and out of the parallel parking stalls along Kuhio Highway, the on-street parking occupies valuable highway space, which could otherwise provide additional through traffic lanes and/or median left-turn lanes. Table 5 summarizes the roadway improvements relevant to this traffic study, which were prioritized in the Kapa`a Transportation Solutions.

Table 5. Potential Traffic Solutions

Location	Description	Priority
Kapa`a Bypass Road	Widen the Kapa`a Bypass Road to provide one lane in the northbound direction from Olohena Road to Kuhio Highway.	<5 Years
Kuhio Highway and Kukui Street	Modify traffic signal timings.	<5 Years
Kuhio Hwy and Kapa`a Bypass Road	Intersection improvements.	<5 Years
Olohena Road at Kapa`a Middle School	Improve crosswalk.	<5 Years
Kapa`a Bypass Road and Olohena Road Roundabout	Add a separate (bypass) right-turn lane at the roundabout from makai bound Olohena Road to southbound Kapa`a Bypass Road.	<5 Years
Kuhio Highway	Provide an additional southbound lane on Kuhio Highway from Kapa`a Bypass Road to Kuamoo Road (scheduled for construction).	<5 Years
Kuhio Highway and Kukui Street	Close the makai leg of Kukui Street to provide business parking. Implement vehicular and pedestrian improvements on Kukui Street (mauka leg) and Huluili Street at Kuhio Highway.	5-10 Years
Kapa`a New Town Park	Provide direct access from the Kapa`a New Town Park to the Kapa`a Bypass Road.	5-10 Years
Kuhio Highway and Lehua Street	Improve the left-turn movement from Lehua Street onto Kuhio Highway.	5-10 Years
Kapa`a Bypass Rd and Kuhio Highway	Re-align the Kapa`a Bypass Road (South Junction) to intersect Kuhio Highway opposite Aleka Loop or Papaloa Road.	5-10 Years

Table 5. Potential Traffic Solutions (Cont'd.)		
Location	**Description**	**Priority**
Kapa`a Bypass Road South of Olohena Road	Improve the horizontal alignment and shoulders of the Kapa`a Bypass Road, south of Olohena Road, to Kuhio Highway.	5-10 Years
Kuhio Highway Between Kawaihau Road and Lehua Street	Provide a two-way median left-turn lane along Kuhio Highway.	5-10 Years
Olohena Rd at Kahau St and Lehua St	Implement intersection improvements and bicycle/pedestrian improvements to Kuhio Highway.	5-10 Years
Olohena Rd at Kaapuni Rd and Kaehulua Rd	Implement intersection improvements	5-10 Years
Kaapuni Road	Upgrade/improve Kaapuni Road to major collector standards, including bicycle lanes.	5-10 Years
Olohena Road Between Kuhio Highway and Kamalu Road	Improve Olohena Road to accommodate non-motorized modes.	5-10 Years
Kapa`a Bus Hub	Relocate the Kapa`a bus hub from its existing location near the skate park to a new location on or near the Kuhio Highway mainline, with amenities.	5-10 Years

Improving the horizontal alignment and providing shoulders on the Kapa`a Bypass Road, south of Olohena Road may impact the proposed Hokua Place frontage. Any widening and realignment should be coordinated with Hokua Place. The Kapa`a Transportation Solutions also identifies Road A as a new connector road between Olohena Road and the Kapa`a Bypass Road, which was prioritized beyond the 10-year time frame. The construction cost of the connector road was estimated at $25,824,000.

E. Peak Hour Traffic Analysis Without Project

1. AM Peak Hour Traffic Without Project

During the AM peak hour of traffic without the proposed project, the overall intersection of Kuhio Highway and Kukui Street is expected to continue to operate at LOS "A". The left-turn movement on makai bound Kukui Street is expected to continue to operate at LOS "F". The traffic movements in both directions on Kuhio Highway are expected to continue to operate at LOS "A" at Kukui Street, during the AM peak hour of traffic without the proposed project.

Makai bound Lehua Street is expected to operate at LOS “F” at Kuhio Highway, during the AM peak hour of traffic without the proposed project. Makai bound Ohia Street is expected to operate at LOS “E” at Kuhio Highway.

During the AM peak hour of traffic without the proposed project, makai bound Olohena Road is expected to operate at LOS “F” at the Kapa`a Bypass Road. Southbound Kapa`a Bypass Road is expected to operate at LOS “D” at Olohena Road. Kaapuni Road is expected to operate at LOS “F” at Olohena Road. The other intersections in the study area are expected to operate at satisfactory Levels of Service, during the AM peak hour of traffic without the proposed project. Figures 7 and 8 depict the AM peak hour volumes without the proposed project.

2. PM Peak Hour Traffic Without Project

The overall intersection of Kuhio Highway and Kukui Street is expected to operate at LOS “A”, during the PM peak hour of traffic without the proposed project. The left-turn movement on makai bound Kukui Street is expected to continue to operate at LOS “E”. The other traffic movements at the intersection are expected to operate at LOS “A”, during the PM peak hour of traffic without the proposed project.

The left-turn movement on makai bound Lehua Street is expected to operate at LOS “E” at Kuhio Highway, during the PM peak hour of traffic without the proposed project. Makai bound Ohia Street also is expected to operate at LOS “F” at Kuhio Highway. Mauka bound Pono Kai Driveway is expected to operate at LOS “E”, during the PM peak hour of traffic without the proposed project.

Southbound Lehua Street is expected to continue to operate at LOS “F” at Olohena Road, during the PM peak hour of traffic without the proposed project. Southbound Kapa`a Bypass Road is expected to operate at LOS “F” at Olohena Road. The right-turn movement from the Kapa`a Bypass Road onto Kuhio Highway is expected to operate LOS “D”. The other intersections in the study area are expected to operate at satisfactory Levels of Service, during the PM peak hour of traffic without the proposed project.

The PM peak hour traffic demands at the intersection of Olohena Road and Kaapuni Road without the proposed project are expected to meet the AASHTO guideline for an exclusive left-turn lane on makai bound Olohena Road. The PM peak hour volumes without the proposed project is depicted on Figures 9 and 10.

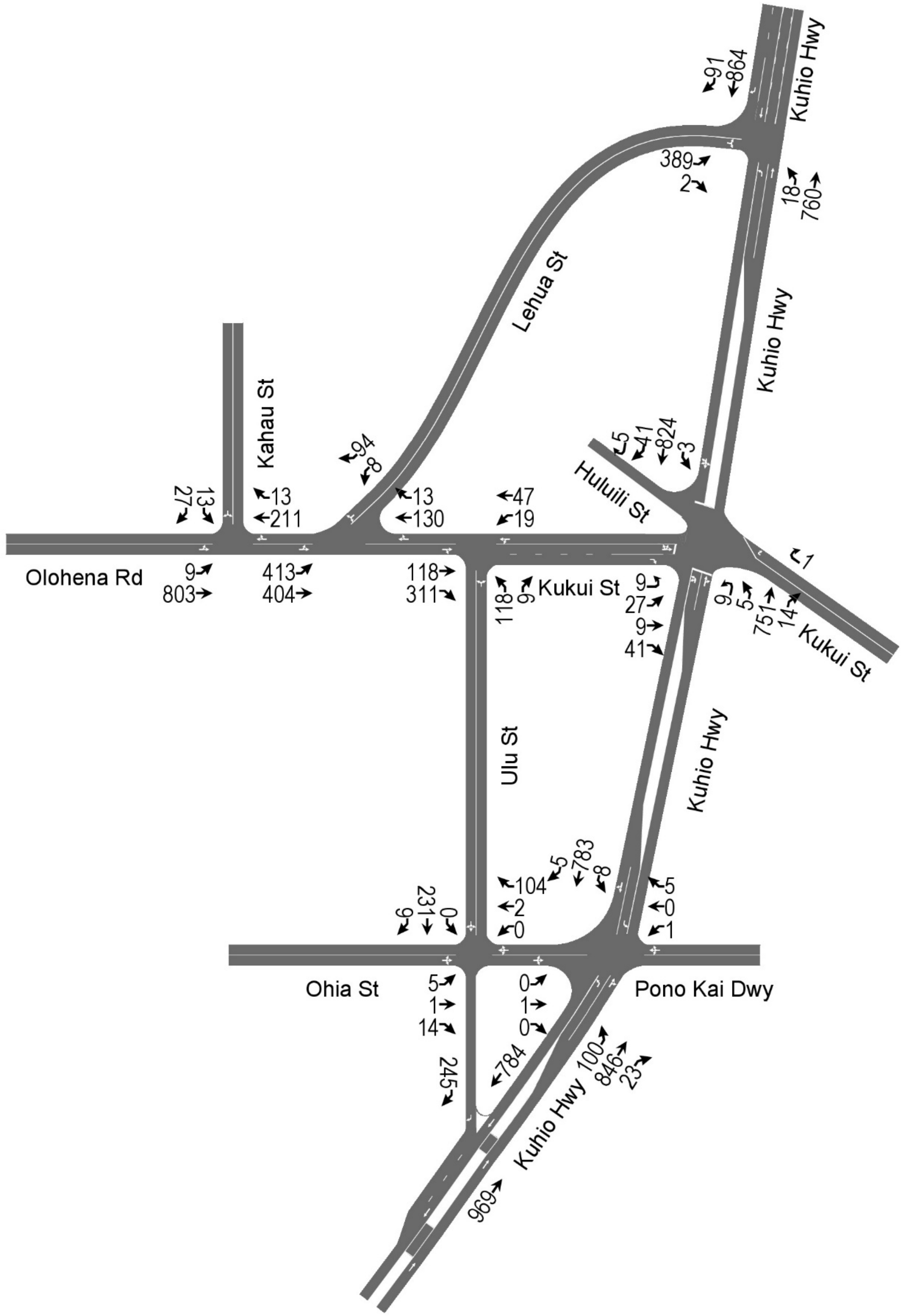


Figure 7. AM Peak Hour Volumes Without Project

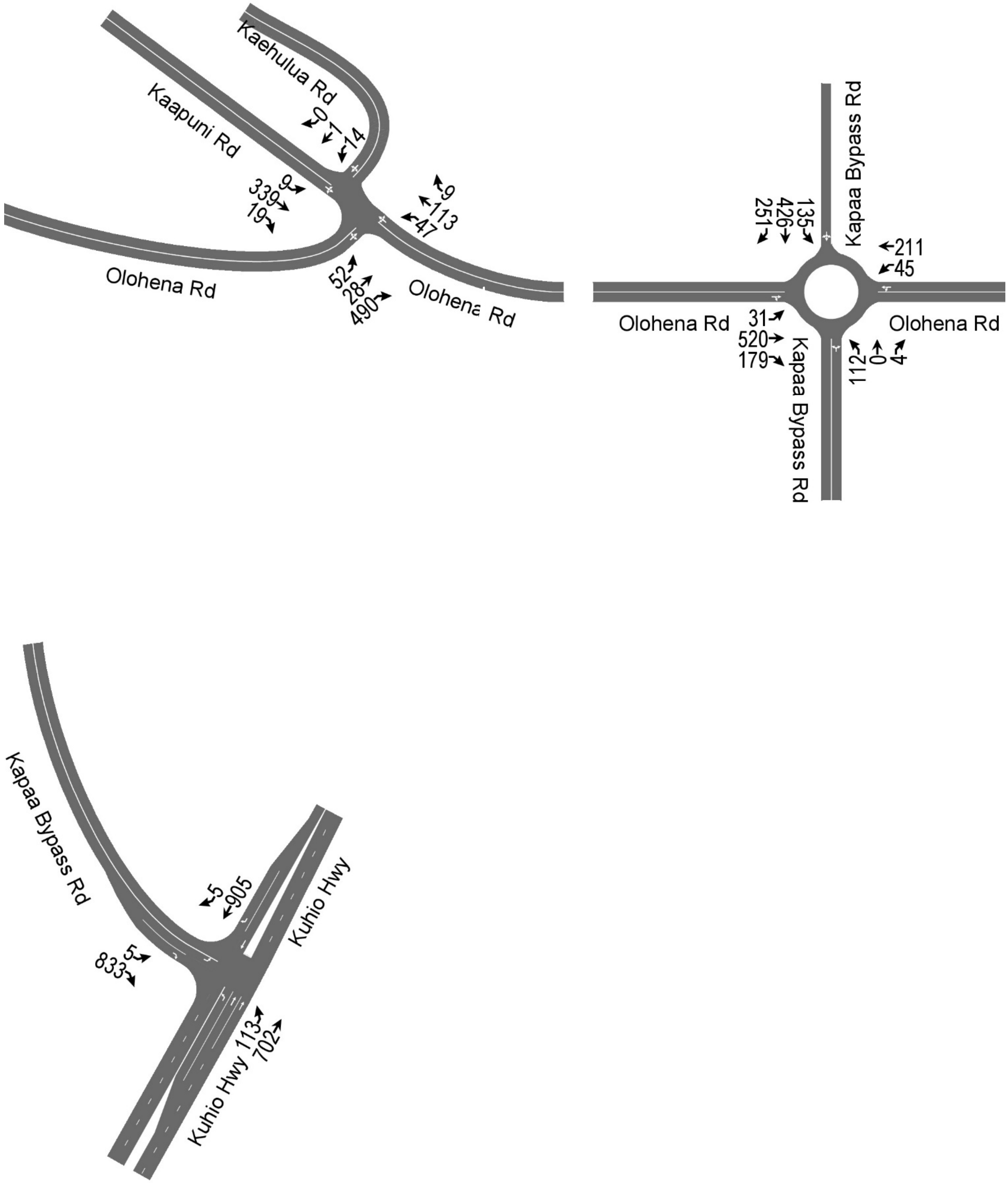


Figure 8. AM Peak Hour Volumes Without Project (Cont'd.)

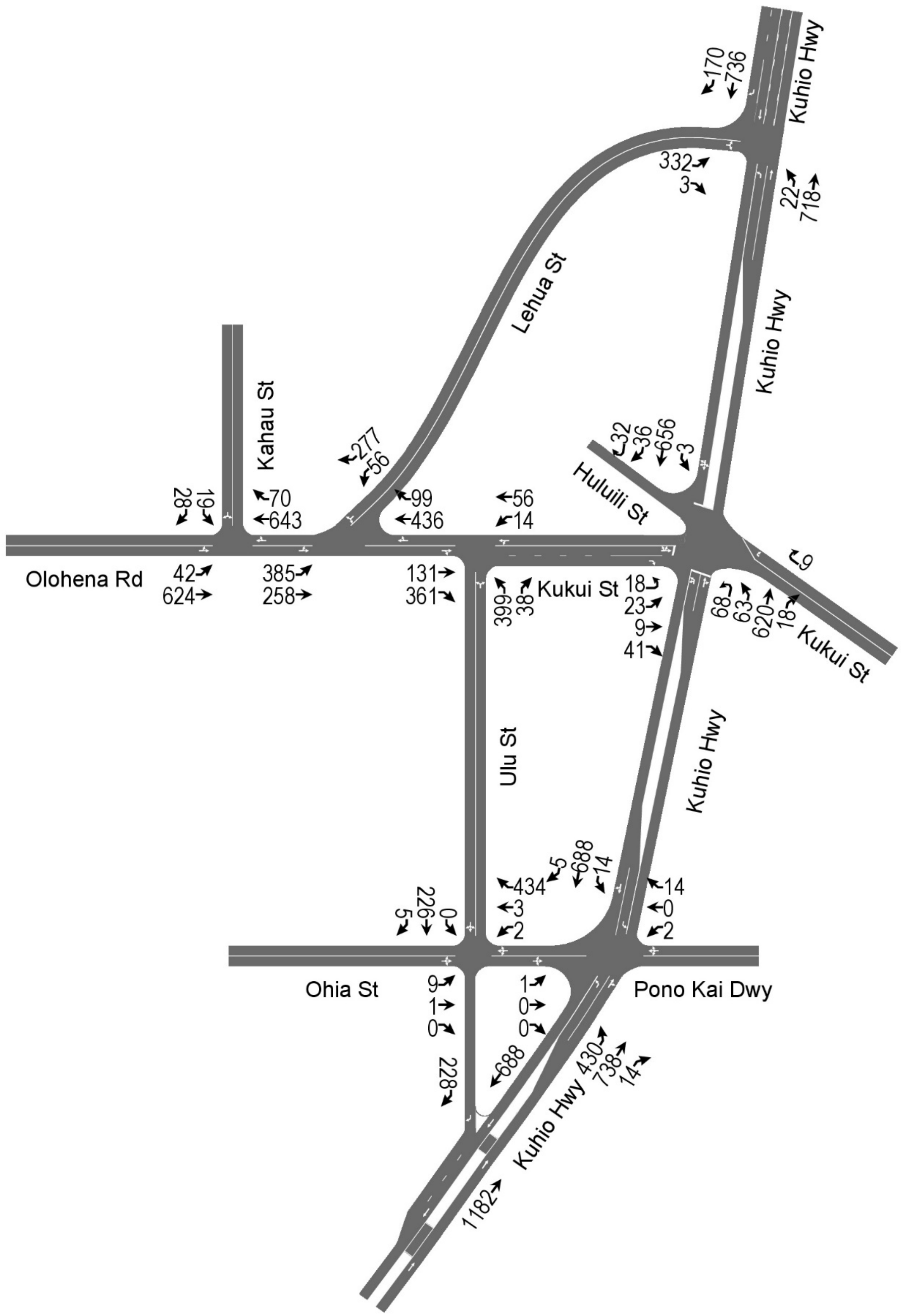


Figure 9. PM Peak Hour Volumes Without Project

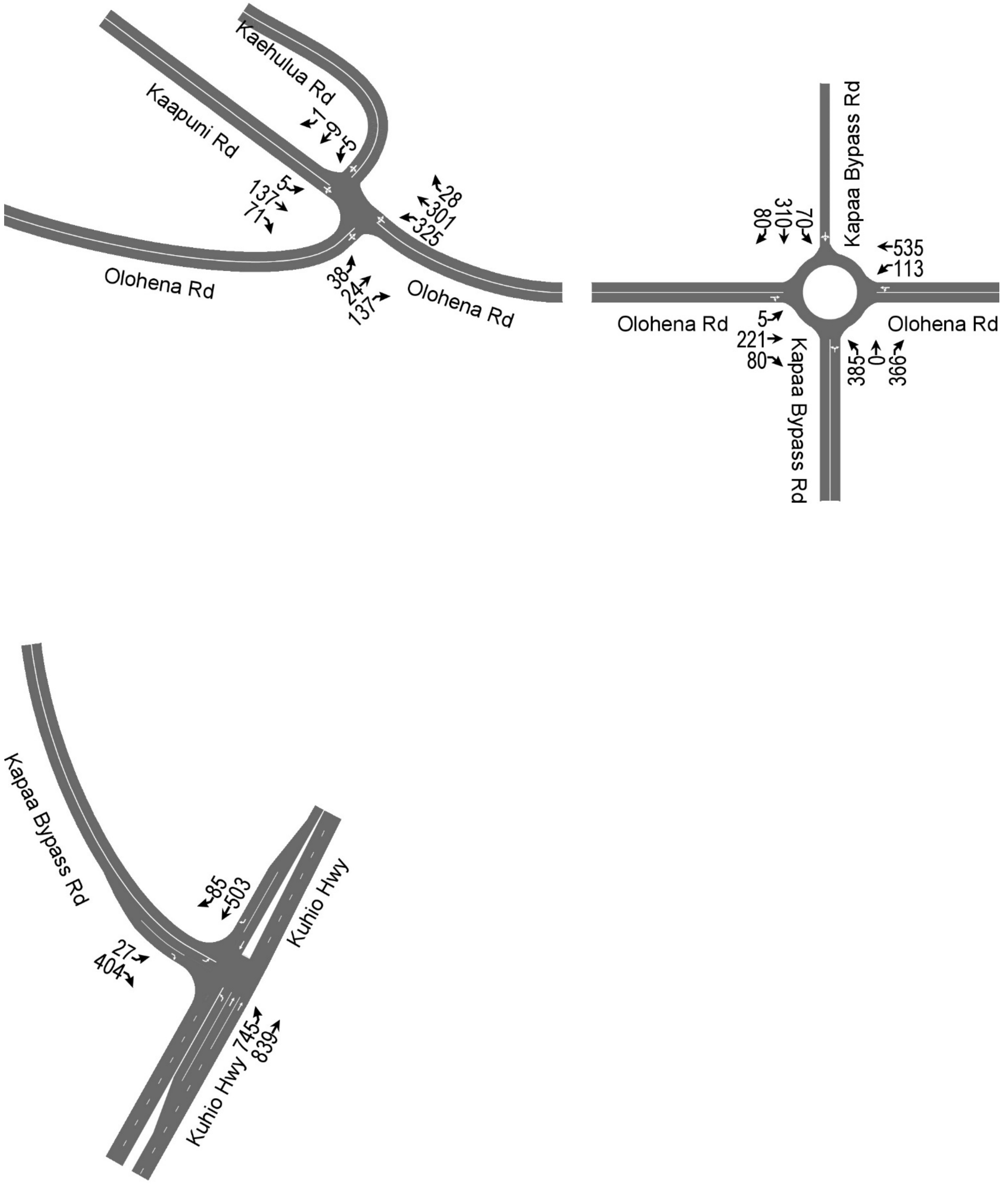


Figure 10. PM Peak Hour Volumes Without Project (Cont'd.)

IV. Traffic Impact Analysis

A. Trip Generation Characteristics

The trip generation characteristics were based upon the ITE trip rates for single-family detached dwelling units (DU) and residential condominium/townhouse units. The weekday ITE trip rates, during the AM peak hour and the PM peak hour of adjacent street traffic, were used for this traffic impact analysis. The ITE regression equations were used to derive the trip rates for the single-family detached dwellings in this analysis. Although ITE recommends the use of the regression equations to derive trip rates, the average peak hour trips rates for the residential condominium/townhouse were used in this analysis. The 800 DU is outside the range of the ITE trip generation data that were utilized to develop the regression equations for condominiums. Furthermore, the average condominium/townhouse rates are higher (more conservative) than the rates that are derived by the regression equations.

The ITE trip generation rates for a shopping center were developed from the regression equations to estimate the trip generation from the proposed 8,000 SFGFA retail center. The pass-by trip rate of 81.2 percent was applied to the PM peak hour trip generation. The ITE pass-by trip rate is reasonable given the size of Hokua Place and the volume of through traffic on Road A. Hokua Place is expected to generate totals of 487 vph and 560 vph, during the AM and PM peak hours of traffic, respectively. The trip generation characteristics for the proposed project are summarized in Table 6.

Table 6. Hokua Place Trip Generation Characteristics

Land Use (ITE Code)	Units	AM Peak Hour (vph)			PM Peak Hour (vph)		
		Enter	Exit	Total	Enter	Exit	Total
Single-Family Phase 1 (265)	16 DU	5	16	21	13	7	20
Single-Family Phase 2 (265)	100 DU	20	60	80	66	38	104
Condominium/ Townhouse (230)	800 DU	60	292	352	279	137	416
Retail Center (820)	8,000 SFGFA	21	13	34	53	57	110
	Pass-By	0	0	0	(-)45	(-)45	(-)90
Total External Trips		**106**	**381**	**487**	**366**	**194**	**560**

B. Site Access Improvements

A conventional channelized, Tee-intersection was considered at the intersection of Road A and the Kapa`a Bypass, with left-turn and right-turn deceleration/storage lanes and a median refuge lane on the Kapa`a Bypass Road. Under unsignalized traffic control, the left-turn lane from Road A onto the Kapa`a Bypass Road is expected to operate at LOS "F", during the PM peak hour of traffic. As an alternative to traffic signalization, a roundabout intersection is recommended Road A and the Kapa`a Bypass Road. The following site access improvements are recommended for the proposed project:

1. Construct a stop-controlled Tee-intersection between Road A and Olohena Road.
2. Construct a stop-controlled Tee-intersection between the Phase 1 Driveway and Olohena Road.
3. Construct a single-lane roundabout at the intersection of Road A and the Kapa`a Bypass Road.

C. Traffic Assignment

The traffic assignments were based upon the existing traffic patterns along Olohena Road and Kukui Street. The traffic assignments also included through traffic demands, which are expected to be diverted from makai bound Olohena Road and from northbound Kapa`a Bypass Road to the proposed Road A. Road A is expected to reduce the traffic demands at the roundabout intersection of the Kapa`a Bypass Road and Olohena Road. Figures 11 and 12 depict the AM peak hour traffic assignments. The PM peak hour traffic assignments are depicted on Figures 13 and 14.

D. AM Peak Hour Traffic Analysis With Project

The roundabout intersection of the Kapa`a Bypass Road and Road A is expected to operate at satisfactory Levels of Service, during the AM peak hour of traffic with the proposed project. Road A is expected to operate at LOS "C" at Olohena Road. The Phase 1 driveway on Olohena Road is expected to operate at LOS "B".

The overall intersection of Kuhio Highway and Kukui Street is expected to continue to operate at LOS "A", during the AM peak hour of traffic with the proposed project. The left-turn movement on makai bound Kukui Street is expected to continue to operate at LOS "F". The traffic movements in both directions on Kuhio Highway are expected to operate at LOS "A" at Kukui Street, during the AM peak hour of traffic with the proposed project.

Makai bound Lehua Street is expected to continue to operate at LOS "F" at Kuhio Highway, during the AM peak hour of traffic with the proposed project. Makai bound Ohia Street also is expected to operate at LOS "F" at Kuhio Highway. The Pono Kai Driveway is expected to operate at LOS "D".

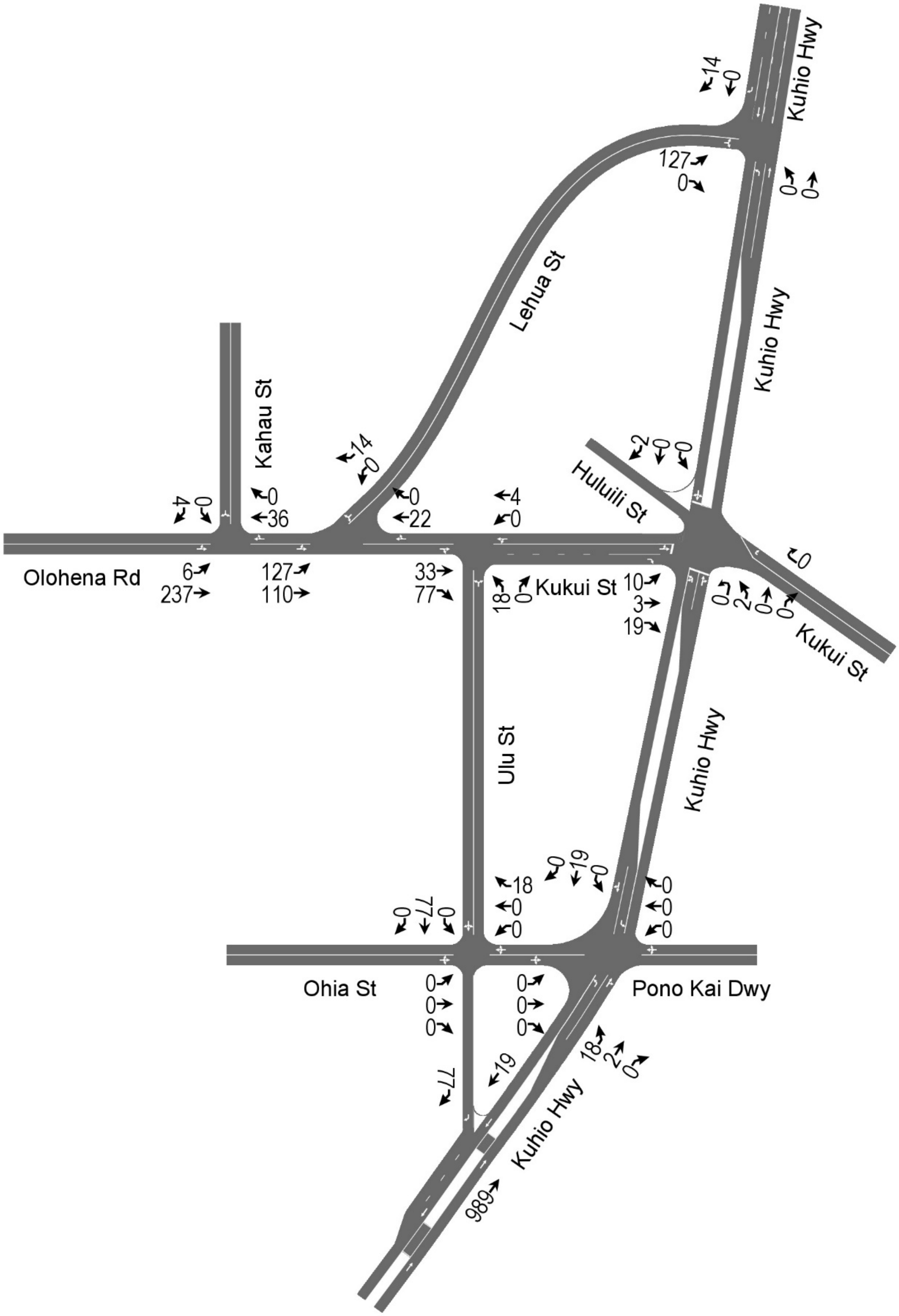


Figure 11. AM Peak Hour Site Traffic Assignment

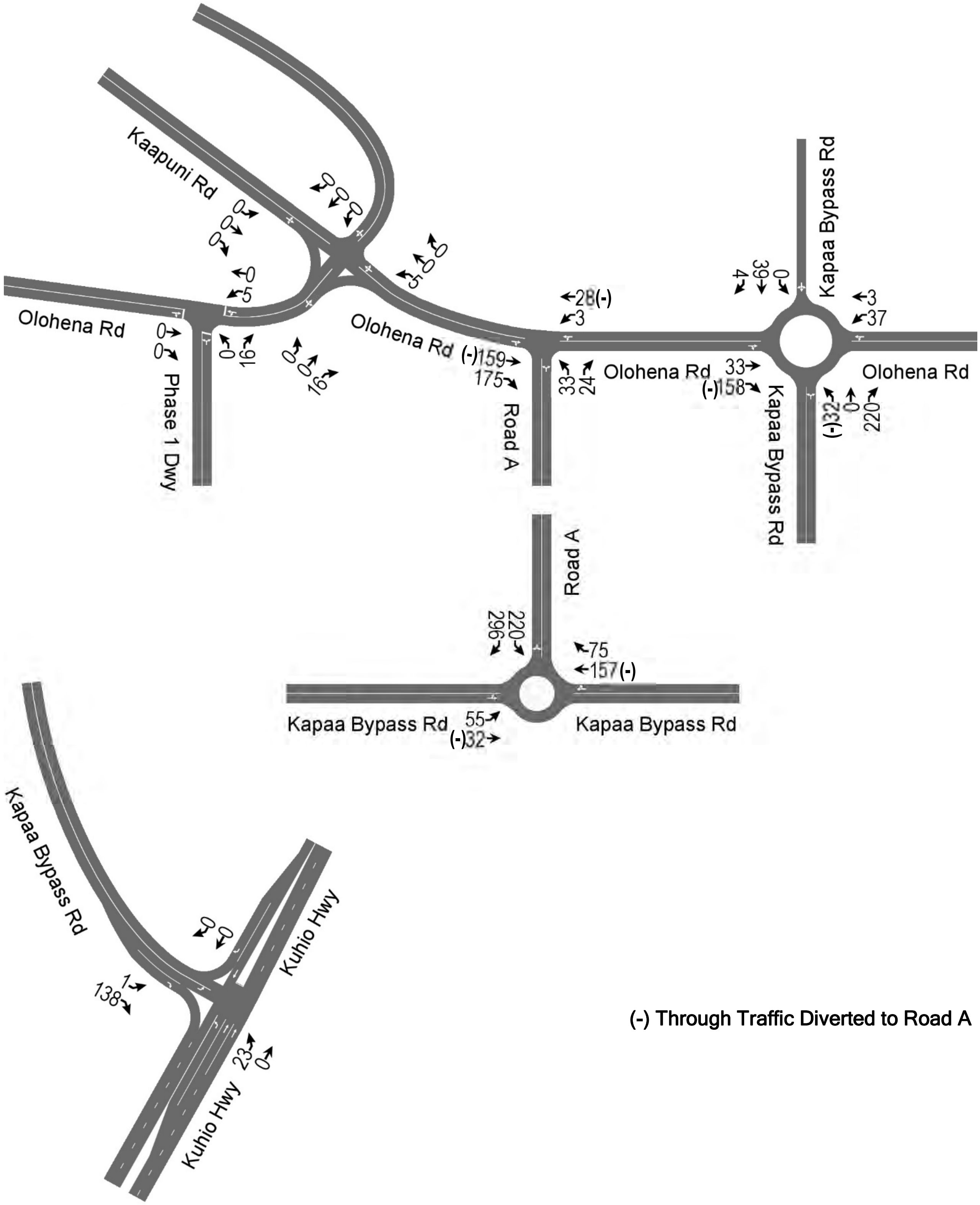


Figure 12. AM Peak Hour Site Traffic Assignment (Cont'd.)

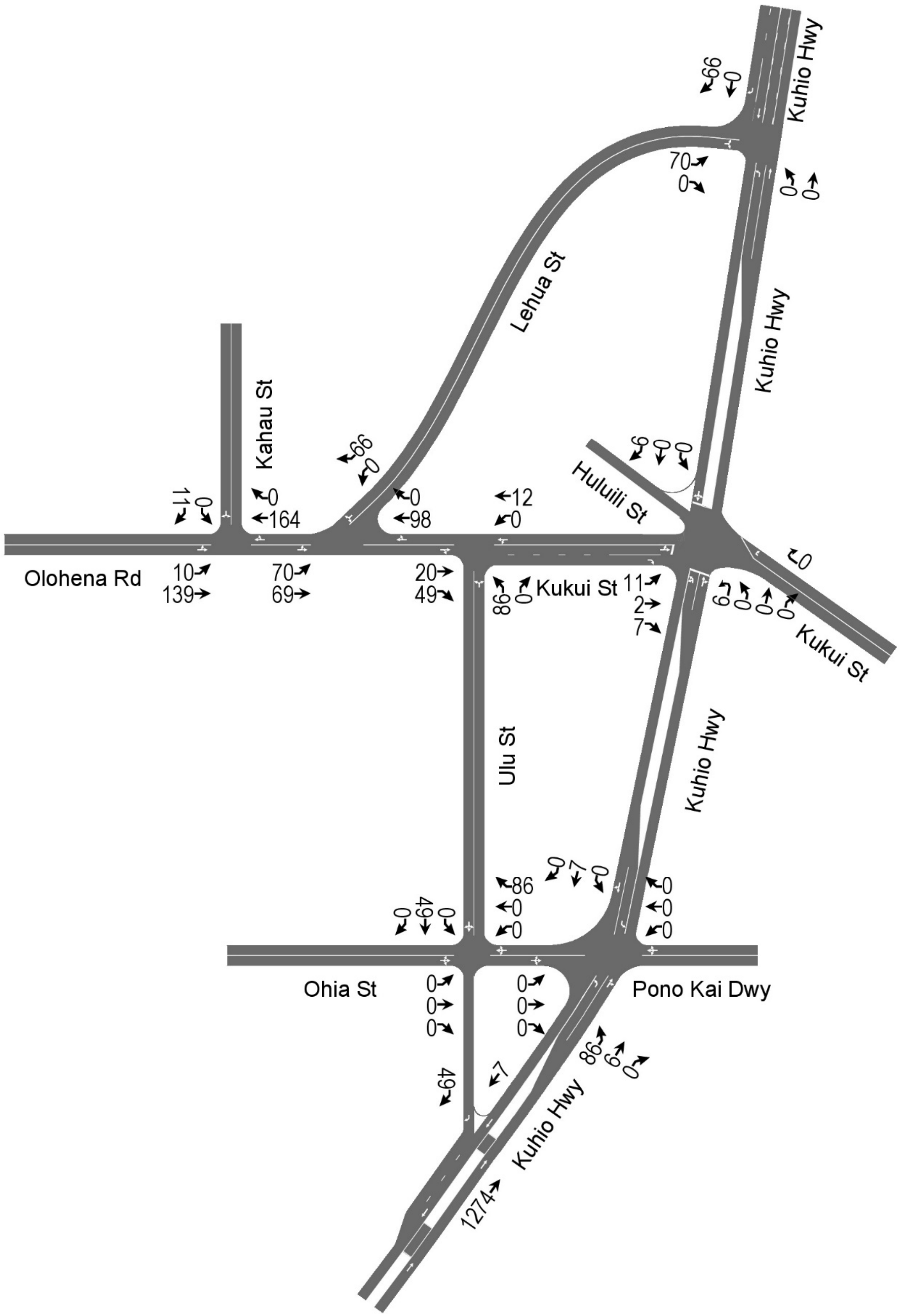


Figure 13. PM Peak Hour Site Traffic Assignment

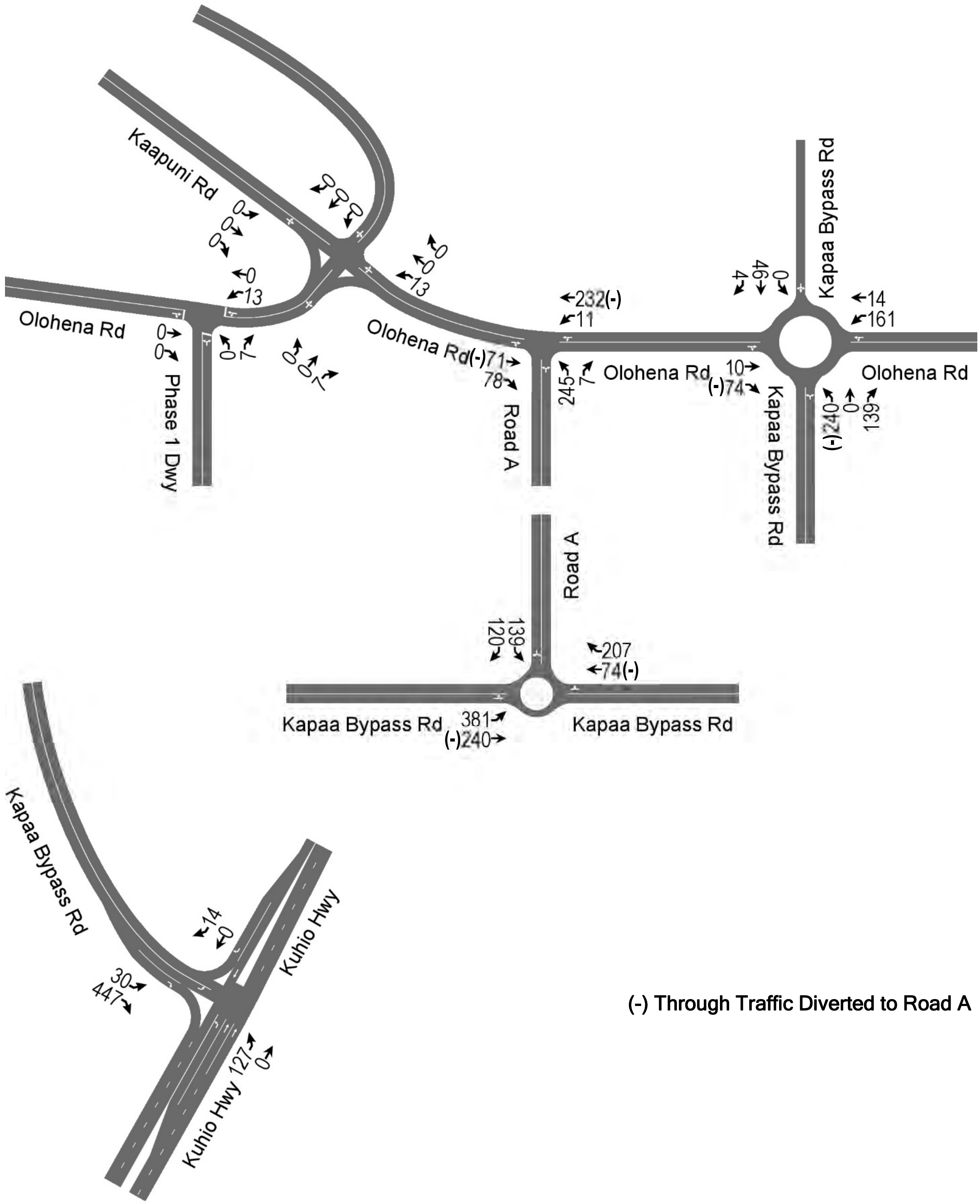


Figure 14. PM Peak Hour Site Traffic Assignment (Cont'd.)

During the AM peak hour of traffic with the proposed project, the overall roundabout intersection of the Kapa`a Bypass Road and Olohena Road is expected to improve from LOS “E” to LOS “D”, during the AM peak hour of traffic with the proposed project. Makai bound Olohena Road is expected to improve from LOS “F” to LOS “E”, due to the diversion of makai bound traffic to Road A. Southbound Kapa`a Bypass Road is expected to worsen from LOS “D” to LOS “E” at Olohena Road.

Kaapuni Road is expected to continue to operate at LOS “F” at Olohena Road. The left-turn movement from the Kapa`a Bypass Road onto Kuhio Highway is expected to operate at LOS “F”, during the AM peak hour of traffic with the proposed project. Figures 15 and 16 depict the AM peak hour volumes with the proposed project.

E. PM Peak Hour Traffic Analysis With Project

During the PM peak hour of traffic with the proposed project, the roundabout intersection of the Kapa`a Bypass Road and Road A is expected to operate at satisfactory Levels of Service. Road A is expected to operate at LOS “D” at Olohena Road. The Phase 1 driveway on Olohena Road is expected to operate at LOS “A”.

The overall intersection of Kuhio Highway and Kukui Street is expected to continue to operate at LOS “A”, during the PM peak hour of traffic with the proposed project. The left-turn movement on makai bound Kukui Street is expected to continue to operate at LOS “F”. The traffic movements in both directions on Kuhio Highway are expected to operate at LOS “A” at Kukui Street, during the PM peak hour of traffic with the proposed project.

Makai bound Lehua Street is expected to continue to operate at LOS “F” at Kuhio Highway, during the PM peak hour of traffic with the proposed project. Makai bound Ohia Street also is expected to operate at LOS “F” at Kuhio Highway. The Pono Kai Driveway is expected to operate at LOS “D” at Kuhio Highway.

During the PM peak hour of traffic with the proposed project, southbound Kapa`a Bypass Road is expected to continue to operate at LOS “F” at its roundabout intersection with Olohena Road. The left-turn and right-turn movements on the Kapa`a Bypass Road (South Junction) at Kuhio Highway are expected to operate at LOS “E” and LOS “D”, respectively. The other intersections in the study area are expected to operate at satisfactory Levels of Service, during the PM peak hour of traffic with the proposed project. Figures 17 and 18 depict the PM peak hour volumes with the proposed project.

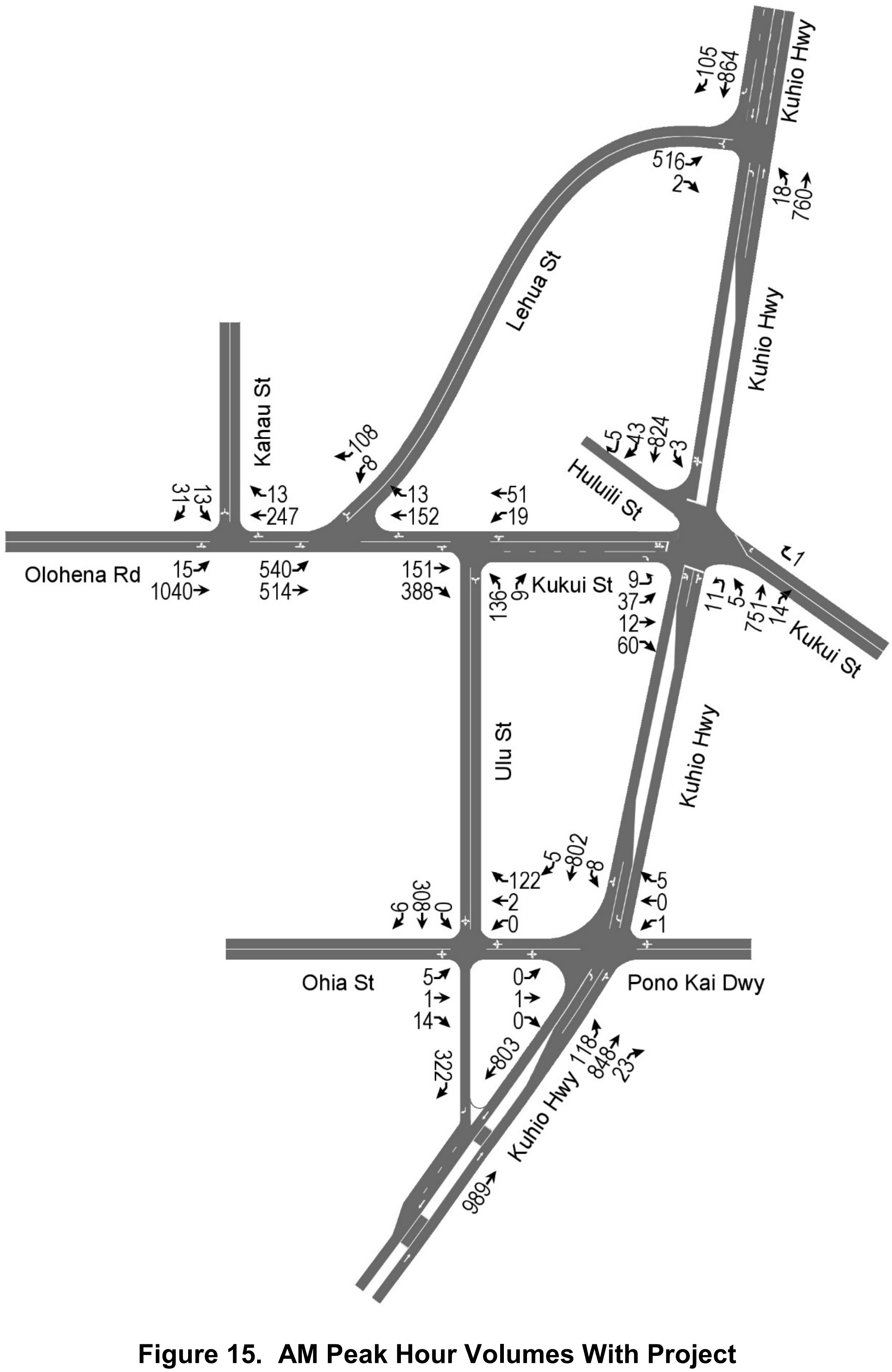


Figure 15. AM Peak Hour Volumes With Project

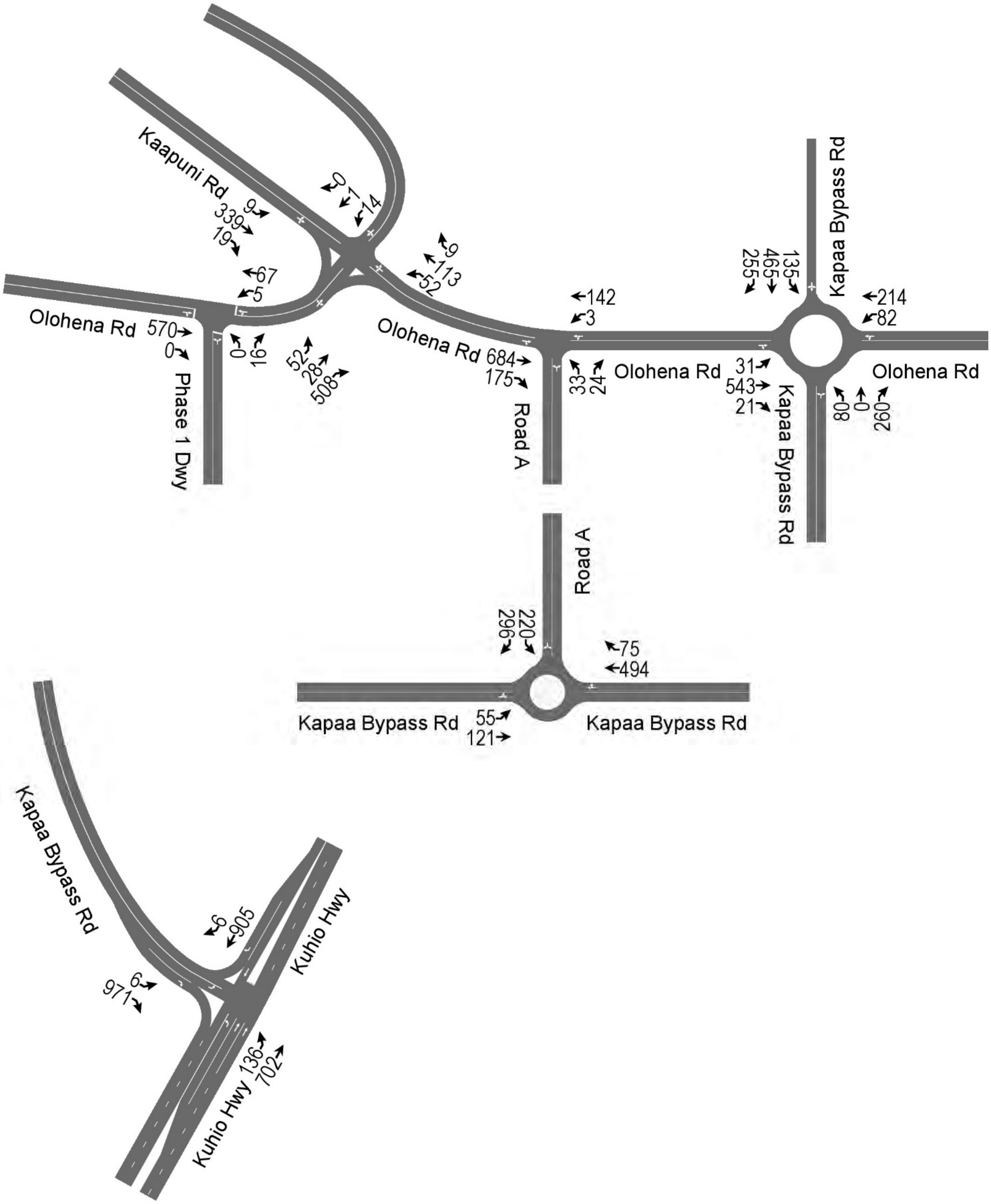


Figure 16. AM Peak Hour Volumes With Project (Cont'd.)

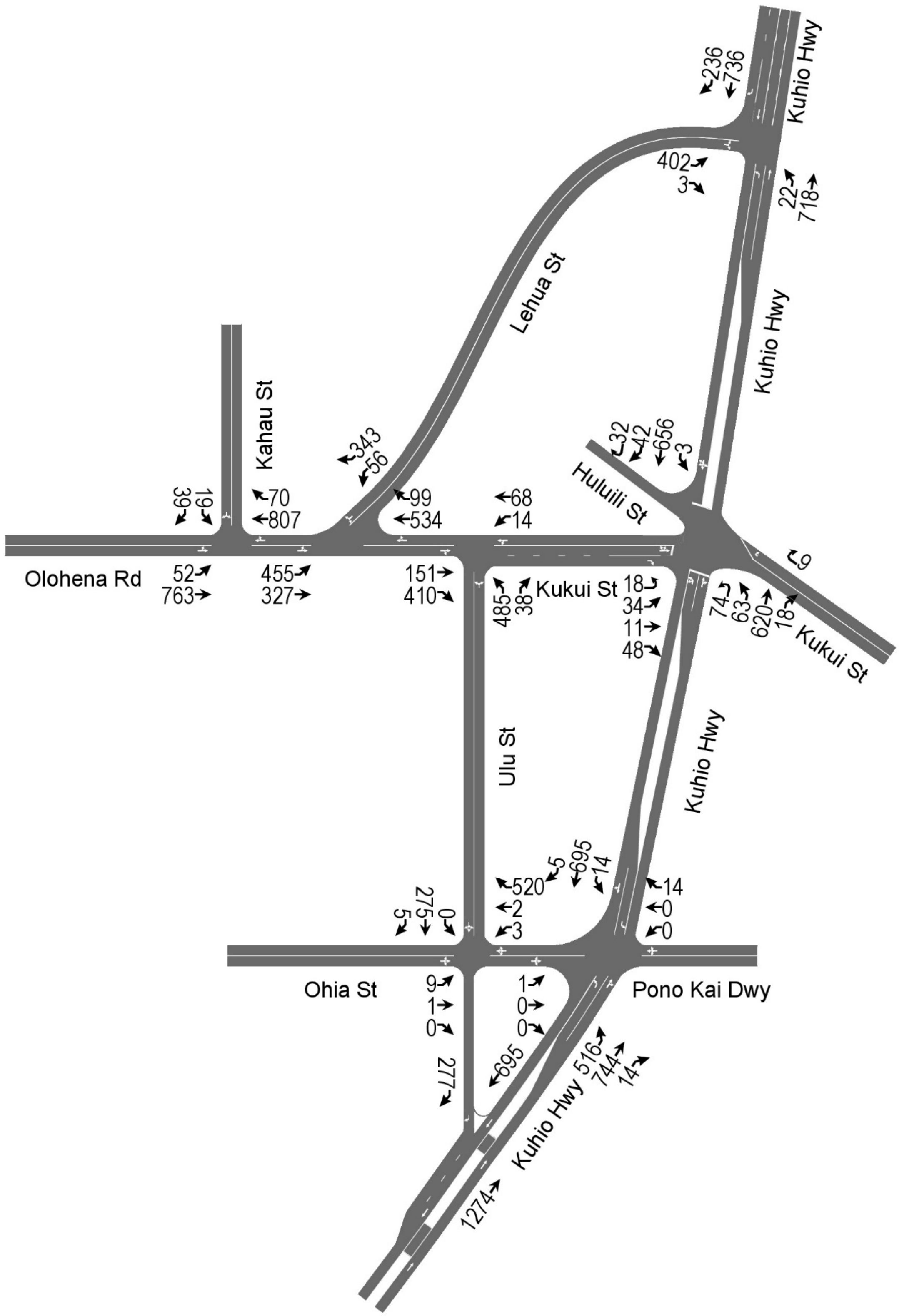


Figure 17. PM Peak Hour Volumes With Project

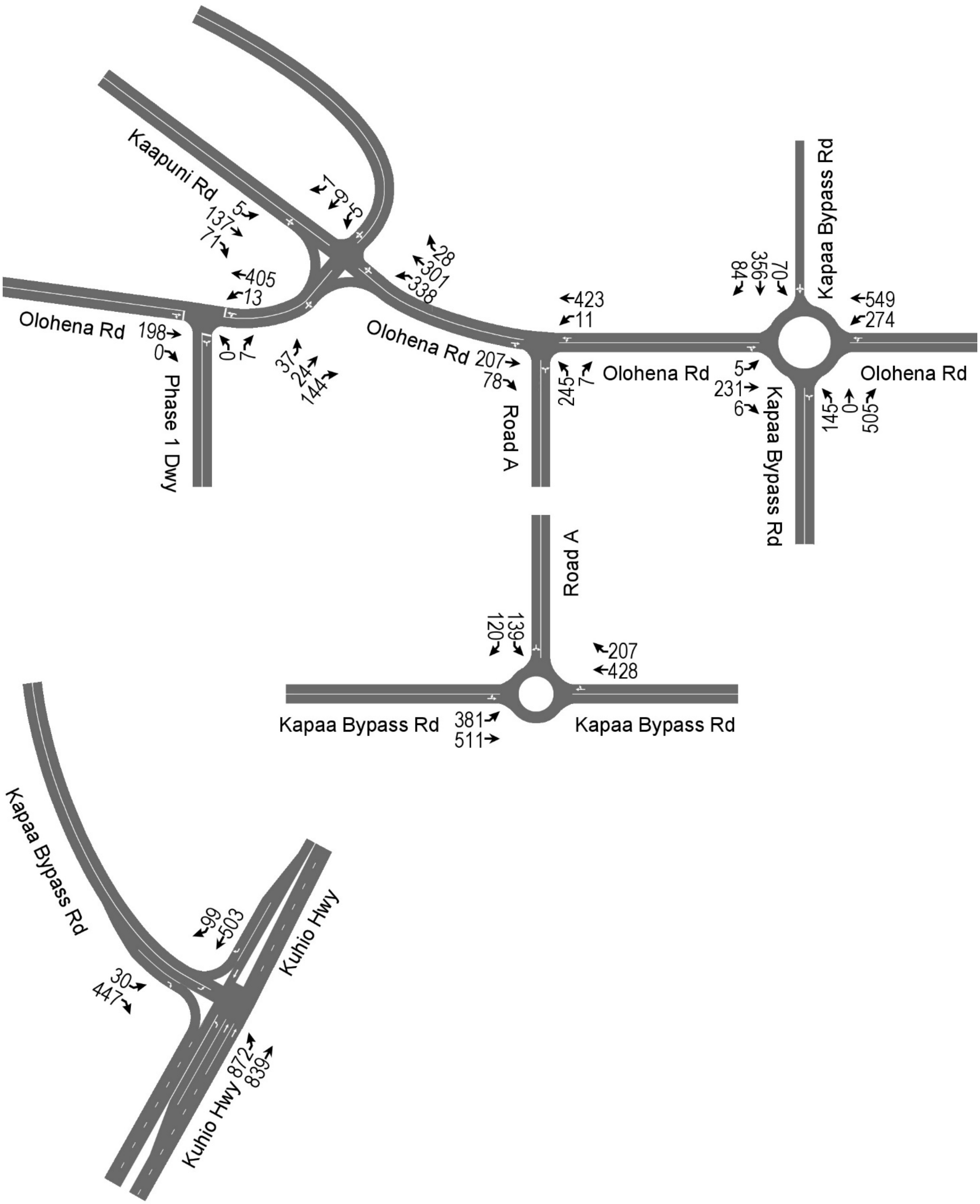


Figure 18. PM Peak Hour Volumes With Project (Cont'd.)

V. Recommendations and Conclusions

A. Recommended Traffic Improvements Without Project

The following traffic improvements expand upon the potential traffic solutions, which were cited in the Kapa`a Transportation Solutions, and are recommended to mitigate the existing and expected traffic congestion without the proposed project:

1. Widen Kuhio Highway between the Kapa`a Bypass Road (South Junction) and Kuamoo Road to provide two through lanes in each direction (DOT).
2. Restripe the median on the north leg of Kuhio Highway at the Kapa`a Bypass Road (South Junction) to provide a median refuge lane to facilitate the left-turn movement from the Kapa`a Bypass Road onto northbound Kuhio Highway.
3. Restrict on-street parking along Kuhio Highway within Kapa`a Town. Provide off-street business parking to replace the restricted parking along Kuhio Highway. Restripe Kuhio Highway to provide additional through and/or left-turn lanes.
4. Modify the traffic signal traffic operations at the intersection of Kuhio Highway and Kukui Street to reduce queuing and delays.
5. Add a right-turn bypass lane at the roundabout intersection from southbound Kapa`a Bypass Road to mauka bound Olohena Road.
6. Realign Kaehulua Road to intersect Olohena Road and Kaapuni Road opposite the mauka leg of Olohena Road to create a four-legged intersection with stop-controls on Kaehulua Road and the mauka leg of Olohena Road. Realign/channelize the mauka leg of Olohena Road to intersect Kaapuni Road and the makai leg of Olohena Road to improve the intersection sight distance. Channelize the right-turn movements on the makai bound approaches of Kaapuni Road and Olohena Road.
7. Extend the median refuge lane/two-way left-turn lane on Kuhio Highway from Lehua Street to Kawaihau Road.

DOT is in the process of widening Kuhio Highway from the Kapa`a Bypass Road to Kuamoo Road (Item No. 1 above). The above Item Nos. 2, 3, and 7 are expected to improve the capacity of Kuhio Highway through Kapa`a Town.

Consolidating the intersections of Olohena Road, Kaapuni Road, and Kaehulua Road (Item No. 6 above) into a single four-legged intersection is expected to improve the traffic operations and safety at the intersection. A roundabout intersection was considered for Olohena Road, Kaapuni Road, and Kaehulua Road. However, the existing roadway slopes would have required extensive grading to provide adequate sight distances at a roundabout intersection.

B. Recommended Traffic Improvements With Project

The following traffic improvements are recommended to mitigate traffic impacts with the proposed project:

1. Construct Road A from Olohena Road to the Kapa`a Bypass Road, as recommended in the Kapa`a Transportation Solutions.
2. Construct a single-lane roundabout at the intersection of Road A and the Kapa`a Bypass Road.

C. Conclusions

An interim solution to the existing traffic congestion in Kapa`a Town is recommended in the Kapa`a Transportation Solutions. Constructing additional off-street parking areas would provide the opportunity to restripe the existing on-street parking lanes and striped shoulders along Kuhio Highway to provide for additional through traffic lanes and/or median left-turn lanes.

The existing southbound traffic demand in Kapa`a Town is reduced by the Kapa`a Bypass Road. Dedication of the Kapa`a Bypass Road right-of-way along the Hokua Place frontage would assure the continued usage of the existing Kapa`a Bypass Road. Any horizontal realignment and/or widening of the Kapa`a Bypass Road along the project frontage should be coordinated with the development of Hokua Place. Widening of the north leg of the Kapa`a Bypass Road between Olohena Road and Kuhio Highway (North Junction) to provide at a two-way, two-lane roadway would provide additional capacity in the northbound direction.

The construction of the proposed Road A is recommended in the Kapa`a Transportation Solutions to provide additional mauka-makai roadway capacity between Kapa`a Valley and the Kapa`a Bypass Road. By diverting through traffic between Olohena Road and the Kapa`a Bypass Road, Road A is expected to mitigate the project's traffic impacts, during the AM and PM peak hour of traffic with the proposed project at the roundabout intersection of the Kapa`a Bypass Road and Olohena Road.

The roundabout at the intersection of the Kapa`a Bypass Road and Road A will increase the intersection capacity, in anticipation of the increase in demand resulting from the future two-lane widening of the Kapa`a Bypass Road between Olohena Road and Kuhio Highway (North Junction). The proposed roundabout intersection of the Kapa`a Bypass Road and Olohena Road is expected to operate at satisfactory Levels of Service, during the AM and PM peak hours of traffic with the proposed project. Table 7 summarizes the measures of effectiveness (MOE) from the traffic analysis of the intersections in the study area.

<table>
<tr><th colspan="16">Table 7. Summary of Capacity Analysis</th></tr>
<tr><th>Scenario</th><th>Intersection</th><th>MOE</th><th>EBL</th><th>EBT</th><th>EBR</th><th>WBL</th><th>WBT</th><th>WBR</th><th>NBL</th><th>NBT</th><th>NBR</th><th>SBL</th><th>SBT</th><th>SBR</th><th>Intersection</th></tr>
<tr><td rowspan="33">Existing AM Peak Hour Traffic</td><td rowspan="3">Kuhio Hwy & Kukui St & Huluili St</td><td>LOS</td><td colspan="2">F</td><td>C</td><td>N/A</td><td>N/A</td><td>A</td><td>A</td><td colspan="2">A</td><td colspan="3">A</td><td>A</td></tr>
<tr><td>Delay</td><td colspan="2">115.8</td><td>31.5</td><td>N/A</td><td>N/A</td><td>1.3</td><td>1.3</td><td colspan="2">2.8</td><td colspan="3">4.5</td><td>7.3</td></tr>
<tr><td>v/c</td><td colspan="2">0.49</td><td>0.34</td><td>N/A</td><td>N/A</td><td>0.02</td><td>0.02</td><td colspan="2">0.42</td><td colspan="3">0.48</td><td>0.49 (maximum)</td></tr>
<tr><td rowspan="3">Ulu St & Kukui St</td><td>LOS</td><td>N/A</td><td>N/A</td><td>N/A</td><td>A</td><td>A</td><td>N/A</td><td colspan="3">B</td><td>N/A</td><td>N/A</td><td>N/A</td><td>A</td></tr>
<tr><td>Delay</td><td>N/A</td><td>N/A</td><td>N/A</td><td>8.3</td><td>0.0</td><td>N/A</td><td colspan="3">11.3</td><td>N/A</td><td>N/A</td><td>N/A</td><td>2.6</td></tr>
<tr><td>v/c</td><td>N/A</td><td>N/A</td><td>N/A</td><td>0.01</td><td>N/A</td><td>N/A</td><td colspan="3">0.16</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td rowspan="3">Olohena Rd & Lehua St</td><td>LOS</td><td>A</td><td>A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td colspan="3">B</td><td>A</td></tr>
<tr><td>Delay</td><td>8.3</td><td>0.0</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td colspan="3">11.7</td><td>4.4</td></tr>
<tr><td>v/c</td><td>0.25</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td colspan="3">0.15</td><td>N/A</td></tr>
<tr><td rowspan="3">Olohena Rd & Kahau St</td><td>LOS</td><td>A</td><td>A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td colspan="3">B</td><td>A</td></tr>
<tr><td>Delay</td><td>7.6</td><td>0.0</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td colspan="3">13.2</td><td>0.6</td></tr>
<tr><td>v/c</td><td>0.01</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td colspan="3">0.08</td><td>N/A</td></tr>
<tr><td rowspan="3">Kuhio Hwy & Lehua St</td><td>LOS</td><td colspan="3">E</td><td>N/A</td><td>N/A</td><td>N/A</td><td>A</td><td>A</td><td>N/A</td><td>N/A</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>Delay</td><td colspan="3">46.6</td><td>N/A</td><td>N/A</td><td>N/A</td><td>9.3</td><td>0.0</td><td>N/A</td><td>N/A</td><td>0.0</td><td>0.0</td><td>8.7</td></tr>
<tr><td>v/c</td><td colspan="3">0.85</td><td>N/A</td><td>N/A</td><td>N/A</td><td>0.02</td><td>0.40</td><td>N/A</td><td>N/A</td><td>0.45</td><td>0.04</td><td>N/A</td></tr>
<tr><td rowspan="3">Kuhio Hwy & Ohia St/Pono Kai Dwy</td><td>LOS</td><td colspan="3">E</td><td colspan="3">C</td><td>A</td><td>N/A</td><td>N/A</td><td>A</td><td>N/A</td><td>N/A</td><td>A</td></tr>
<tr><td>Delay</td><td colspan="3">48.9</td><td colspan="3">23.7</td><td>9.60</td><td>N/A</td><td>N/A</td><td>9.4</td><td>N/A</td><td>N/A</td><td>0.7</td></tr>
<tr><td>v/c</td><td colspan="3">0.012</td><td colspan="3">0.025</td><td>0.10</td><td>N/A</td><td>N/A</td><td>0.01</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td rowspan="3">Ulu St & Ohia St</td><td>LOS</td><td colspan="3">B</td><td colspan="3">A</td><td></td><td></td><td></td><td>A</td><td></td><td></td><td>A</td></tr>
<tr><td>Delay</td><td colspan="3">10</td><td colspan="3">8.8</td><td></td><td></td><td></td><td>0.0</td><td></td><td></td><td>3.1</td></tr>
<tr><td>v/c</td><td colspan="3">0.023</td><td colspan="3">0.089</td><td></td><td></td><td></td><td>N/A</td><td></td><td></td><td>N/A</td></tr>
<tr><td rowspan="3">Kapa`a Bypass Rd & Olohena Rd</td><td>LOS</td><td colspan="3">D</td><td colspan="3">A</td><td colspan="3">A</td><td colspan="3">C</td><td>C</td></tr>
<tr><td>Delay</td><td colspan="3">30</td><td colspan="3">5.1</td><td colspan="3">7.1</td><td colspan="3">18.2</td><td>20.0</td></tr>
<tr><td>v/c</td><td colspan="3">0.855</td><td colspan="3">0.204</td><td colspan="3">0.19</td><td colspan="3">0.757</td><td>N/A</td></tr>
<tr><td rowspan="3">Olohena Rd & Kaapuni Rd</td><td>LOS</td><td>A</td><td>A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td colspan="3">E</td><td>B</td></tr>
<tr><td>Delay</td><td>7.7</td><td>0.0</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td colspan="3">35.1</td><td>12.3</td></tr>
<tr><td>v/c</td><td>0.05</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td colspan="3">0.751</td><td>N/A</td></tr>
<tr><td rowspan="3">Kaapuni Rd & Kaehulua Rd</td><td>LOS</td><td>A</td><td>A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td colspan="3">B</td><td>A</td></tr>
<tr><td>Delay</td><td>7.6</td><td>0.0</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td colspan="3">11.7</td><td>0.4</td></tr>
<tr><td>v/c</td><td>0.01</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td colspan="3">0.024</td><td>N/A</td></tr>
<tr><td rowspan="3">Kuhio Hwy & Kapa`a Bypass Rd</td><td>LOS</td><td>C</td><td>N/A</td><td>A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>B</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>A</td></tr>
<tr><td>Delay</td><td>20.7</td><td>N/A</td><td>0.0</td><td>N/A</td><td>N/A</td><td>N/A</td><td>10.0</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>0.7</td></tr>
<tr><td>v/c</td><td>0.02</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>0.12</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="16">Legend
EBL – Makai (East) Bound Left-Turn Movement
EBT – Makai (East) Bound Through Movement
EBR – Makai (East) Bound Right–Turn Movement
WBL – Mauka (West) Bound Left-Turn Movement
WBT – Mauka (West) Bound Through Movement
WBR – Mauka (West) Bound Right-Turn Movement
NBL – North Bound Left-Turn Movement
NBT – North Bound Through Movement
NBR – North Bound Right-Turn Movement
SBL – South Bound Left-Turn Movement
SBT – South Bound Through Movement
SBR – South Bound Right-Turn Movement</td></tr>
</table>

Table 7. Summary of Capacity Analysis (Cont'd.)

Scenario	Intersection	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
Existing PM Peak Hour Traffic	Kuhio Hwy & Kukui St & Huluili St	LOS	E		A	N/A	N/A	A	A	A		A			A
		Delay	61.6		6.9	N/A	N/A	2.4	2.4	3.4		8.2			7.4
		v/c	0.39		0.22	N/A	N/A	0.18	0.18	0.36		0.48			0.48 (maximum)
	Ulu Street & Kukui Street	LOS	N/A	N/A	N/A	A	A	N/A	C			N/A	N/A	N/A	A
		Delay	N/A	N/A	N/A	8.2	0.0	N/A	17.4			N/A	N/A	N/A	7.7
		v/c	N/A	N/A	N/A	0.01	N/A	N/A	0.567			N/A	N/A	N/A	N/A
	Olohena Road & Lehua Street	LOS	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E			B
		Delay	9.8	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	47			12.9
		v/c	0.31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.81			N/A
	Olohena Road & Kahau Street	LOS	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C			A
		Delay	9.1	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	19.0			0.9
		v/c	0.04	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.14			N/A
	Kuhio Hwy & Lehua Street	LOS	D			N/A	N/A	N/A	A	A	N/A	N/A	A	A	A
		Delay	29.2			N/A	N/A	N/A	9.0	0.0	N/A	N/A	0.0	0.0	5.0
		v/c	0.68			N/A	N/A	N/A	0.02	0.38	N/A	N/A	0.39	0.09	N/A
	Kuhio Hwy & Ohia St/Pono Kai Driveway	LOS	F			D			B	N/A	N/A	A	N/A	N/A	A
		Delay	143.4			33.1			11.3	N/A	N/A	9.0	N/A	N/A	3.0
		v/c	0.04			0.10			0.40	N/A	N/A	0.01	N/A	N/A	N/A
	Ulu Street & Ohia Street	LOS	C			B			N/A	N/A	N/A	A	N/A	N/A	A
		Delay	15.5			10.6			N/A	N/A	N/A	0.0	N/A	N/A	7.1
		v/c	0.03			0.38			N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Kapa`a Bypass Rd & Olohena Rd	LOS	A			B			B			D			B
		Delay	7.9			11.5			11.5			26.6			14.2
		v/c	0.32			0.57			0.61			0.73			N/A
	Olohena Rd & Kaapuni Rd	LOS	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C			B
		Delay	8.7	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17.3			4.1
		v/c	0.05	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.39			N/A
	Kaapuni Rd & Kaehulua Rd	LOS	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	B			A
		Delay	7.9	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11.7			0.4
		v/c	0.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.02			N/A
	Kuhio Hwy & Kapa`a Bypass Rd	LOS	B	N/A	C	N/A	N/A	N/A	B	N/A	N/A	N/A	N/A	N/A	A
		Delay	14.0	N/A	19.0	N/A	N/A	N/A	12.7	N/A	N/A	N/A	N/A	N/A	6.7
		v/c	0.06	N/A	N/A	N/A	N/A	N/A	0.59	N/A	N/A	N/A	N/A	N/A	N/A

Table 7. Summary of Capacity Analysis (Cont'd.)

Scenario	Intersection	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
AM Peak Hour Traffic Without Project	Kuhio Hwy & Kukui Street & Huluili Street	LOS	F		C	N/A	N/A	A	A	A		A			A
		Delay	117.0		29.9	N/A	N/A	1.5	1.5	3.7		6.3			8.5
		v/c	0.52		0.36	N/A	N/A	0.03	0.03	0.49		0.57			0.57 (maximum)
	Ulu Street & Kukui Street	LOS	N/A	N/A	N/A	A	A	N/A	B			N/A	N/A	N/A	A
		Delay	N/A	N/A	N/A	8.5	0.0	N/A	12.2			N/A	N/A	N/A	2.7
		v/c	N/A	N/A	N/A	0.02	N/A	N/A	0.203			N/A	N/A	N/A	N/A
	Olohena Road & Lehua Street	LOS	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	B			A
		Delay	8.5	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13.1			4.6
		v/c	0.29	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.19			N/A
	Olohena Road & Kahau Street	LOS	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	B			A
		Delay	7.7	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14.2			0.6
		v/c	0.01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.09			N/A
	Kuhio Hwy & Lehua Street	LOS	F			N/A	N/A	N/A	A	A	N/A	N/A	A	A	B
		Delay	104.5			N/A	N/A	N/A	9.7	0.0	N/A	N/A	0.0	0.0	19.3
		v/c	1.33			N/A	N/A	N/A	0.02	0.45	N/A	N/A	0.51	0.06	N/A
	Kuhio Hwy & Ohia St/Pono Kai Driveway	LOS	F			D			B	N/A	N/A	A	N/A	N/A	A
		Delay	65			27.4			10.00	N/A	N/A	9.8	N/A	N/A	0.7
		v/c	0.016			0.036			0.12	N/A	N/A	0.01	N/A	N/A	N/A
	Ulu Street & Ohia Street	LOS	B			A			N/A	N/A	N/A	A	N/A	N/A	A
		Delay	10.3			8.8			N/A	N/A	N/A	0.0	N/A	N/A	3.1
		v/c	0.029			0.101			N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Kapa`a Bypass Rd & Olohena Rd	LOS	F			A			A			D			E
		Delay	64.9			5.4			7.4			30.1			38.7
		v/c	1.027			0.233			0.174			0.888			N/A
	Olohena Rd & Kaapuni Rd	LOS	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	B			A
		Delay	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11.4			7.8
		v/c	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.399			N/A
	Kaapuni Rd & Kaehulua Rd	LOS	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	B			A
		Delay	7.6	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.6			0.4
		v/c	0.01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.031			N/A
	Kuhio Hwy & Kapa`a Bypass Rd	LOS	C	N/A	A	N/A	N/A	N/A	B	N/A	N/A	N/A	N/A	N/A	A
		Delay	24.0	N/A	0.0	N/A	N/A	N/A	10.7	N/A	N/A	N/A	N/A	N/A	0.8
		v/c	0.03	N/A	N/A	N/A	N/A	N/A	0.15	N/A	N/A	N/A	N/A	N/A	N/A

Table 7. Summary of Capacity Analysis (Cont'd.)

Scenario	Intersection	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
PM Peak Hour Traffic Without Project	Kuhio Hwy & Kukui St & Huluili St	LOS	E		A	N/A	N/A	A	A	A		A			A
		Delay	62.1		8.6	N/A	N/A	2.7	2.7	3.9		9.6			8.3
		v/c	0.42		0.25	N/A	N/A	0.22	0.22	0.41		0.55			0.55 (maximum)
	Ulu Street & Kukui Street	LOS	N/A	N/A	N/A	A	A	N/A	C			N/A	N/A	N/A	B
		Delay	N/A	N/A	N/A	8.5	0.0	N/A	24.7			N/A	N/A	N/A	10.9
		v/c	N/A	N/A	N/A	0.01	N/A	N/A	0.72			N/A	N/A	N/A	N/A
	Olohena Road & Lehua Street	LOS	B	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	F			E
		Delay	10.8	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	199.9			46.8
		v/c	0.38	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.30			N/A
	Olohena Road & Kahau Street	LOS	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C			A
		Delay	9.5	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	24.3			1.1
		v/c	0.05	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.20			N/A
	Kuhio Hwy & Lehua Street	LOS	E			N/A	N/A	N/A	A	A	N/A	N/A	A	A	B
		Delay	48.4			N/A	N/A	N/A	9.3	0.0	N/A	N/A	0.0	0.0	19.3
		v/c	0.85			N/A	N/A	N/A	0.03	0.42	N/A	N/A	0.43	0.10	N/A
	Kuhio Hwy & Ohia St/Pono Kai Driveway	LOS	F			E			B	N/A	N/A	A	N/A	N/A	A
		Delay	261.5			47.7			12.80	N/A	N/A	9.3	N/A	N/A	3.5
		v/c	0.067			0.16			0.48	N/A	N/A	0.02	N/A	N/A	N/A
	Ulu Street & Ohia Street	LOS	C			B			N/A	N/A	N/A	A	N/A	N/A	A
		Delay	17.5			11.1			N/A	N/A	N/A	0.0	N/A	N/A	7.4
		v/c	0.033			0.428			N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Kapa`a Bypass Rd & Olohena Rd	LOS	A			C			C			F			D
		Delay	9.8			16.8			16.9			72.9			27.7
		v/c	0.399			0.714			0.744			1.002			N/A
	Olohena Road & Kaapuni Road	LOS	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C			A
		Delay	9.1	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	23.5			5.4
		v/c	0.07	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.538			N/A
	Kaapuni Road & Kaehulua Road	LOS	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	B			A
		Delay	8.1	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.6			0.4
		v/c	0.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.031			N/A
	Kuhio Hwy & Kapa`a Bypass Rd	LOS	C	N/A	D	N/A	N/A	N/A	C	N/A	N/A	N/A	N/A	N/A	A
		Delay	22.6	N/A	25.4	N/A	N/A	N/A	15.6	N/A	N/A	N/A	N/A	N/A	8.6
		v/c	0.12	N/A	N/A	N/A	N/A	N/A	0.70	N/A	N/A	N/A	N/A	N/A	N/A

Table 7. Summary of Capacity Analysis (Cont'd.)

Scenario	Intersection	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
AM Peak Hour Traffic With Project	Kuhio Hwy & Kukui Street & Huluili Street	LOS	F		C	N/A	N/A	A	A	A		A			A
		Delay	118.9		26.1	N/A	N/A	1.8	1.8	4.1		7.0			10.0
		v/c	0.59		0.42	N/A	N/A	0.03	0.03	0.49		0.57			0.59 (maximum)
	Ulu Street & Kukui Street	LOS	N/A	N/A	N/A	A	A	N/A	B			N/A	N/A	N/A	A
		Delay	N/A	N/A	N/A	8.8	0.0	N/A	13.6			N/A	N/A	N/A	2.8
		v/c	N/A	N/A	N/A	0.02	N/A	N/A	0.257			N/A	N/A	N/A	N/A
	Olohena Road & Lehua Street	LOS	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C			A
		Delay	9.2	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	19			5.4
		v/c	0.39	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.31			N/A
	Olohena Road & Kahau Street	LOS	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C			A
		Delay	7.8	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17.3			0.6
		v/c	0.01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.13			N/A
	Kuhio Hwy & Lehua Street	LOS	F			N/A	N/A	N/A	A	A	N/A	N/A	A	A	F
		Delay	237.5			N/A	N/A	N/A	9.7	0.0	N/A	N/A	0.0	0.0	54.4
		v/c	1.43			N/A	N/A	N/A	0.02	0.45	N/A	N/A	0.51	0.05	N/A
	Kuhio Hwy & Ohia Street/Pono Kai Driveway	LOS	F			D			B	N/A	N/A	A	N/A	N/A	A
		Delay	71.7			29.0			10.2	N/A	N/A	9.8	N/A	N/A	0.8
		v/c	0.02			0.04			0.15	N/A	N/A	0.01	N/A	N/A	N/A
	Ulu Street & Ohia Street	LOS	B			A			N/A	N/A	N/A	A	N/A	N/A	A
		Delay	11			8.9			N/A	N/A	N/A	0.0	N/A	N/A	2.9
		v/c	0.03			0.12			N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Kapa`a Bypass Rd & Olohena Rd	LOS	E			A			B			E			D
		Delay	42.1			5.7			14.5			40.7			31.9
		v/c	0.91			0.27			0.53			0.95			N/A
	Road A & Olohena Road	LOS	N/A	N/A	N/A	A	A	N/A	C			N/A	N/A	N/A	A
		Delay	N/A	N/A	N/A	9.6	0.0	N/A	17.9			N/A	N/A	N/A	1.0
		v/c	N/A	N/A	N/A	0.00	N/A	N/A	0.17			N/A	N/A	N/A	N/A
	Olohena Road & Kaapuni Road	LOS	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	F			D
		Delay	7.8	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	106.1			35.5
		v/c	0.06	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.078			N/A
	Kaapuni Rd & Kaehulua Rd	LOS	A	A	N/A	N/A	B	N/A	N/A	N/A	N/A	B			A
		Delay	7.6	0.0	N/A	N/A	12.6	N/A	N/A	N/A	N/A	12.6			0.4
		v/c	0.01	-	N/A	N/A	0.03	N/A	N/A	N/A	N/A	0.03			N/A
	Phase 1 Dwy & Olohena Rd	LOS	N/A	N/A	N/A	A	A	N/A	B			N/A	N/A	N/A	A
		Delay	N/A	N/A	N/A	8.6	0.0	N/A	12.1			N/A	N/A	N/A	0.4
		v/c	N/A	N/A	N/A	0.01	N/A	N/A	0.03			N/A	N/A	N/A	N/A

Table 7. Summary of Capacity Analysis (Cont'd.)

Scenario	Intersection	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
AM Peak Hour Traffic With Project (Cont'd.)	Kapa`a Bypass Road & Road A	LOS	A			A			N/A			C			B
		Delay	4.8			7.3			N/A			15.1			10.1
		v/c	0.16			0.45			N/A			0.64			N/A
	Kuhio Hwy & Kapa`a Bypass Road	LOS	F	N/A	A	N/A	N/A	N/A	B	N/A	N/A	N/A	N/A	N/A	A
		Delay	51.1	N/A	0.0	N/A	N/A	N/A	10.9	N/A	N/A	N/A	N/A	N/A	1.0
		v/c	0.07	N/A	N/A	N/A	N/A	N/A	0.18	N/A	N/A	N/A	N/A	N/A	N/A
AM Peak Hour Traffic With Project - Improved	Kuhio Hwy & Kukui Street & Huluili Street	LOS	C		B	N/A	N/A	A	A	A		A			A
		Delay	32.8		11.4	N/A	N/A	0.0	3.8	7.0		8.2			.6
		v/c	0.31		0.27	N/A	N/A	N/A	0.03	0.56		0.63			0.63 (maximum)
	Kuhio Hwy & Lehua Street	LOS	F			N/A	N/A	N/A	A	A	N/A	N/A	A	A	E
		Delay	196.5			N/A	N/A	N/A	9.7	0.0	N/A	N/A	0.0	0.0	45.0
		v/c	1.34			N/A	N/A	N/A	0.02	0.45	N/A	N/A	0.51	0.06	N/A
	Kapa`a Bypass Rd & Olohena Rd	LOS	C			A			B			B		A	B
		Delay	23.9			5.4			11.1			12.1		0.0	12.9
		v/c	0.79			0.25			0.46			0.61		0.13	N/A
	Olohena Rd & Kaapuni Road & Kaehulua Road	LOS	A	A		A	A		D			E			B
		Delay	7.5	0.0		8.1	0.0		34.9			43.2			19.0
		v/c	0.01	N/A		0.04	-		0.87			0.14			N/A
	Kuhio Hwy & Kapa`a Bypass Road	LOS	C	N/A	A	N/A	N/A	N/A	B	A	N/A	N/A	A	A	A
		Delay	21.8	N/A	0.0	N/A	N/A	N/A	10.9	0.0	N/A	N/A	0.0	0.0	0.9
		v/c	0.03	N/A	N/A	N/A	N/A	N/A	0.18	N/A	N/A	N/A	N/A	N/A	N/A
PM Peak Hour Traffic With Project	Kuhio Hwy & Kukui Street & Huluili Street	LOS	E		B	N/A	N/A	A	A	A		B			A
		Delay	63.3		11.1	N/A	N/A	3.0	3.0	4.2		10.5			9.4
		v/c	0.48		0.27	N/A	N/A	0.23	0.23	0.42		0.56			0.56 (maximum)
	Ulu Street & Kukui Street	LOS	N/A	N/A	N/A	A	A	N/A	E			N/A	N/A	N/A	A
		Delay	N/A	N/A	N/A	8.7	0.0	N/A	49.9			N/A	N/A	N/A	22.5
		v/c	N/A	N/A	N/A	0.01	N/A	N/A	0.93			N/A	N/A	N/A	N/A
	Olohena Road & Lehua Street	LOS	B	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	F			A
		Delay	12.7	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	714.0			160.2
		v/c	0.49	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.45			N/A
	Olohena Road & Kahau Street	LOS	B	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E			A
		Delay	10.4	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	36.5			1.5
		v/c	0.07	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.34			N/A

Table 7. Summary of Capacity Analysis (Cont'd.)															
Scenario	**Intersection**	**MOE**	**EBL**	**EBT**	**EBR**	**WBL**	**WBT**	**WBR**	**NBL**	**NBT**	**NBR**	**SBL**	**SBT**	**SBR**	**Intersection**
PM Peak Hour Traffic With Project (Cont'd.)	**Kuhio Hwy & Lehua Street**	**LOS**	F			N/A	N/A	N/A	A	A	N/A	N/A	A	A	B
		Delay	85.7			N/A	N/A	N/A	9.3	0.0	N/A	N/A	0.0	0.0	12.5
		v/c	1.03			N/A	N/A	N/A	0.03	0.42	N/A	N/A	0.43	0.14	N/A
	Kuhio Hwy & Ohia St/Pono Kai Driveway	**LOS**	F			B			B	N/A	N/A	A	N/A	N/A	A
		Delay	401.7			14.6			14.6	N/A	N/A	9.3	N/A	N/A	4.1
		v/c	0.10			0.04			0.58	N/A	N/A	0.02	N/A	N/A	N/A
	Ulu Street & Ohia Street	**LOS**	C			B			N/A	N/A	N/A	A	N/A	N/A	A
		Delay	21.7			12.1			N/A	N/A	N/A	0.0	N/A	N/A	8.1
		v/c	0.04			0.51			N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Kapa`a Bypass Rd & Olohena Rd	**LOS**	B			B			B			F			D
		Delay	11.3			14.2			13.3			84.7			29.8
		v/c	0.39			0.72			0.65			1.05			N/A
	Road A & Olohena Road	**LOS**	N/A	N/A	N/A	A	A	N/A	D			N/A	N/A	N/A	A
		Delay	N/A	N/A	N/A	7.8	0.0	N/A	26.7			N/A	N/A	N/A	7.0
		v/c	N/A	N/A	N/A	0.01	N/A	N/A	0.61			N/A	N/A	N/A	N/A
	Olohena Road & Kaapuni Road	**LOS**	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C			D
		Delay	9.1	0.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	24.5			5.5
		v/c	0.07	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.55			N/A
	Kaapuni Road & Kaehulua Road	**LOS**	A	A	N/A	N/A	B	N/A	N/A	N/A	N/A	B			A
		Delay	8.1	0.0	N/A	N/A	12.6	N/A	N/A	N/A	N/A	12.6			0.4
		v/c	0.00	-	N/A	N/A	0.03	N/A	N/A	N/A	N/A	0.03			N/A
	Phase 1 Dwy & Olohena Road	**LOS**	N/A	N/A	N/A	A	A	N/A	A			N/A	N/A	N/A	A
		Delay	N/A	N/A	N/A	7.6	0.0	N/A	9.3			N/A	N/A	N/A	0.2
		v/c	N/A	N/A	N/A	0.01	N/A	N/A	0.01			N/A	N/A	N/A	N/A
	Kapa`a Bypass Rd & Road A	**LOS**	C			C			N/A			A			B
		Delay	16.0			16.1			N/A			7.4			14.8
		v/c	0.76			0.70			75			0.30			N/A
	Kuhio Hwy & Kapa`a Bypass Road	**LOS**	E	N/A	A	N/A	N/A	N/A	C	N/A	N/A	N/A	N/A	N/A	B
		Delay	44.7	N/A	0.0	N/A	N/A	N/A	21.1	N/A	N/A	N/A	N/A	N/A	12.0
		v/c	0.25	N/A	N/A	N/A	N/A	N/A	0.81	N/A	N/A	N/A	N/A	N/A	N/A
PM Peak Hour Traffic With Project - Improved	**Kuhio Hwy & Kukui Street & Huluili Street**	**LOS**	C		A	N/A	N/A	A	A	A		B			B
		Delay	32.0		1.8	N/A	N/A	0.1	4.0	5.9		16.7			11.4
		v/c	0.32		0.18	N/A	N/A	N/A	0.24	0.46		0.66			0.66 (maximum)
	Kuhio Hwy & Lehua Street	**LOS**	F			N/A	N/A	N/A	A	A	N/A	N/A	A	A	B
		Delay	65.9			N/A	N/A	N/A	9.3	0.0	N/A	N/A	0.0	0.0	12.7
		v/c	0.96			N/A	N/A	N/A	0.03	0.42	N/A	N/A	0.43	0.14	N/A

Table 7. Summary of Capacity Analysis (Cont'd.)

Scenario	Intersection	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
PM Peak Hour Traffic With Project – Improved (Cont'd.)	Kapa`a Bypass Rd & Olohena Rd	LOS	A			B			B			D		A	B
		Delay	9.1			12.5			11.2			25.1		0.0	13.7
		v/c	0.33			0.68			0.60			0.72		0.04	N/A
	Olohena Rd & Kaapuni Road & Kaehulua Road	LOS	A	A		A	A		C			E			A
		Delay	7.9	0.0		8.2	0.0		21.3			36.0			7.1
		v/c	0.00	N/A		0.23	N/A		0.48			0.12			N/A
	Kuhio Hwy & Kapa`a Bypass Road	LOS	E	N/A	A	N/A	N/A	N/A	C	A	N/A	N/A	A	A	A
		Delay	44.9	N/A	0.0	N/A	N/A	N/A	22.4	0.0	N/A	N/A	0.0	0.0	8.9
		v/c	0.25	N/A	N/A	N/A	N/A	N/A	0.81	N/A	N/A	N/A	N/A	N/A	N/A

TRAFFIC IMPACT ANALYSIS REPORT UPDATE

FOR THE PROPOSED

HOKUA PLACE

KAPA`A, KAUAI, HAWAII
TAX MAP KEY: (4) 4-3-03: 01

APPENDIX A

TRAFFIC COUNT DATA

Study Name Kuhio Hwy Kukui ST 3-15-17 to 3-17-17
Start Date 3/15/17
Start Time 3:00 PM
Site Code Hokua Place

Start	Kukui St Makai Bound				Kukui St Mauka Bound				Kuhio Hwy Northbound				Kuhio Hwy Southbound				Intersection	
3/15/17	LT-Huluili	LT-Kuhio	Thru	Right-Turn	Left-Turn	Thru	Thru-Huluili	RT-Kuhio	LT-Kukui	LT-Huluili	Thru	Right-Turn	Left-Turn	Thru	RT-Kukui	RT-Huluili	15-Min Totals	Hourly Totals
3:00 PM	4	11	6	12	0	0	0	4	4	1	121	2	3	126	14	1	309	1160
3:15 PM	1	16	1	9	0	0	0	7	4	1	89	2	1	129	16	0	276	1136
3:30 PM	10	12	0	9	0	0	0	7	5	0	86	0	3	144	12	1	289	1142
3:45 PM	9	15	4	16	1	0	0	1	11	2	99	1	1	113	13	0	286	1125
4:00 PM	7	18	6	11	0	0	0	2	7	0	96	1	3	111	18	5	285	1136
4:15 PM	4	16	4	11	0	0	0	8	7	1	97	0	1	112	20	1	282	1123
4:30 PM	3	9	1	13	0	0	0	2	8	0	110	1	2	107	15	1	272	1153
4:45 PM	2	12	1	11	0	0	0	1	5	0	103	2	3	136	17	4	297	1177
5:00 PM	4	13	4	4	0	0	0	2	7	7	82	1	2	133	10	3	272	1144
5:15 PM	12	9	5	16	0	0	0	1	4	5	109	0	2	134	9	6	312	
5:30 PM	4	3	3	6	0	0	0	2	6	6	123	2	0	133	7	1	296	
5:45 PM	2	7	5	6	0	0	0	3	1	1	108	0	1	124	5	1	264	
3/16/17																		
7:00 AM	0	8	2	8	0	0	0	2	1	1	124	1	0	184	2	2	335	1397
7:15 AM	2	6	0	9	0	0	0	0	2	1	166	3	0	182	9	0	**380**	**1410**
7:30 AM	0	6	1	15	0	0	0	0	7	5	143	1	1	153	6	1	339	1367
7:45 AM	2	3	3	15	0	0	0	0	4	4	153	1	0	151	7	0	343	1399
8:00 AM	2	11	4	9	0	0	0	1	3	1	143	2	2	165	2	3	348	1397
8:15 AM	0	0	1	3	0	0	0	4	4	1	143	4	3	172	2	0	337	
8:30 AM	0	5	3	6	0	0	0	9	7	0	153	9	1	170	7	1	371	
8:45 AM	3	9	0	8	0	0	0	9	2	2	151	5	2	143	6	1	341	
3/16/17																		
3:00 PM	7	7	2	9	1	0	0	1	5	1	93	3	2	134	10	4	279	1182
3:15 PM	2	11	2	3	0	0	0	3	10	2	129	1	2	125	9	3	302	1203
3:30 PM	2	7	4	18	0	0	0	4	7	3	105	3	2	144	14	1	314	1160
3:45 PM	3	8	5	7	0	0	0	10	2	1	96	0	1	148	5	1	287	1160
4:00 PM	3	3	4	9	0	0	0	0	3	4	113	4	2	139	10	6	300	1162
4:15 PM	2	8	1	6	0	0	0	0	3	3	111	1	2	114	8	0	259	1176
4:30 PM	1	9	1	3	0	0	0	0	4	0	136	2	1	148	7	2	314	1269
4:45 PM	6	5	2	3	0	0	0	0	10	1	114	2	3	134	8	1	289	1281
5:00 PM	7	4	1	8	0	0	0	6	4	3	119	3	2	144	10	3	314	**1305**
5:15 PM	4	5	2	9	0	0	0	2	15	14	137	4	0	145	8	7	**352**	
5:30 PM	2	6	0	0	0	0	0	2	3	1	154	3	0	145	5	5	326	
5:45 PM	0	6	1	7	0	0	0	1	3	0	134	3	1	147	6	4	313	
3/17/17																		
6:45 AM	0	4	1	6	0	0	0	2	2	0	104	1	1	167	6	0	294	1326
7:00 AM	1	3	1	8	0	0	0	3	3	0	101	2	0	179	7	0	308	1386
7:15 AM	0	4	0	11	0	0	0	2	5	0	172	2	0	170	5	0	371	1415
7:30 AM	1	10	1	12	0	0	0	3	9	1	141	2	1	167	5	0	353	1395
7:45 AM	1	7	2	12	0	0	0	2	3	0	145	2	2	164	14	0	354	1364
8:00 AM	1	9	0	14	0	0	0	4	11	2	135	3	2	149	7	0	337	
8:15 AM	3	5	1	7	0	0	0	11	5	0	146	4	2	155	12	0	351	
8:30 AM	0	6	0	6	0	0	0	2	4	0	125	3	2	164	10	0	322	

AM Peak Hour Traffic			3/16/17														
7:15 AM	6	26	8	48	0	0	0	1	16	11	605	7	3	651	24	4	1410
PHF	0.75	1.08	N/A	1.33	N/A	N/A	N/A	N/A	2.00	2.75	0.91	0.58	N/A	0.89	0.67	N/A	0.93
PHV	8	24	0	36	0	0	0	0	8	4	664	12	0	728	36	0	1520
T Factor	0%	15%	0%	4%	N/A	N/A	N/A	0%	6%	9%	4%	0%	0%	1%	4%	0%	
PM Peak Hour Traffic			3/16/17														
5:00 PM	13	21	4	24	0	0	0	11	25	18	544	13	3	581	29	19	1305
PHF	0.81	1.05	0.50	0.67	N/A	N/A	N/A	1.38	0.42	0.32	0.99	0.81	N/A	1.00	0.91	0.68	0.93
PHV	16	20	8	36	0	0	0	8	60	56	548	16	0	580	32	28	1408
T Factor	0%	0%	0%	0%	N/A	N/A	N/A	0%	0%	0%	0%	0%	0%	1%	0%	0%	

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Count Name: Kuhio Hwy Lehua St 3-15-17 to 3-17-17
Site Code: Hokua Place
Start Date: 03/15/2017

Turning Movement Data

Start Time	Lehua St Eastbound				Kuhio Hwy Northbound				Kuhio Hwy Southbound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
3:00 PM	71	3	1	74	2	142	0	144	0	140	59	0	199	417
3:15 PM	68	4	14	72	4	137	0	141	0	146	51	0	197	410
3:30 PM	75	2	8	77	2	136	0	138	0	154	56	0	210	425
3:45 PM	72	1	2	73	2	148	0	150	0	134	45	0	179	402
Hourly Total	286	10	25	296	10	563	0	573	0	574	211	0	785	1654
4:00 PM	69	4	6	73	1	145	1	146	0	135	54	0	189	408
4:15 PM	72	2	1	74	5	144	1	149	0	139	37	0	176	399
4:30 PM	75	2	5	77	3	143	0	146	0	130	45	0	175	398
4:45 PM	74	0	5	74	5	160	0	165	0	164	38	0	202	441
Hourly Total	290	8	17	298	14	592	2	606	0	568	174	0	742	1646
5:00 PM	82	0	5	82	0	134	0	134	0	140	55	0	195	411
5:15 PM	85	1	6	86	7	145	0	152	0	145	51	0	196	434
5:30 PM	96	2	3	98	2	163	0	165	0	137	34	0	171	434
5:45 PM	69	2	8	71	1	161	0	162	0	131	25	0	156	389
Hourly Total	332	5	22	337	10	603	0	613	0	553	165	0	718	1668
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7:00 AM	51	0	1	51	0	140	0	140	0	213	8	0	221	412
7:15 AM	86	0	2	86	4	168	0	172	0	191	20	0	211	469
7:30 AM	95	1	0	96	1	163	0	164	0	170	15	0	185	445
7:45 AM	64	1	2	65	1	180	0	181	0	184	15	0	199	445
Hourly Total	296	2	5	298	6	651	0	657	0	758	58	0	816	1771
8:00 AM	45	0	4	45	2	169	0	171	1	189	18	0	208	424
8:15 AM	29	1	3	30	10	145	0	155	0	194	12	0	206	391
8:30 AM	34	3	3	37	2	168	0	170	0	185	16	0	201	408
8:45 AM	41	1	10	42	5	161	0	166	0	150	21	0	171	379
Hourly Total	149	5	20	154	19	643	0	662	1	718	67	0	786	1602
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	85	2	3	87	3	131	0	134	0	153	49	0	202	423
3:15 PM	67	1	7	68	5	162	0	167	0	138	42	0	180	415
3:30 PM	71	4	4	75	6	145	0	151	0	155	55	0	210	436
3:45 PM	78	2	1	80	5	141	0	146	0	146	35	0	181	407
Hourly Total	301	9	15	310	19	579	0	598	0	592	181	0	773	1681
4:00 PM	71	0	0	71	4	148	0	152	0	163	51	0	214	437
4:15 PM	66	2	1	68	2	145	0	147	0	119	39	0	158	373
4:30 PM	68	3	0	71	1	175	0	176	0	158	45	0	203	450
4:45 PM	81	1	1	82	1	134	0	135	0	146	25	0	171	388
Hourly Total	286	6	2	292	8	602	0	610	0	586	160	0	746	1648
5:00 PM	80	1	1	81	3	140	0	143	0	163	34	0	197	421
5:15 PM	74	1	6	75	2	161	0	163	0	160	27	0	187	425
5:30 PM	50	2	0	52	4	167	0	171	0	158	28	0	186	409
5:45 PM	55	1	2	56	3	133	0	136	0	151	33	0	184	376
Hourly Total	259	5	9	264	12	601	0	613	0	632	122	0	754	1631
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6:45 AM	32	4	1	36	2	107	0	109	0	178	13	7	191	336
Hourly Total	32	4	1	36	2	107	0	109	0	178	13	7	191	336
7:00 AM	62	1	2	63	1	115	0	116	0	183	13	0	196	375
7:15 AM	62	0	1	62	0	170	0	170	0	188	12	0	200	432
7:30 AM	87	0	1	87	2	181	0	183	0	177	9	0	186	456
7:45 AM	69	0	0	69	1	173	0	174	0	195	18	0	213	456
Hourly Total	280	1	4	281	4	639	0	643	0	743	52	0	795	1719
8:00 AM	42	1	3	43	4	144	0	148	0	168	10	0	178	369
8:15 AM	35	1	2	36	1	156	0	157	0	189	21	0	210	403
8:30 AM	23	0	4	23	0	141	0	141	0	172	12	0	184	348
Grand Total	2611	57	129	2668	109	6021	2	6130	1	6431	1246	7	7678	16476
Approach %	97.9	2.1	-	-	1.8	98.2	-	-	0.0	83.8	16.2	-	-	-
Total %	15.8	0.3	-	16.2	0.7	36.5	-	37.2	0.0	39.0	7.6	-	46.6	-
Lights	2566	56	-	2622	109	5892	-	6001	1	6326	1180	-	7507	16130
% Lights	98.3	98.2	-	98.3	100.0	97.9	-	97.9	100.0	98.4	94.7	-	97.8	97.9
Mediums	43	1	-	44	0	120	-	120	0	99	64	-	163	327
% Mediums	1.6	1.8	-	1.6	0.0	2.0	-	2.0	0.0	1.5	5.1	-	2.1	2.0
Articulated Trucks	2	0	-	2	0	9	-	9	0	6	2	-	8	19
% Articulated Trucks	0.1	0.0	-	0.1	0.0	0.1	-	0.1	0.0	0.1	0.2	-	0.1	0.1
All Pedestrians	-	-	129	-	-	-	2	-	-	-	-	7	-	-
% All Pedestrians	-	-	100.0	-	-	-	100.0	-	-	-	-	100.0	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Kuhio Hwy [SB]

Exit	Enter	Total
8458	7507	15965
163	163	326
11	8	19
0	0	0
8632	**7678**	**16310**

RT	Th	LT	Ped
1180	6326	1	0
64	99	0	0
2	6	0	0
0	0	0	7
1246	**6431**	**1**	**7**

Lehua St [EB]

Exit	Enter	Total
1289	2622	3911
64	44	108
2	2	4
0	0	0
1355	**2668**	**4023**

LT	RT	Ped
2566	56	0
43	1	0
2	0	0
0	0	129
2611	**57**	**129**

Fake Approach [WB]

Exit	Enter	Total
1	0	1
0	0	0
0	0	0
0	0	0
1	**0**	**1**

03/15/2017 3:00 PM
Ending At
03/17/2017 8:45 AM

Lights
Mediums
Articulated Trucks
All Pedestrians

LT	Th	Ped
109	5892	0
0	120	0
0	9	0
0	0	2
109	**6021**	**2**

Kuhio Hwy [NB]

Exit	Enter	Total
6382	6001	12383
100	120	220
6	9	15
0	0	0
6488	**6130**	**12618**

Turning Movement Data Plot

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (4:45 PM)

Start Time	Lehua St Eastbound				Kuhio Hwy Northbound				Kuhio Hwy Southbound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
4:45 PM	74	0	5	74	5	160	0	165	0	164	38	0	202	441
5:00 PM	82	0	5	82	0	134	0	134	0	140	55	0	195	411
5:15 PM	85	1	6	86	7	145	0	152	0	145	51	0	196	434
5:30 PM	96	2	3	98	2	163	0	165	0	137	34	0	171	434
Total	337	3	19	340	14	602	0	616	0	586	178	0	764	1720
Approach %	99.1	0.9	-	-	2.3	97.7	-	-	0.0	76.7	23.3	-	-	-
Total %	19.6	0.2	-	19.8	0.8	35.0	-	35.8	0.0	34.1	10.3	-	44.4	-
PHF	0.878	0.375	-	0.867	0.500	0.923	-	0.933	0.000	0.893	0.809	-	0.946	0.975
Lights	332	3	-	335	14	598	-	612	0	581	173	-	754	1701
% Lights	98.5	100.0	-	98.5	100.0	99.3	-	99.4	-	99.1	97.2	-	98.7	98.9
Mediums	5	0	-	5	0	4	-	4	0	5	5	-	10	19
% Mediums	1.5	0.0	-	1.5	0.0	0.7	-	0.6	-	0.9	2.8	-	1.3	1.1
Articulated Trucks	0	0	-	0	0	0	-	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	-	0.0	0.0	0.0	-	0.0	-	0.0	0.0	-	0.0	0.0
All Pedestrians	-	-	19	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Kuhio Hwy [SB]

Exit	Enter	Total
930	754	1684
9	10	19
0	0	0
0	0	0
939	**764**	**1703**

RT	Th	LT	Ped
173	581	0	0
5	5	0	0
0	0	0	0
0	0	0	0
178	**586**	**0**	**0**

Lehua St [EB]

Total	Enter	Exit
522	335	187
10	5	5
0	0	0
0	0	0
532	**340**	**192**

LT	RT	Ped
332	3	0
5	0	0
0	0	0
0	0	19
337	**3**	**19**

Peak Hour Data

03/15/2017 4:45 PM
Ending At
03/15/2017 5:45 PM

Lights
Mediums
Articulated Trucks
All Pedestrians

Fake Approach [WB]

Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

LT	Th	Ped
14	598	0
0	4	0
0	0	0
0	0	0
14	**602**	**0**

Exit	Enter	Total
584	612	1196
5	4	9
0	0	0
0	0	0
589	**616**	**1205**

Kuhio Hwy [NB]

Turning Movement Peak Hour Data Plot (4:45 PM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (7:15 AM)

Start Time	Lehua St Eastbound				Kuhio Hwy Northbound				Kuhio Hwy Southbound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
7:15 AM	86	0	2	86	4	168	0	172	0	191	20	0	211	469
7:30 AM	95	1	0	96	1	163	0	164	0	170	15	0	185	445
7:45 AM	64	1	2	65	1	180	0	181	0	184	15	0	199	445
8:00 AM	45	0	4	45	2	169	0	171	1	189	18	0	208	424
Total	290	2	8	292	8	680	0	688	1	734	68	0	803	1783
Approach %	99.3	0.7	-	-	1.2	98.8	-	-	0.1	91.4	8.5	-	-	-
Total %	16.3	0.1	-	16.4	0.4	38.1	-	38.6	0.1	41.2	3.8	-	45.0	-
PHF	0.763	0.500	-	0.760	0.500	0.944	-	0.950	0.250	0.961	0.850	-	0.951	0.950
Lights	287	2	-	289	8	658	-	666	1	720	57	-	778	1733
% Lights	99.0	100.0	-	99.0	100.0	96.8	-	96.8	100.0	98.1	83.8	-	96.9	97.2
Mediums	3	0	-	3	0	20	-	20	0	13	10	-	23	46
% Mediums	1.0	0.0	-	1.0	0.0	2.9	-	2.9	0.0	1.8	14.7	-	2.9	2.6
Articulated Trucks	0	0	-	0	0	2	-	2	0	1	1	-	2	4
% Articulated Trucks	0.0	0.0	-	0.0	0.0	0.3	-	0.3	0.0	0.1	1.5	-	0.2	0.2
All Pedestrians	-	-	8	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Kuhio Hwy [SB]

Exit	Enter	Total
945	778	1723
23	23	46
2	2	4
0	0	0
970	**803**	**1773**

RT	Th	LT	Ped
57	720	1	0
10	13	0	0
1	1	0	0
0	0	0	0
68	**734**	**1**	**0**

Peak Hour Data

Lehua St [EB]

Exit	Enter	Total
65	289	354
10	3	13
1	0	1
0	0	0
76	**292**	**368**

LT	RT	Ped
287	2	0
3	0	0
0	0	0
0	0	8
290	**2**	**8**

03/16/2017 7:15 AM
Ending At
03/16/2017 8:15 AM

Lights
Mediums
Articulated Trucks
All Pedestrians

Fake Approach [WB]

Exit	Enter	Total
1	0	1
0	0	0
0	0	0
0	0	0
1	**0**	**1**

LT	Th	Ped
8	658	0
0	20	0
0	2	0
0	0	0
8	**680**	**0**

Exit	Enter	Total
722	666	1388
13	20	33
1	2	3
0	0	0
736	**688**	**1424**

Kuhio Hwy [NB]

Turning Movement Peak Hour Data Plot (7:15 AM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (3:15 PM)

Start Time	Lehua St Eastbound				Kuhio Hwy Northbound				Kuhio Hwy Southbound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
3:15 PM	67	1	7	68	5	162	0	167	0	138	42	0	180	415
3:30 PM	71	4	4	75	6	145	0	151	0	155	55	0	210	436
3:45 PM	78	2	1	80	5	141	0	146	0	146	35	0	181	407
4:00 PM	71	0	0	71	4	148	0	152	0	163	51	0	214	437
Total	287	7	12	294	20	596	0	616	0	602	183	0	785	1695
Approach %	97.6	2.4	-	-	3.2	96.8	-	-	0.0	76.7	23.3	-	-	-
Total %	16.9	0.4	-	17.3	1.2	35.2	-	36.3	0.0	35.5	10.8	-	46.3	-
PHF	0.920	0.438	-	0.919	0.833	0.920	-	0.922	0.000	0.923	0.832	-	0.917	0.970
Lights	285	7	-	292	20	592	-	612	0	590	177	-	767	1671
% Lights	99.3	100.0	-	99.3	100.0	99.3	-	99.4	-	98.0	96.7	-	97.7	98.6
Mediums	2	0	-	2	0	4	-	4	0	11	6	-	17	23
% Mediums	0.7	0.0	-	0.7	0.0	0.7	-	0.6	-	1.8	3.3	-	2.2	1.4
Articulated Trucks	0	0	-	0	0	0	-	0	0	1	0	-	1	1
% Articulated Trucks	0.0	0.0	-	0.0	0.0	0.0	-	0.0	-	0.2	0.0	-	0.1	0.1
All Pedestrians	-	-	12	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-

Peak Hour Data

03/16/2017 3:15 PM
Ending At
03/16/2017 4:15 PM

Lights
Mediums
Articulated Trucks
All Pedestrians

Kuhio Hwy [SB]

Exit	Enter	Total
877	767	1644
6	17	23
0	1	1
0	0	0
883	**785**	**1668**

RT	Th	LT	Ped
177	590	0	0
6	11	0	0
0	1	0	0
0	0	0	0
183	**602**	**0**	**0**

Lehua St [EB]

Exit	Enter	Total
197	292	489
6	2	8
0	0	0
0	0	0
203	**294**	**497**

Ped	RT	LT
0	7	285
0	0	2
0	0	0
12	0	0
12	**7**	**287**

Fake Approach [WB]

Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

LT	Th	Ped
20	592	0
0	4	0
0	0	0
0	0	0
20	**596**	**0**

Exit	Enter	Total
597	612	1209
11	4	15
1	0	1
0	0	0
609	**616**	**1225**

Kuhio Hwy [NB]

Turning Movement Peak Hour Data Plot (3:15 PM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (7:00 AM)

Start Time	Lehua St Eastbound				Kuhio Hwy Northbound				Kuhio Hwy Southbound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
7:00 AM	62	1	2	63	1	115	0	116	0	183	13	0	196	375
7:15 AM	62	0	1	62	0	170	0	170	0	188	12	0	200	432
7:30 AM	87	0	1	87	2	181	0	183	0	177	9	0	186	456
7:45 AM	69	0	0	69	1	173	0	174	0	195	18	0	213	456
Total	280	1	4	281	4	639	0	643	0	743	52	0	795	1719
Approach %	99.6	0.4	-	-	0.6	99.4	-	-	0.0	93.5	6.5	-	-	-
Total %	16.3	0.1	-	16.3	0.2	37.2	-	37.4	0.0	43.2	3.0	-	46.2	-
PHF	0.805	0.250	-	0.807	0.500	0.883	-	0.878	0.000	0.953	0.722	-	0.933	0.942
Lights	276	1	-	277	4	614	-	618	0	729	42	-	771	1666
% Lights	98.6	100.0	-	98.6	100.0	96.1	-	96.1	-	98.1	80.8	-	97.0	96.9
Mediums	4	0	-	4	0	22	-	22	0	13	10	-	23	49
% Mediums	1.4	0.0	-	1.4	0.0	3.4	-	3.4	-	1.7	19.2	-	2.9	2.9
Articulated Trucks	0	0	-	0	0	3	-	3	0	1	0	-	1	4
% Articulated Trucks	0.0	0.0	-	0.0	0.0	0.5	-	0.5	-	0.1	0.0	-	0.1	0.2
All Pedestrians	-	-	4	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-

Kuhio Hwy [SB]

Exit	Enter	Total
890	771	1661
26	23	49
3	1	4
0	0	0
919	**795**	**1714**

RT	Th	LT	Ped
42	729	0	0
10	13	0	0
0	1	0	0
0	0	0	0
52	**743**	**0**	**0**

Lehua St [EB]

Exit	Enter	Total
46	277	323
10	4	14
0	0	0
0	0	0
56	**281**	**337**

LT	RT	Ped
276	1	0
4	0	0
0	0	0
0	0	4
280	**1**	**4**

Peak Hour Data

03/17/2017 7:00 AM
Ending At
03/17/2017 8:00 AM

Lights
Mediums
Articulated Trucks
All Pedestrians

Fake Approach [WB]

Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

LT	Th	Ped
4	614	0
0	22	0
0	3	0
0	0	0
4	**639**	**0**

Kuhio Hwy [NB]

Exit	Enter	Total
730	618	1348
13	22	35
1	3	4
0	0	0
744	**643**	**1387**

Turning Movement Peak Hour Data Plot (7:00 AM)

Study Name **Kuhio Hwy Ulu St Ohia St 3-15-17 to 3-17-17**
Start Date **3/15/17**
Start Time **3:00 PM**
Site Code **Hokua Place**

Start	Ohia St Eastbound					Pono Kai Dwy Westbound					Kuhio Hwy Northbound					Kuhio Hwy Southbound					Ulu St Southeast Bound					Intersection	
3/15/17	LT-Ulu	LT-Kuhio	Thru	RT-Kuhio	RT-Ulu	LT-Kuhio	LT-Ulu	Thru	RT-Ulu	RT-Kuhio	UT-Ulu	LT-Ohia	LT-Ulu	Thru	Right-Turn	Left-Turn	Thru	RT-Ulu	RT-Ohia	UT-Ulu	UT-Kuhio	LT-Dwy	RT-Kuhio	Thru	RT-Ohia	15-Min Totals	Hourly Totals
3:00 PM	2	0	0	0	0	0	0	0	0	3	0	0	74	154	6	0	154	0	0	2	0	0	0	55	0	450	1699
3:15 PM	4	0	0	0	0	0	0	0	0	3	1	0	61	124	18	3	128	0	0	5	0	0	0	74	3	424	1656
3:30 PM	3	0	0	0	0	0	0	0	0	2	0	1	77	106	4	3	138	0	0	3	0	0	0	67	0	404	1632
3:45 PM	1	0	0	0	2	0	0	0	0	0	0	1	75	123	11	2	136	0	0	4	0	0	0	63	3	421	1640
4:00 PM	3	0	1	0	0	0	0	0	0	2	0	0	66	118	8	1	139	0	2	2	0	0	0	63	2	407	1673
4:15 PM	2	1	0	0	0	0	0	0	0	1	0	0	55	121	12	1	126	0	0	3	0	0	0	76	2	400	1674
4:30 PM	0	0	1	0	0	0	0	0	0	3	0	0	66	137	12	0	125	0	0	1	0	1	0	65	1	412	1715
4:45 PM	1	0	0	0	0	0	0	0	0	2	1	0	70	136	14	1	166	0	0	1	0	0	0	62	0	454	1734
5:00 PM	1	0	0	0	0	1	0	0	0	1	0	0	91	120	10	3	132	0	1	3	0	0	0	44	1	408	1670
5:15 PM	0	1	0	0	1	0	0	0	0	2	1	1	78	131	12	1	156	0	1	1	0	0	0	54	1	441	
5:30 PM	2	0	0	0	2	0	0	0	0	2	0	0	68	157	9	2	152	0	3	0	0	0	0	34	0	431	
5:45 PM	2	0	0	0	1	0	0	0	0	3	0	1	64	131	8	1	138	0	1	1	0	0	0	35	4	390	
3/16/17																											
7:00 AM	2	0	0	0	2	0	0	0	0	3	0	0	16	135	1	0	200	0	3	2	0	0	0	46	3	413	1664
7:15 AM	1	1	0	0	1	0	0	0	0	0	0	3	24	162	1	0	182	0	2	0	2	0	0	39	2	420	1673
7:30 AM	5	4	0	0	2	0	0	0	0	0	0	0	23	165	5	2	162	0	0	0	0	0	0	50	1	419	1683
7:45 AM	1	0	0	0	1	0	0	0	0	2	0	0	27	157	3	1	159	0	1	2	0	0	0	57	1	412	1710
8:00 AM	0	0	0	0	0	0	0	0	0	3	0	0	32	158	4	4	180	0	2	0	0	0	0	38	1	422	**1743**
8:15 AM	0	0	1	0	2	0	0	0	0	2	0	0	27	164	2	1	195	0	0	1	0	0	0	34	1	430	
8:30 AM	1	0	0	0	3	0	0	0	0	1	0	0	22	187	5	0	173	0	0	1	0	0	0	51	2	**446**	
8:45 AM	2	0	0	0	1	1	0	0	0	3	0	0	29	188	4	2	165	0	0	1	0	0	0	47	2	445	
3/16/17																											
3:00 PM	1	0	0	0	1	1	0	0	0	1	1	0	57	124	8	0	152	0	0	0	0	0	0	42	2	390	1643
3:15 PM	2	0	0	0	0	0	0	0	0	2	0	0	76	145	13	0	140	0	0	0	0	0	0	39	1	418	1705
3:30 PM	0	0	0	0	2	0	0	0	0	2	0	0	67	142	10	3	164	0	0	0	0	0	0	38	1	429	1688
3:45 PM	1	0	0	0	0	0	0	0	0	1	0	0	81	118	9	4	155	0	0	0	0	0	0	36	1	406	1732
4:00 PM	3	0	0	0	0	0	0	0	0	1	0	0	71	147	6	3	162	0	0	0	0	0	0	57	2	452	1743
4:15 PM	1	0	0	0	0	0	0	0	0	0	0	0	72	137	10	0	131	0	0	2	0	0	0	48	0	401	1714
4:30 PM	2	0	0	0	0	0	0	0	0	3	0	0	95	163	3	3	152	0	0	1	0	0	0	50	1	**473**	**1756**
4:45 PM	0	0	0	0	0	1	0	0	0	2	0	0	76	153	5	1	139	0	0	1	0	0	0	39	0	417	1704
5:00 PM	2	1	0	0	0	0	0	0	0	4	0	0	60	141	6	1	162	0	0	0	0	0	0	46	0	423	1695
5:15 PM	2	0	0	0	0	1	0	0	0	2	2	2	71	140	6	1	159	0	1	2	0	0	0	53	1	443	
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	1	58	163	5	1	150	0	0	0	0	0	0	43	0	421	
5:45 PM	1	0	0	0	1	0	0	0	0	2	0	1	53	139	5	1	156	0	0	1	0	0	0	47	1	408	
3/17/17																											
7:00 AM	2	1	0	0	1	0	0	0	0	1	0	1	19	123	0	1	185	0	2	0	0	0	0	48	2	386	1668
7:15 AM	1	1	0	0	0	0	0	0	0	0	0	0	25	182	2	3	172	0	1	0	1	0	0	45	1	434	1680
7:30 AM	5	1	0	0	1	0	0	0	0	0	0	0	21	162	2	2	176	0	1	0	0	0	0	50	0	421	1676
7:45 AM	4	1	0	0	0	1	0	0	0	2	0	0	25	145	3	1	172	0	0	3	0	0	0	67	3	427	1655
8:00 AM	0	1	0	0	0	0	0	0	0	0	1	0	24	148	4	1	170	0	1	1	0	0	0	45	2	398	1660
8:15 AM	0	0	0	0	0	0	0	0	0	4	0	0	27	174	7	0	159	0	1	0	0	0	0	56	2	430	
8:30 AM	0	2	0	0	0	1	0	0	0	2	0	1	30	126	1	3	178	0	0	1	0	0	0	52	3	400	
8:45 AM	0	2	0	0	1	0	0	0	0	4	0	2	21	166	4	1	181	0	0	2	0	0	0	46	2	432	

AM Peak Hour Traffic			3/16/17																							
8:00 AM	3	0	1	0	6	1	0	0	0	9	0	0	110	697	15	7	713	0	2	3	0	0	0	170	6	1743
PHF	0.75	N/A	N/A	N/A	0.50	N/A	N/A	N/A	N/A	2.25	N/A	N/A	1.25	0.93	0.75	N/A	1.03	N/A	N/A	0.75	N/A	N/A	N/A	0.83	0.75	0.98
PHV	4	0	0	0	12	0	0	0	0	4	0	0	88	748	20	0	692	0	0	4	0	0	0	204	8	1784
T Factor	0%	N/A	0%	N/A	17%	0%	N/A	N/A	N/A	11%	N/A	N/A	5%	4%	0%	0%	3%	N/A	0%	0%	N/A	N/A	N/A	4%	17%	
													5	29	0		20									
														4%			3%									
PM Peak Hour Traffic			3/16/17																							
4:30 PM	6	1	0	0	0	2	0	0	0	11	2	2	302	597	20	6	612	0	1	4	0	0	0	188	2	1756
PHF	0.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.92	N/A	N/A	0.79	0.92	1.67	0.50	1.01	N/A	N/A	1.00	N/A	N/A	N/A	0.94	0.50	0.93
PHV	8	0	0	0	0	0	0	0	0	12	0	0	380	652	12	12	608	0	0	4	0	0	0	200	4	1892
T Factor	0%	0%	N/A	N/A	N/A	0%	N/A	N/A	N/A	0%	0%	0%	1%	1%	0%	0%	0%	N/A	0%	0%	N/A	N/A	N/A	1%	0%	

Study Name **Olohena Rd Lehua St Kahau St 3-13-17 to 3-15-17**
Start Date **03/13/2017**
Start Time **3:00 PM**
Site Code **Hokua Place**

Start	Olohena Rd Eastbound			Olohena Rd Westbound			Kahau St Southbound			Lehua St Southwest Bound			Intersection	
3/13/17	LT-Kahau	LT-Lehua	Thru	Thru	RT-Kahau	RT-Lehua	UT-Lehua	LT-Olohena	Right-Turn	LT-Olohena	RT-Olohena	UT-Kahau	15-Min Totals	Hourly Totals
3:00 PM	12	55	88	79	3	12	9	8	16	8	38	9	337	**1326**
3:15 PM	12	90	70	52	9	10	3	9	6	18	44	11	334	1308
3:30 PM	9	80	53	86	7	21	2	2	6	12	51	8	**337**	1277
3:45 PM	7	60	63	86	7	13	4	3	5	12	51	7	318	1212
4:00 PM	18	68	56	77	8	11	5	8	4	8	42	14	319	1177
4:15 PM	22	59	42	82	9	12	0	4	3	8	43	19	303	
4:30 PM	19	49	65	72	3	7	4	6	3	8	33	3	272	
4:45 PM	9	71	38	81	7	11	2	7	6	11	33	7	283	
3/14/17														
6:30 AM	3	23	36	15	2	0	2	0	0	2	5	4	92	573
6:45 AM	2	40	41	13	7	0	5	4	0	0	10	4	126	698
7:00 AM	4	52	46	25	2	1	1	2	4	1	8	3	149	787
7:15 AM	6	84	57	29	5	3	0	5	1	3	12	1	206	818
7:30 AM	4	81	58	35	0	3	11	3	6	2	13	1	217	762
7:45 AM	4	66	94	28	2	1	0	3	3	0	13	1	215	
8:00 AM	2	38	81	28	1	3	3	2	2	0	18	2	180	
8:15 AM	8	35	49	31	3	4	1	2	5	1	8	3	150	
3/14/17														
3:30 PM	8	61	57	28	4	12	5	5	3	6	25	13	227	1158
3:45 PM	14	66	53	56	8	11	2	7	3	12	40	7	279	1229
4:00 PM	24	78	44	70	10	19	1	9	5	15	46	6	327	1223
4:15 PM	14	55	50	84	10	13	3	12	3	12	54	15	325	1149
4:30 PM	14	81	53	61	3	10	1	3	4	5	56	7	298	1079
4:45 PM	14	66	56	76	3	8	1	7	4	5	26	7	273	
5:00 PM	10	65	45	72	5	8	0	3	4	0	37	4	253	
5:15 PM	9	76	37	71	6	9	0	2	5	8	30	2	255	
3/15/17														
6:30 AM	4	18	27	9	5	0	2	2	1	2	6	6	82	602
6:45 AM	4	48	54	23	8	0	2	7	2	1	7	6	162	748
7:00 AM	1	53	54	23	1	1	1	3	1	0	9	1	148	829
7:15 AM	7	81	59	16	1	4	9	4	8	2	17	2	210	**839**
7:30 AM	2	95	59	35	5	6	0	2	5	1	18	0	228	793
7:45 AM	2	90	89	27	2	3	2	1	6	0	20	1	**243**	
8:00 AM	4	36	58	29	2	2	2	1	2	4	17	1	158	
8:15 AM	1	42	62	21	3	1	0	4	7	4	17	2	164	

AM Peak Hour Traffic			3/15/17										
7:15 AM	15	302	265	107	10	15	13	8	21	7	72	4	839
PHF	1.88	0.84	0.74	0.99	1.25	1.25	1.63	2.00	0.88	N/A	0.90	1.00	0.86
Peak Flow	8	360	356	108	8	12	8	4	24	7	80	4	972
T Factor	0%	1%	4%	3%	10%	0%	8%	50%	19%	0%	7%	25%	
PM Peak Hour Traffic		1.0%	3/13/17					23.8%			7.2%		
3:00 PM	40	285	274	303	26	56	18	22	33	50	184	35	1326
PHF	1.11	0.89	1.29	0.88	0.93	0.67	2.25	2.75	1.38	1.04	0.90	1.09	0.98
Peak Flow	36	320	212	344	28	84	8	8	24	48	204	32	1348
T Factor	13%	3%	4%	1%	0%	2%	0%	0%	6%	2%	2%	0%	

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Data

Start Time	Olohena Rd Eastbound				Olohena Rd Westbound			Kapaa Bypass Rd Northbound			Kapaa Bypass Rd Southbound				
	Left-Turn	Thru	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
3:00 PM	2	106	33	141	33	102	135	64	38	102	21	32	10	63	441
3:15 PM	4	65	17	86	29	73	102	67	65	132	33	63	28	124	444
3:30 PM	4	50	18	72	42	98	140	57	72	129	14	69	19	102	443
3:45 PM	1	49	11	61	32	118	150	77	57	134	19	46	29	94	439
Hourly Total	11	270	79	360	136	391	527	265	232	497	87	210	86	383	1767
4:00 PM	1	47	17	65	24	114	138	82	78	160	15	66	17	98	461
4:15 PM	2	48	17	67	10	126	136	83	64	147	16	61	10	87	437
4:30 PM	2	35	11	48	16	105	121	89	76	165	13	57	19	89	423
4:45 PM	3	40	12	55	17	109	126	80	64	144	11	41	19	71	396
Hourly Total	8	170	57	235	67	454	521	334	282	616	55	225	65	345	1717
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6:30 AM	0	46	37	83	7	16	23	5	4	9	10	40	4	54	169
6:45 AM	3	61	45	109	7	17	24	3	5	8	20	66	9	95	236
Hourly Total	3	107	82	192	14	33	47	8	9	17	30	106	13	149	405
7:00 AM	3	86	76	165	11	28	39	10	2	12	14	96	24	134	350
7:15 AM	3	107	59	169	10	33	43	23	12	35	30	119	31	180	427
7:30 AM	7	116	40	163	10	47	57	25	9	34	30	95	56	181	435
7:45 AM	8	112	34	154	10	35	45	26	13	39	36	101	41	178	416
Hourly Total	21	421	209	651	41	143	184	84	36	120	110	411	152	673	1628
8:00 AM	2	77	27	106	13	32	45	10	11	21	24	91	22	137	309
8:15 AM	1	65	21	87	12	32	44	12	5	17	20	68	14	102	250
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	3	142	48	193	25	64	89	22	16	38	44	159	36	239	559
3:30 PM	2	42	19	63	18	37	55	41	61	102	14	48	19	81	301
3:45 PM	3	46	6	55	37	86	123	93	84	177	14	46	20	80	435
Hourly Total	5	88	25	118	55	123	178	134	145	279	28	94	39	161	736
4:00 PM	2	38	17	57	36	104	140	66	74	140	22	70	44	136	473
4:15 PM	2	51	15	68	42	104	146	68	58	126	11	62	23	96	436
4:30 PM	4	38	12	54	43	85	128	77	76	153	22	65	21	108	443
4:45 PM	4	47	15	66	31	84	115	98	77	175	11	42	20	73	429
Hourly Total	12	174	59	245	152	377	529	309	285	594	66	239	108	413	1781
5:00 PM	5	41	18	64	21	106	127	98	69	167	15	55	28	98	456
5:15 PM	2	36	12	50	29	92	121	96	82	178	10	43	24	77	426
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	7	77	30	114	50	198	248	194	151	345	25	98	52	175	882
6:30 AM	0	38	43	81	8	9	17	3	1	4	9	51	6	66	168
6:45 AM	2	79	56	137	9	26	35	10	7	17	18	58	10	86	275
Hourly Total	2	117	99	218	17	35	52	13	8	21	27	109	16	152	443
7:00 AM	2	90	59	151	10	26	36	10	2	12	13	98	16	127	326
7:15 AM	1	108	62	171	17	24	41	26	6	32	24	107	45	176	420
7:30 AM	4	116	34	154	16	47	63	27	8	35	32	111	50	193	445
7:45 AM	10	126	45	181	13	45	58	25	12	37	39	83	47	169	445
Hourly Total	17	440	200	657	56	142	198	88	28	116	108	399	158	665	1636
8:00 AM	3	73	34	110	13	39	52	16	8	24	16	99	16	131	317
8:15 AM	4	86	21	111	15	30	45	9	8	17	15	72	10	97	270
Grand Total	96	2165	943	3204	641	2029	2670	1476	1208	2684	611	2221	751	3583	12141
Approach %	3.0	67.6	29.4	-	24.0	76.0	-	55.0	45.0	-	17.1	62.0	21.0	-	-
Total %	0.8	17.8	7.8	26.4	5.3	16.7	22.0	12.2	9.9	22.1	5.0	18.3	6.2	29.5	-
Lights	93	2104	922	3119	574	1982	2556	1459	1182	2641	598	2175	735	3508	11824
% Lights	96.9	97.2	97.8	97.3	89.5	97.7	95.7	98.8	97.8	98.4	97.9	97.9	97.9	97.9	97.4
Mediums	3	60	19	82	61	47	108	15	23	38	12	41	16	69	297
% Mediums	3.1	2.8	2.0	2.6	9.5	2.3	4.0	1.0	1.9	1.4	2.0	1.8	2.1	1.9	2.4
Articulated Trucks	0	1	2	3	6	0	6	2	3	5	1	5	0	6	20
% Articulated Trucks	0.0	0.0	0.2	0.1	0.9	0.0	0.2	0.1	0.2	0.2	0.2	0.2	0.0	0.2	0.2

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

03/13/2017 3:00 PM
Ending At
03/15/2017 8:30 AM

Lights
Mediums
Articulated Trucks

Kapaa Bypass Rd [SB]

Exit	Enter	Total
93	3508	3601
3	69	72
0	6	6
96	**3583**	**3679**

RT	Th	LT
735	2175	598
16	41	12
0	5	1
751	**2221**	**611**

Olohena Rd [EB]

Exit	Enter	Total
4176	3119	7295
78	82	160
2	3	5
4256	**3204**	**7460**

RT	Th	LT
922	2104	93
19	60	3
2	1	0
943	**2165**	**96**

Olohena Rd [WB]

Exit	Enter	Total
3884	2556	6440
95	108	203
5	6	11
3984	**2670**	**6654**

Th	LT
1982	574
47	61
0	6
2029	**641**

LT	RT
1459	1182
15	23
2	3
1476	**1208**

Exit	Enter	Total
3671	2641	6312
121	38	159
13	5	18
3805	**2684**	**6489**

Kapaa Bypass Rd [NB]

Turning Movement Data Plot

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

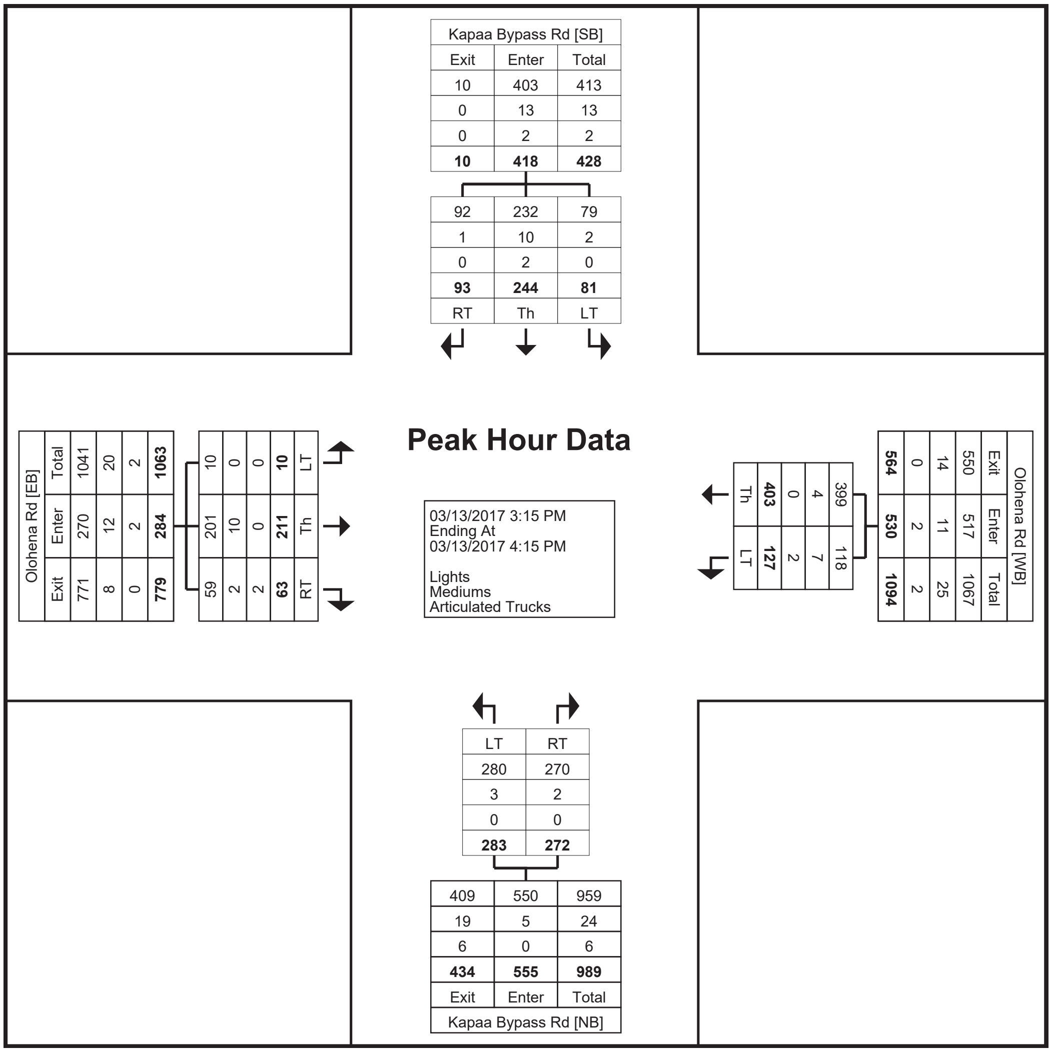
Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (3:15 PM)

Start Time	Olohena Rd Eastbound				Olohena Rd Westbound			Kapaa Bypass Rd Northbound			Kapaa Bypass Rd Southbound				
	Left-Turn	Thru	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
3:15 PM	4	65	17	86	29	73	102	67	65	132	33	63	28	124	444
3:30 PM	4	50	18	72	42	98	140	57	72	129	14	69	19	102	443
3:45 PM	1	49	11	61	32	118	150	77	57	134	19	46	29	94	439
4:00 PM	1	47	17	65	24	114	138	82	78	160	15	66	17	98	461
Total	10	211	63	284	127	403	530	283	272	555	81	244	93	418	1787
Approach %	3.5	74.3	22.2	-	24.0	76.0	-	51.0	49.0	-	19.4	58.4	22.2	-	-
Total %	0.6	11.8	3.5	15.9	7.1	22.6	29.7	15.8	15.2	31.1	4.5	13.7	5.2	23.4	-
PHF	0.625	0.812	0.875	0.826	0.756	0.854	0.883	0.863	0.872	0.867	0.614	0.884	0.802	0.843	0.969
Lights	10	201	59	270	118	399	517	280	270	550	79	232	92	403	1740
% Lights	100.0	95.3	93.7	95.1	92.9	99.0	97.5	98.9	99.3	99.1	97.5	95.1	98.9	96.4	97.4
Mediums	0	10	2	12	7	4	11	3	2	5	2	10	1	13	41
% Mediums	0.0	4.7	3.2	4.2	5.5	1.0	2.1	1.1	0.7	0.9	2.5	4.1	1.1	3.1	2.3
Articulated Trucks	0	0	2	2	2	0	2	0	0	0	0	2	0	2	6
% Articulated Trucks	0.0	0.0	3.2	0.7	1.6	0.0	0.4	0.0	0.0	0.0	0.0	0.8	0.0	0.5	0.3

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com



Turning Movement Peak Hour Data Plot (3:15 PM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (7:00 AM)

Start Time	Olohena Rd Eastbound				Olohena Rd Westbound			Kapaa Bypass Rd Northbound			Kapaa Bypass Rd Southbound				
	Left-Turn	Thru	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
7:00 AM	3	86	76	165	11	28	39	10	2	12	14	96	24	134	350
7:15 AM	3	107	59	169	10	33	43	23	12	35	30	119	31	180	427
7:30 AM	7	116	40	163	10	47	57	25	9	34	30	95	56	181	435
7:45 AM	8	112	34	154	10	35	45	26	13	39	36	101	41	178	416
Total	21	421	209	651	41	143	184	84	36	120	110	411	152	673	1628
Approach %	3.2	64.7	32.1	-	22.3	77.7	-	70.0	30.0	-	16.3	61.1	22.6	-	-
Total %	1.3	25.9	12.8	40.0	2.5	8.8	11.3	5.2	2.2	7.4	6.8	25.2	9.3	41.3	-
PHF	0.656	0.907	0.688	0.963	0.932	0.761	0.807	0.808	0.692	0.769	0.764	0.863	0.679	0.930	0.936
Lights	21	410	205	636	31	136	167	83	35	118	108	406	150	664	1585
% Lights	100.0	97.4	98.1	97.7	75.6	95.1	90.8	98.8	97.2	98.3	98.2	98.8	98.7	98.7	97.4
Mediums	0	10	4	14	9	7	16	1	0	1	2	4	2	8	39
% Mediums	0.0	2.4	1.9	2.2	22.0	4.9	8.7	1.2	0.0	0.8	1.8	1.0	1.3	1.2	2.4
Articulated Trucks	0	1	0	1	1	0	1	0	1	1	0	1	0	1	4
% Articulated Trucks	0.0	0.2	0.0	0.2	2.4	0.0	0.5	0.0	2.8	0.8	0.0	0.2	0.0	0.1	0.2

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Peak Hour Data

03/14/2017 7:00 AM
Ending At
03/14/2017 8:00 AM

Lights
Mediums
Articulated Trucks

Kapaa Bypass Rd [SB]

Exit	Enter	Total
21	664	685
0	8	8
0	1	1
21	**673**	**694**

RT	Th	LT
150	406	108
2	4	2
0	1	0
152	**411**	**110**

Olohena Rd [EB]

Exit	Enter	Total
369	636	1005
10	14	24
0	1	1
379	**651**	**1030**

RT	Th	LT
205	410	21
4	10	0
0	1	0
209	**421**	**21**

Olohena Rd [WB]

Exit	Enter	Total
553	167	720
12	16	28
2	1	3
567	**184**	**751**

Th	LT
136	31
7	9
0	1
143	**41**

LT	RT
83	35
1	0
0	1
84	**36**

Kapaa Bypass Rd [NB]

Exit	Enter	Total
642	118	760
17	1	18
2	1	3
661	**120**	**781**

Turning Movement Peak Hour Data Plot (7:00 AM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (3:45 PM)

Start Time	Olohena Rd Eastbound				Olohena Rd Westbound			Kapaa Bypass Rd Northbound			Kapaa Bypass Rd Southbound				
	Left-Turn	Thru	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
3:45 PM	3	46	6	55	37	86	123	93	84	177	14	46	20	80	435
4:00 PM	2	38	17	57	36	104	140	66	74	140	22	70	44	136	473
4:15 PM	2	51	15	68	42	104	146	68	58	126	11	62	23	96	436
4:30 PM	4	38	12	54	43	85	128	77	76	153	22	65	21	108	443
Total	11	173	50	234	158	379	537	304	292	596	69	243	108	420	1787
Approach %	4.7	73.9	21.4	-	29.4	70.6	-	51.0	49.0	-	16.4	57.9	25.7	-	-
Total %	0.6	9.7	2.8	13.1	8.8	21.2	30.1	17.0	16.3	33.4	3.9	13.6	6.0	23.5	-
PHF	0.688	0.848	0.735	0.860	0.919	0.911	0.920	0.817	0.869	0.842	0.784	0.868	0.614	0.772	0.945
Lights	11	168	47	226	149	374	523	301	285	586	69	234	107	410	1745
% Lights	100.0	97.1	94.0	96.6	94.3	98.7	97.4	99.0	97.6	98.3	100.0	96.3	99.1	97.6	97.6
Mediums	0	5	3	8	9	5	14	2	7	9	0	8	1	9	40
% Mediums	0.0	2.9	6.0	3.4	5.7	1.3	2.6	0.7	2.4	1.5	0.0	3.3	0.9	2.1	2.2
Articulated Trucks	0	0	0	0	0	0	0	1	0	1	0	1	0	1	2
% Articulated Trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.4	0.0	0.2	0.1

Kapaa Bypass Rd [SB]

Exit	Enter	Total
11	410	421
0	9	9
0	1	1
11	**420**	**431**

RT	Th	LT
107	234	69
1	8	0
0	1	0
108	**243**	**69**

Olohena Rd [EB]

Exit	Enter	Total
782	226	1008
8	8	16
1	0	1
791	**234**	**1025**

LT	Th	RT
11	168	47
0	5	3
0	0	0
11	**173**	**50**

Peak Hour Data

03/14/2017 3:45 PM
Ending At
03/14/2017 4:45 PM

Lights
Mediums
Articulated Trucks

Th	LT
374	149
5	9
0	0
379	**158**

Exit	Enter	Total
522	523	1045
12	14	26
0	0	0
534	**537**	**1071**

Olohena Rd [WB]

LT	RT
301	285
2	7
1	0
304	**292**

Exit	Enter	Total
430	586	1016
20	9	29
1	1	2
451	**596**	**1047**

Kapaa Bypass Rd [NB]

Turning Movement Peak Hour Data Plot (3:45 PM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (7:00 AM)

Start Time	Olohena Rd Eastbound				Olohena Rd Westbound			Kapaa Bypass Rd Northbound			Kapaa Bypass Rd Southbound				
	Left-Turn	Thru	Right-Turn	App. Total	Left-Turn	Thru	App. Total	Left-Turn	Right-Turn	App. Total	Left-Turn	Thru	Right-Turn	App. Total	Int. Total
7:00 AM	2	90	59	151	10	26	36	10	2	12	13	98	16	127	326
7:15 AM	1	108	62	171	17	24	41	26	6	32	24	107	45	176	420
7:30 AM	4	116	34	154	16	47	63	27	8	35	32	111	50	193	445
7:45 AM	10	126	45	181	13	45	58	25	12	37	39	83	47	169	445
Total	17	440	200	657	56	142	198	88	28	116	108	399	158	665	1636
Approach %	2.6	67.0	30.4	-	28.3	71.7	-	75.9	24.1	-	16.2	60.0	23.8	-	-
Total %	1.0	26.9	12.2	40.2	3.4	8.7	12.1	5.4	1.7	7.1	6.6	24.4	9.7	40.6	-
PHF	0.425	0.873	0.806	0.907	0.824	0.755	0.786	0.815	0.583	0.784	0.692	0.899	0.790	0.861	0.919
Lights	16	430	195	641	45	135	180	87	28	115	105	395	153	653	1589
% Lights	94.1	97.7	97.5	97.6	80.4	95.1	90.9	98.9	100.0	99.1	97.2	99.0	96.8	98.2	97.1
Mediums	1	10	5	16	9	7	16	1	0	1	2	4	5	11	44
% Mediums	5.9	2.3	2.5	2.4	16.1	4.9	8.1	1.1	0.0	0.9	1.9	1.0	3.2	1.7	2.7
Articulated Trucks	0	0	0	0	2	0	2	0	0	0	1	0	0	1	3
% Articulated Trucks	0.0	0.0	0.0	0.0	3.6	0.0	1.0	0.0	0.0	0.0	0.9	0.0	0.0	0.2	0.2

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Peak Hour Data

03/15/2017 7:00 AM
Ending At
03/15/2017 8:00 AM

Lights
Mediums
Articulated Trucks

Kapaa Bypass Rd [SB]

Exit	Enter	Total
16	653	669
1	11	12
0	1	1
17	**665**	**682**

RT	Th	LT
153	395	105
5	4	2
0	0	1
158	**399**	**108**

Olohena Rd [EB]

Exit	Enter	Total
375	641	1016
13	16	29
0	0	0
388	**657**	**1045**

RT	Th	LT
195	430	16
5	10	1
0	0	0
200	**440**	**17**

Olohena Rd [WB]

Exit	Enter	Total
563	180	743
12	16	28
1	2	3
576	**198**	**774**

Th	LT
135	45
7	9
0	2
142	**56**

Kapaa Bypass Rd [NB]

LT	RT
87	28
1	0
0	0
88	**28**

Exit	Enter	Total
635	115	750
18	1	19
2	0	2
655	**116**	**771**

Turning Movement Peak Hour Data Plot (7:00 AM)

Study Name **Olohena Rd Kaapuni Rd Kaehulu Rd 3-13-17 to 3-15-17**
Start Date **03/13/2017**
Start Time **3:30 PM**
Site Code **Hokua Place**

Start	Olohena Rd Eastbound			Olohena Rd Westbound			Kaehulua Rd Southbound			Kaapuni Rd Southeast Bound			Intersection	
3/13/17	LT-Kaapuni	LT-Kaehulu	Thru	Thru	RT-Kaapuni	RT-Kaehulua	LT-Olohena	RT-Olohena	RT-Kaapuni	LT-Kaehulua	LT-Olohena	RT-Olohena	15-Min Totals	Hourly Totals
3:30 PM	4	5	33	38	70	3	0	0	0	0	28	5	186	811
3:45 PM	1	0	28	51	80	6	2	0	0	0	28	8	204	802
4:00 PM	4	0	37	54	84	3	2	0	0	0	21	5	210	797
4:15 PM	7	2	24	50	77	9	1	0	0	0	36	5	211	775
4:30 PM	6	0	18	49	64	5	0	0	1	0	25	9	177	744
4:45 PM	8	4	23	51	72	4	0	4	0	0	26	7	199	
5:00 PM	4	2	36	44	62	1	0	1	0	0	30	8	188	
5:15 PM	5	2	20	53	65	6	2	0	1	0	19	7	180	
3/14/17														
6:30 AM	4	1	36	10	6	0	2	2	0	0	52	5	118	702
6:45 AM	4	1	61	7	7	0	0	0	0	1	65	2	148	789
7:00 AM	3	1	79	14	15	2	2	0	0	1	78	3	198	**835**
7:15 AM	11	6	104	10	24	2	3	0	0	2	72	4	238	782
7:30 AM	3	9	86	17	28	4	1	1	0	5	45	6	205	674
7:45 AM	5	6	53	24	32	2	2	0	0	0	60	10	194	
8:00 AM	5	4	37	30	13	2	4	1	0	1	45	3	145	
8:15 AM	5	2	45	16	17	1	1	0	0	0	40	3	130	
3/14/17														
3:30 PM	6	2	30	33	35	2	0	3	1	2	42	4	160	800
3:45 PM	9	2	22	51	60	3	0	3	2	0	26	11	189	833
4:00 PM	8	5	29	69	64	6	1	2	0	1	29	15	229	**858**
4:15 PM	5	4	26	68	68	2	4	0	0	0	31	14	222	855
4:30 PM	10	0	19	60	63	3	0	2	1	2	24	9	193	834
4:45 PM	11	4	27	38	85	4	2	0	0	1	31	11	214	
5:00 PM	9	0	32	58	81	6	5	1	1	0	30	3	226	
5:15 PM	5	4	17	58	73	4	3	3	3	0	26	5	201	
3/15/17														
6:30 AM	2	1	33	9	2	0	2	3	0	0	49	2	103	658
6:45 AM	2	0	64	8	12	0	1	1	0	0	64	1	153	763
7:00 AM	2	2	83	11	9	2	2	0	0	0	73	9	193	824
7:15 AM	8	7	97	9	20	1	2	0	0	0	61	4	209	761
7:30 AM	10	7	82	21	23	4	1	0	0	0	54	6	208	699
7:45 AM	11	3	65	22	33	5	3	0	0	0	60	12	214	
8:00 AM	3	1	44	20	14	5	0	1	0	0	40	2	130	
8:15 AM	7	0	48	19	13	1	1	1	0	0	51	6	147	
AM Peak Hour Traffic			3/14/17											
7:00 AM	22	22	322	65	99	10	8	1	0	8	255	23	835	
PHF	0.50	0.92	0.77	1.63	1.03	1.25	0.67	N/A	N/A	1.00	0.89	1.44	0.88	
PHV	44	24	416	40	96	8	12	1	0	8	288	16	952	
T Factor	9%	0%	1%	0%	2%	0%	0%	0%	N/A	0%	2%	0%		
PM Peak Hour Traffic			3/14/17											
4:00 PM	34	13	101	235	280	15	7	4	1	4	115	49	858	
PHF	1.06	0.65	0.87	0.85	1.09	0.63	1.75	0.50	N/A	1.00	0.99	0.82	0.94	
PHV	32	20	116	276	256	24	4	8	1	4	116	60	916	
T Factor	0%	0%	2%	0%	1%	0%	0%	0%	0%	0%	2%	0%		

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Count Name: Kuhio Hwy Kapaa Bypass 3-15-17 to 3-17-17
Site Code: Hokua Place
Start Date: 03/15/2017
Page No: 1

Turning Movement Data

Start Time	Kapaa Bypass Rd Eastbound				Kuhio Hwy Northbound				Kuhio Hwy Southbound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
3:00 PM	1	105	0	106	99	191	0	290	0	106	5	0	111	507
3:15 PM	3	100	0	103	122	210	0	332	0	88	7	0	95	530
3:30 PM	8	93	0	101	120	207	0	327	0	73	8	0	81	509
3:45 PM	8	104	0	112	148	201	0	349	0	88	21	0	109	570
Hourly Total	20	402	0	422	489	809	0	1298	0	355	41	0	396	2116
4:00 PM	1	108	0	109	168	161	0	329	0	91	16	0	107	545
4:15 PM	9	94	0	103	154	172	0	326	0	97	14	0	111	540
4:30 PM	6	90	0	96	166	187	0	353	0	112	19	0	131	580
4:45 PM	2	95	0	97	146	176	0	322	0	112	15	0	127	546
Hourly Total	18	387	0	405	634	696	0	1330	0	412	64	0	476	2211
5:00 PM	5	88	0	93	149	232	0	381	0	138	27	0	165	639
5:15 PM	2	91	0	93	149	192	0	341	0	152	25	0	177	611
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	7	179	0	186	298	424	0	722	0	290	52	0	342	1250
6:30 AM	0	78	0	78	14	124	0	138	0	203	0	0	203	419
6:45 AM	2	116	0	118	8	124	0	132	0	190	1	0	191	441
Hourly Total	2	194	0	196	22	248	0	270	0	393	1	0	394	860
7:00 AM	1	161	0	162	20	129	0	149	0	233	0	0	233	544
7:15 AM	1	184	0	185	25	155	0	180	0	200	1	0	201	566
7:30 AM	2	152	0	154	24	152	0	176	0	167	0	0	167	497
7:45 AM	1	155	1	156	33	180	0	213	0	135	0	0	135	504
Hourly Total	5	652	1	657	102	616	0	718	0	735	1	0	736	2111
8:00 AM	0	150	0	150	24	187	0	211	0	132	1	0	133	494
8:15 AM	3	131	0	134	21	177	0	198	0	165	0	0	165	497
8:30 AM	3	130	0	133	33	191	0	224	0	161	1	0	162	519
8:45 AM	1	108	0	109	25	209	0	234	0	189	0	0	189	532
Hourly Total	7	519	0	526	103	764	0	867	0	647	2	0	649	2042
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	5	103	0	108	97	217	0	314	0	96	6	0	102	524
3:15 PM	8	117	0	125	131	156	0	287	0	84	9	0	93	505
3:30 PM	6	83	0	89	138	227	0	365	1	76	8	0	85	539
3:45 PM	2	87	1	89	119	182	0	301	0	76	7	0	83	473
Hourly Total	21	390	1	411	485	782	0	1267	1	332	30	0	363	2041
4:00 PM	2	122	0	124	126	152	0	278	0	96	7	0	103	505
4:15 PM	6	109	1	115	136	158	0	294	0	95	6	0	101	510
4:30 PM	6	96	1	102	143	174	0	317	0	78	2	0	80	499
4:45 PM	5	93	0	98	138	181	0	319	0	83	6	0	89	506
Hourly Total	19	420	2	439	543	665	0	1208	0	352	21	0	373	2020
5:00 PM	2	98	0	100	146	204	0	350	0	85	3	0	88	538
5:15 PM	4	113	0	117	121	159	0	280	0	92	2	0	94	491
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	6	211	0	217	267	363	0	630	0	177	5	0	182	1029
6:30 AM	0	82	0	82	11	115	0	126	0	185	0	0	185	393
6:45 AM	0	89	0	89	10	126	0	136	0	164	3	0	167	392
Hourly Total	0	171	0	171	21	241	0	262	0	349	3	0	352	785
7:00 AM	1	131	0	132	17	133	0	150	0	219	1	0	220	502
7:15 AM	3	168	0	171	32	158	0	190	0	182	3	0	185	546
7:30 AM	1	125	0	126	40	146	0	186	0	166	2	0	168	480
7:45 AM	1	123	0	124	30	165	0	195	0	138	0	0	138	457
Hourly Total	6	547	0	553	119	602	0	721	0	705	6	0	711	1985
8:00 AM	4	116	0	120	20	169	0	189	0	150	0	0	150	459
8:15 AM	1	125	0	126	28	158	0	186	0	133	2	0	135	447
Grand Total	116	4313	4	4429	3131	6537	0	9668	1	5030	228	0	5259	19356
Approach %	2.6	97.4	-	-	32.4	67.6	-	-	0.0	95.6	4.3	-	-	-
Total %	0.6	22.3	-	22.9	16.2	33.8	-	49.9	0.0	26.0	1.2	-	27.2	-
Lights	114	4214	-	4328	3083	6353	-	9436	1	4901	225	-	5127	18891
% Lights	98.3	97.7	-	97.7	98.5	97.2	-	97.6	100.0	97.4	98.7	-	97.5	97.6
Mediums	2	91	-	93	47	171	-	218	0	115	3	-	118	429
% Mediums	1.7	2.1	-	2.1	1.5	2.6	-	2.3	0.0	2.3	1.3	-	2.2	2.2
Articulated Trucks	0	8	-	8	1	13	-	14	0	14	0	-	14	36
% Articulated Trucks	0.0	0.2	-	0.2	0.0	0.2	-	0.1	0.0	0.3	0.0	-	0.3	0.2
All Pedestrians	-	-	4	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Count Name: Kuhio Hwy Kapaa Bypass 3-15-17 to 3-17-17
Site Code: Hokua Place
Start Date: 03/15/2017
Page No: 2

Kuhio Hwy [SB]

Exit	Enter	Total
6467	5127	11594
173	118	291
13	14	27
0	0	0
6653	**5259**	**11912**

RT	Th	LT	Ped
225	4901	1	0
3	115	0	0
0	14	0	0
0	0	0	0
228	**5030**	**1**	**0**

Kapaa Bypass Rd [EB]

Total	Enter	Exit
7636	4328	3308
143	93	50
9	8	1
0	0	0
7788	**4429**	**3359**

LT	RT	Ped
114	4214	0
2	91	0
0	8	0
0	0	4
116	**4313**	**4**

03/15/2017 3:00 PM
Ending At
03/17/2017 8:30 AM

Lights
Mediums
Articulated Trucks
All Pedestrians

Fake Approach [WB]

Exit	Enter	Total
1	0	1
0	0	0
0	0	0
0	0	0
1	**0**	**1**

LT	Th	Ped
3083	6353	0
47	171	0
1	13	0
0	0	0
3131	**6537**	**0**

Exit	Enter	Total
9115	9436	18551
206	218	424
22	14	36
0	0	0
9343	**9668**	**19011**

Kuhio Hwy [NB]

Turning Movement Data Plot

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Count Name: Kuhio Hwy Kapaa Bypass 3-15-17 to 3-17-17
Site Code: Hokua Place
Start Date: 03/15/2017

Turning Movement Peak Hour Data (4:30 PM)

Start Time	Kapaa Bypass Rd Eastbound				Kuhio Hwy Northbound				Kuhio Hwy Southbound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
4:30 PM	6	90	0	96	166	187	0	353	0	112	19	0	131	580
4:45 PM	2	95	0	97	146	176	0	322	0	112	15	0	127	546
5:00 PM	5	88	0	93	149	232	0	381	0	138	27	0	165	639
5:15 PM	2	91	0	93	149	192	0	341	0	152	25	0	177	611
Total	15	364	0	379	610	787	0	1397	0	514	86	0	600	2376
Approach %	4.0	96.0	-	-	43.7	56.3	-	-	0.0	85.7	14.3	-	-	-
Total %	0.6	15.3	-	16.0	25.7	33.1	-	58.8	0.0	21.6	3.6	-	25.3	-
PHF	0.625	0.958	-	0.977	0.919	0.848	-	0.917	0.000	0.845	0.796	-	0.847	0.930
Lights	15	358	-	373	607	778	-	1385	0	506	85	-	591	2349
% Lights	100.0	98.4	-	98.4	99.5	98.9	-	99.1	-	98.4	98.8	-	98.5	98.9
Mediums	0	5	-	5	3	9	-	12	0	7	1	-	8	25
% Mediums	0.0	1.4	-	1.3	0.5	1.1	-	0.9	-	1.4	1.2	-	1.3	1.1
Articulated Trucks	0	1	-	1	0	0	-	0	0	1	0	-	1	2
% Articulated Trucks	0.0	0.3	-	0.3	0.0	0.0	-	0.0	-	0.2	0.0	-	0.2	0.1
All Pedestrians	-	-	0	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Count Name: Kuhio Hwy Kapaa Bypass 3-15-17 to 3-17-17
Site Code: Hokua Place
Start Date: 03/15/2017

Peak Hour Data

03/15/2017 4:30 PM
Ending At
03/15/2017 5:30 PM

Lights
Mediums
Articulated Trucks
All Pedestrians

Kuhio Hwy [SB]

Exit	Enter	Total
793	591	1384
9	8	17
0	1	1
0	0	0
802	**600**	**1402**

RT	Th	LT	Ped
85	506	0	0
1	7	0	0
0	1	0	0
0	0	0	0
86	**514**	**0**	**0**

Kapaa Bypass Rd [EB]

Exit	Enter	Total
692	373	1065
4	5	9
0	1	1
0	0	0
696	**379**	**1075**

LT	RT	Ped
15	358	0
0	5	0
0	1	0
0	0	0
15	**364**	**0**

Fake Approach [WB]

Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

LT	Th	Ped
607	778	0
3	9	0
0	0	0
0	0	0
610	**787**	**0**

Kuhio Hwy [NB]

Exit	Enter	Total
864	1385	2249
12	12	24
2	0	2
0	0	0
878	**1397**	**2275**

Turning Movement Peak Hour Data Plot (4:30 PM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (7:00 AM)

	Kapaa Bypass Rd Eastbound				Kuhio Hwy Northbound				Kuhio Hwy Southbound					
Start Time	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
7:00 AM	1	161	0	162	20	129	0	149	0	233	0	0	233	544
7:15 AM	1	184	0	185	25	155	0	180	0	200	1	0	201	566
7:30 AM	2	152	0	154	24	152	0	176	0	167	0	0	167	497
7:45 AM	1	155	1	156	33	180	0	213	0	135	0	0	135	504
Total	5	652	1	657	102	616	0	718	0	735	1	0	736	2111
Approach %	0.8	99.2	-	-	14.2	85.8	-	-	0.0	99.9	0.1	-	-	-
Total %	0.2	30.9	-	31.1	4.8	29.2	-	34.0	0.0	34.8	0.0	-	34.9	-
PHF	0.625	0.886	-	0.888	0.773	0.856	-	0.843	0.000	0.789	0.250	-	0.790	0.932
Lights	4	635	-	639	100	600	-	700	0	711	1	-	712	2051
% Lights	80.0	97.4	-	97.3	98.0	97.4	-	97.5	-	96.7	100.0	-	96.7	97.2
Mediums	1	14	-	15	2	16	-	18	0	23	0	-	23	56
% Mediums	20.0	2.1	-	2.3	2.0	2.6	-	2.5	-	3.1	0.0	-	3.1	2.7
Articulated Trucks	0	3	-	3	0	0	-	0	0	1	0	-	1	4
% Articulated Trucks	0.0	0.5	-	0.5	0.0	0.0	-	0.0	-	0.1	0.0	-	0.1	0.2
All Pedestrians	-	-	1	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-

Peak Hour Data

03/16/2017 7:00 AM
Ending At
03/16/2017 8:00 AM

Lights
Mediums
Articulated Trucks
All Pedestrians

Kuhio Hwy [SB]

Exit	Enter	Total
604	712	1316
17	23	40
0	1	1
0	0	0
621	**736**	**1357**

RT	Th	LT	Ped
1	711	0	0
0	23	0	0
0	1	0	0
0	0	0	0
1	**735**	**0**	**0**

Kapaa Bypass Rd [EB]

Exit	Enter	Total
101	639	740
2	15	17
0	3	3
0	0	0
103	**657**	**760**

LT	RT	Ped
4	635	0
1	14	0
0	3	0
0	0	1
5	**652**	**1**

Fake Approach [WB]

Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

LT	Th	Ped
100	600	0
2	16	0
0	0	0
0	0	0
102	**616**	**0**

Kuhio Hwy [NB]

Exit	Enter	Total
1346	700	2046
37	18	55
4	0	4
0	0	0
1387	**718**	**2105**

Turning Movement Peak Hour Data Plot (7:00 AM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (4:15 PM)

Start Time	Kapaa Bypass Rd Eastbound				Kuhio Hwy Northbound				Kuhio Hwy Southbound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
4:15 PM	6	109	1	115	136	158	0	294	0	95	6	0	101	510
4:30 PM	6	96	1	102	143	174	0	317	0	78	2	0	80	499
4:45 PM	5	93	0	98	138	181	0	319	0	83	6	0	89	506
5:00 PM	2	98	0	100	146	204	0	350	0	85	3	0	88	538
Total	19	396	2	415	563	717	0	1280	0	341	17	0	358	2053
Approach %	4.6	95.4	-	-	44.0	56.0	-	-	0.0	95.3	4.7	-	-	-
Total %	0.9	19.3	-	20.2	27.4	34.9	-	62.3	0.0	16.6	0.8	-	17.4	-
PHF	0.792	0.908	-	0.902	0.964	0.879	-	0.914	0.000	0.897	0.708	-	0.886	0.954
Lights	19	385	-	404	558	710	-	1268	0	337	17	-	354	2026
% Lights	100.0	97.2	-	97.3	99.1	99.0	-	99.1	-	98.8	100.0	-	98.9	98.7
Mediums	0	11	-	11	5	7	-	12	0	4	0	-	4	27
% Mediums	0.0	2.8	-	2.7	0.9	1.0	-	0.9	-	1.2	0.0	-	1.1	1.3
Articulated Trucks	0	0	-	0	0	0	-	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	-	0.0	0.0	0.0	-	0.0	-	0.0	0.0	-	0.0	0.0
All Pedestrians	-	-	2	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Count Name: Kuhio Hwy Kapaa Bypass 3-15-17 to 3-17-17
Site Code: Hokua Place
Start Date: 03/15/2017
Page No: 8

Kuhio Hwy [SB]		
Exit	Enter	Total
729	354	1083
7	4	11
0	0	0
0	0	0
736	**358**	**1094**

RT	Th	LT	Ped
17	337	0	0
0	4	0	0
0	0	0	0
0	0	0	0
17	**341**	**0**	**0**

Peak Hour Data

03/16/2017 4:15 PM
Ending At
03/16/2017 5:15 PM

Lights
Mediums
Articulated Trucks
All Pedestrians

Kapaa Bypass Rd [EB]		
Exit	Enter	Total
575	404	979
5	11	16
0	0	0
0	0	0
580	**415**	**995**

LT	RT	Ped
19	385	0
0	11	0
0	0	0
0	0	2
19	**396**	**2**

Fake Approach [WB]		
Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

LT	Th	Ped
558	710	0
5	7	0
0	0	0
0	0	0
563	**717**	**0**

Kuhio Hwy [NB]		
Exit	Enter	Total
722	1268	1990
15	12	27
0	0	0
0	0	0
737	**1280**	**2017**

Turning Movement Peak Hour Data Plot (4:15 PM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (7:00 AM)

Start Time	Kapaa Bypass Rd Eastbound				Kuhio Hwy Northbound				Kuhio Hwy Southbound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
7:00 AM	1	131	0	132	17	133	0	150	0	219	1	0	220	502
7:15 AM	3	168	0	171	32	158	0	190	0	182	3	0	185	546
7:30 AM	1	125	0	126	40	146	0	186	0	166	2	0	168	480
7:45 AM	1	123	0	124	30	165	0	195	0	138	0	0	138	457
Total	6	547	0	553	119	602	0	721	0	705	6	0	711	1985
Approach %	1.1	98.9	-	-	16.5	83.5	-	-	0.0	99.2	0.8	-	-	-
Total %	0.3	27.6	-	27.9	6.0	30.3	-	36.3	0.0	35.5	0.3	-	35.8	-
PHF	0.500	0.814	-	0.808	0.744	0.912	-	0.924	0.000	0.805	0.500	-	0.808	0.909
Lights	5	535	-	540	113	569	-	682	0	688	6	-	694	1916
% Lights	83.3	97.8	-	97.6	95.0	94.5	-	94.6	-	97.6	100.0	-	97.6	96.5
Mediums	1	10	-	11	5	29	-	34	0	15	0	-	15	60
% Mediums	16.7	1.8	-	2.0	4.2	4.8	-	4.7	-	2.1	0.0	-	2.1	3.0
Articulated Trucks	0	2	-	2	1	4	-	5	0	2	0	-	2	9
% Articulated Trucks	0.0	0.4	-	0.4	0.8	0.7	-	0.7	-	0.3	0.0	-	0.3	0.5
All Pedestrians	-	-	0	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Kuhio Hwy [SB]

Exit	Enter	Total
574	694	1268
30	15	45
4	2	6
0	0	0
608	**711**	**1319**

RT	Th	LT	Ped
6	688	0	0
0	15	0	0
0	2	0	0
0	0	0	0
6	**705**	**0**	**0**

Peak Hour Data

Kapaa Bypass Rd [EB]

Total	659	16	3	0	**678**
Enter	540	11	2	0	**553**
Exit	119	5	1	0	**125**

LT	5	1	0	0	**6**
RT	535	10	2	0	**547**
Ped	0	0	0	0	**0**

Fake Approach [WB]

Exit	0	0	0	0	**0**
Enter	0	0	0	0	**0**
Total	0	0	0	0	**0**

03/17/2017 7:00 AM
Ending At
03/17/2017 8:00 AM

Lights
Mediums
Articulated Trucks
All Pedestrians

LT	Th	Ped
113	569	0
5	29	0
1	4	0
0	0	0
119	**602**	**0**

Exit	Enter	Total
1223	682	1905
25	34	59
4	5	9
0	0	0
1252	**721**	**1973**

Kuhio Hwy [NB]

Turning Movement Peak Hour Data Plot (7:00 AM)

TRAFFIC IMPACT ANALYSIS REPORT UPDATE

FOR THE PROPOSED

HOKUA PLACE

KAPA`A, KAUAI, HAWAII
TAX MAP KEY: (4) 4-3-03: 01

APPENDIX B

CAPACITY ANALYSIS WORKSHEETS

EXISTING TRAFFIC CONDITIONS

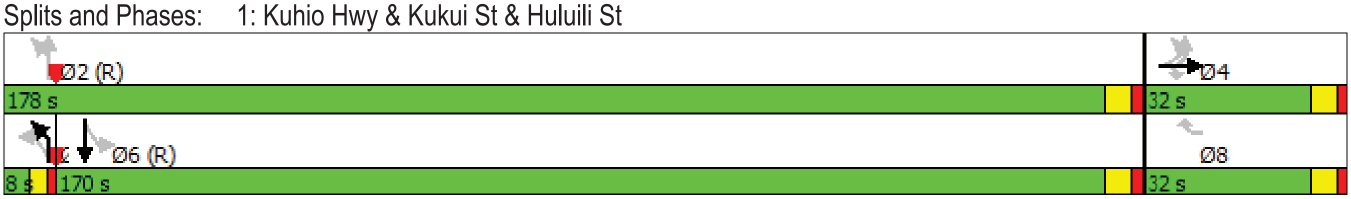
Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	24	8	36	1	8	4	664	12	3	728	36
Future Volume (vph)	8	24	8	36	1	8	4	664	12	3	728	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0		0			60		0	0		0
Storage Lanes		0		1			1		0	0		0
Taper Length (ft)		100					100			100		
Satd. Flow (prot)	0	0	1621	1501	1589	0	1631	1760	0	0	1799	0
Flt Permitted			0.962				0.367				0.998	
Satd. Flow (perm)	0	0	1582	1420	1526	0	630	1760	0	0	1795	0
Right Turn on Red				Yes	Yes				No			
Satd. Flow (RTOR)				36	374							
Link Speed (mph)			30					30			30	
Link Distance (ft)			417					1113			697	
Travel Time (s)			9.5					25.3			15.8	
Confl. Peds. (#/hr)	2	4		7	4	4	4		7	4		4
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	15%	0%	4%	0%	6%	9%	4%	0%	0%	1%	4%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	40	36	1	0	12	676	0	0	771	0
Turn Type	Perm	Perm	NA	Perm	Perm	custom	custom	NA		Perm	NA	
Protected Phases			4				5				6	
Permitted Phases	4	4		4	8	5	2	2		6		
Detector Phase	4	4	4	4	8	5	5	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	3.0	3.0	7.0		7.0	7.0	
Minimum Split (s)	27.0	27.0	27.0	27.0	27.0	7.0	7.0	26.0		34.0	34.0	
Total Split (s)	32.0	32.0	32.0	32.0	32.0	8.0	8.0	178.0		170.0	170.0	
Total Split (%)	15.2%	15.2%	15.2%	15.2%	15.2%	3.8%	3.8%	84.8%		81.0%	81.0%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	1.0	1.0	2.0		2.0	2.0	
Lost Time Adjust (s)			0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)			6.0	6.0	6.0		4.0	6.0			6.0	
Lead/Lag						Lead	Lead			Lag	Lag	
Lead-Lag Optimize?						Yes	Yes					
Recall Mode	None	None	None	None	None	None	None	C-Max		C-Max	C-Max	
Act Effct Green (s)			10.9	10.9	10.9		191.7	190.9			187.0	
Actuated g/C Ratio			0.05	0.05	0.05		0.91	0.91			0.89	
v/c Ratio			0.49	0.34	0.00		0.02	0.42			0.48	
Control Delay			115.8	31.5	0.0		1.3	2.8			4.5	
Queue Delay			0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay			115.8	31.5	0.0		1.3	2.8			4.5	
LOS			F	C	A		A	A			A	
Approach Delay			75.8					2.8			4.5	

Lane Group	SBR2
Lane Configurations	
Traffic Volume (vph)	4
Future Volume (vph)	4
Ideal Flow (vphpl)	1900
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	0
Flt Permitted	
Satd. Flow (perm)	0
Right Turn on Red	No
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	4
Peak Hour Factor	1.00
Heavy Vehicles (%)	0%
Shared Lane Traffic (%)	
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	
Minimum Split (s)	
Total Split (s)	
Total Split (%)	
Yellow Time (s)	
All-Red Time (s)	
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Approach LOS			E					A			A	
Queue Length 50th (ft)			55	0	0		1	127			157	
Queue Length 95th (ft)			103	44	0		4	201			360	
Internal Link Dist (ft)			337					1033			617	
Turn Bay Length (ft)							60					
Base Capacity (vph)			195	207	516		602	1600			1598	
Starvation Cap Reductn			0	0	0		0	0			0	
Spillback Cap Reductn			0	0	0		0	0			0	
Storage Cap Reductn			0	0	0		0	0			0	
Reduced v/c Ratio			0.21	0.17	0.00		0.02	0.42			0.48	

Intersection Summary	
Area Type: Other	
Cycle Length: 210	
Actuated Cycle Length: 210	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.49	
Intersection Signal Delay: 7.3	Intersection LOS: A
Intersection Capacity Utilization 66.2%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Kuhio Hwy & Kukui St & Huluili St



Lane Group	SBR2
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Intersection	
Int Delay, s/veh	2.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	100	264	16	40	100	8
Future Vol, veh/h	100	264	16	40	100	8
Conflicting Peds, #/hr	0	0	0	0	1	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	6	17	0	6	9
Mvmt Flow	100	264	16	40	100	8

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	364	0	305	232
Stage 1	-	-	-	-	232	-
Stage 2	-	-	-	-	73	-
Critical Hdwy	-	-	4.27	-	6.46	6.29
Critical Hdwy Stg 1	-	-	-	-	5.46	-
Critical Hdwy Stg 2	-	-	-	-	5.46	-
Follow-up Hdwy	-	-	2.353	-	3.554	3.381
Pot Cap-1 Maneuver	-	-	1116	-	679	790
Stage 1	-	-	-	-	797	-
Stage 2	-	-	-	-	940	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1116	-	668	790
Mov Cap-2 Maneuver	-	-	-	-	668	-
Stage 1	-	-	-	-	785	-
Stage 2	-	-	-	-	939	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.4	11.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	676	-	-	1116	-
HCM Lane V/C Ratio	0.16	-	-	0.014	-
HCM Control Delay (s)	11.3	-	-	8.3	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.6	-	-	0	-

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	368	360	116	12	7	84
Future Vol, veh/h	368	360	116	12	7	84
Conflicting Peds, #/hr	7	0	0	7	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	1	5	20	0	0	8
Mvmt Flow	368	360	116	12	7	84

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	135	0	-	0	1225	129
Stage 1	-	-	-	-	129	-
Stage 2	-	-	-	-	1096	-
Critical Hdwy	4.11	-	-	-	6.4	6.28
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.209	-	-	-	3.5	3.372
Pot Cap-1 Maneuver	1456	-	-	-	199	905
Stage 1	-	-	-	-	902	-
Stage 2	-	-	-	-	323	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1447	-	-	-	134	899
Mov Cap-2 Maneuver	-	-	-	-	134	-
Stage 1	-	-	-	-	612	-
Stage 2	-	-	-	-	321	-

Approach	EB	WB	SW
HCM Control Delay, s	4.2	0	11.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SWLn1
Capacity (veh/h)	1447	-	-	-	625
HCM Lane V/C Ratio	0.254	-	-	-	0.146
HCM Control Delay (s)	8.3	0	-	-	11.7
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	1	-	-	-	0.5

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	8	716	188	12	12	24
Future Vol, veh/h	8	716	188	12	12	24
Conflicting Peds, #/hr	6	0	0	6	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	4	14	24	19
Mvmt Flow	8	716	188	12	12	24

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	206	0	-	0	932	200
Stage 1	-	-	-	-	200	-
Stage 2	-	-	-	-	732	-
Critical Hdwy	4.1	-	-	-	6.64	6.39
Critical Hdwy Stg 1	-	-	-	-	5.64	-
Critical Hdwy Stg 2	-	-	-	-	5.64	-
Follow-up Hdwy	2.2	-	-	-	3.716	3.471
Pot Cap-1 Maneuver	1377	-	-	-	270	800
Stage 1	-	-	-	-	784	-
Stage 2	-	-	-	-	438	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1370	-	-	-	265	796
Mov Cap-2 Maneuver	-	-	-	-	265	-
Stage 1	-	-	-	-	772	-
Stage 2	-	-	-	-	436	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	13.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1370	-	-	-	477
HCM Lane V/C Ratio	0.006	-	-	-	0.075
HCM Control Delay (s)	7.6	0	-	-	13.2
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	344	2	16	672	764	68
Future Volume (Veh/h)	344	2	16	672	764	68
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	344	2	16	672	764	68
Pedestrians	8					
Lane Width (ft)	11.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	TWLTL	
Median storage veh)					2	
Upstream signal (ft)				697		
pX, platoon unblocked	0.93					
vC, conflicting volume	1476	772	772			
vC1, stage 1 conf vol	772					
vC2, stage 2 conf vol	704					
vCu, unblocked vol	1474	772	772			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	16	99	98			
cM capacity (veh/h)	409	400	846			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	346	16	672	764	68
Volume Left	344	16	0	0	0
Volume Right	2	0	0	0	68
cSH	409	846	1700	1700	1700
Volume to Capacity	0.85	0.02	0.40	0.45	0.04
Queue Length 95th (ft)	203	1	0	0	0
Control Delay (s)	46.6	9.3	0.0	0.0	0.0
Lane LOS	E	A			
Approach Delay (s)	46.6	0.2		0.0	
Approach LOS	E				

Intersection Summary			
Average Delay	8.7		
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	1	0	1	0	4	88	748	20	7	713	4
Future Vol, veh/h	0	1	0	1	0	4	88	748	20	7	713	4
Conflicting Peds, #/hr	3	0	0	0	0	3	0	0	16	16	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
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	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	0	0	11	5	4	0	2	2	2
Mvmt Flow	0	1	0	1	0	4	88	748	20	7	713	4

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1668	1689	715	1680	1681	777	717	0	0	784	0	0
Stage 1	729	729	-	950	950	-	-	-	-	-	-	-
Stage 2	939	960	-	730	731	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.31	4.15	-	-	4.12	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.399	2.245	-	-	2.218	-	-
Pot Cap-1 Maneuver	77	94	434	76	96	383	870	-	-	834	-	-
Stage 1	417	431	-	315	341	-	-	-	-	-	-	-
Stage 2	320	338	-	417	430	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	70	83	434	68	84	377	870	-	-	822	-	-
Mov Cap-2 Maneuver	70	83	-	68	84	-	-	-	-	-	-	-
Stage 1	375	427	-	279	302	-	-	-	-	-	-	-
Stage 2	284	299	-	412	426	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	48.9	23.7	1	0.1
HCM LOS	E	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	870	-	-	83	198	822	-	-
HCM Lane V/C Ratio	0.101	-	-	0.012	0.025	0.009	-	-
HCM Control Delay (s)	9.6	-	-	48.9	23.7	9.4	-	-
HCM Lane LOS	A	-	-	E	C	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	0	0.1	0	-	-

Intersection	
Int Delay, s/veh	3.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣						✣	
Traffic Vol, veh/h	4	1	12	0	2	92	0	0	0	0	204	8
Future Vol, veh/h	4	1	12	0	2	92	0	0	0	0	204	8
Conflicting Peds, #/hr	4	0	0	0	0	4	0	0	0	0	0	7
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	17	0	0	5	0	0	0	0	4	17
Mvmt Flow	4	1	12	0	2	92	0	0	0	0	204	8

Major/Minor	Minor2			Minor1			Major2		
Conflicting Flow All	266	215	215	215	219	4	0	0	0
Stage 1	215	215	-	0	0	-	-	-	-
Stage 2	51	0	-	215	219	-	-	-	-
Critical Hdwy	7.1	6.5	6.37	7.1	6.5	6.25	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	6.1	5.5	-	-	-	-
Follow-up Hdwy	3.5	4	3.453	3.5	4	3.345	2.2	-	-
Pot Cap-1 Maneuver	691	686	789	746	683	1071	-	-	-
Stage 1	792	729	-	-	-	-	-	-	-
Stage 2	-	-	-	792	726	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	624	682	784	734	679	1067	-	-	-
Mov Cap-2 Maneuver	624	682	-	734	679	-	-	-	-
Stage 1	792	725	-	-	-	-	-	-	-
Stage 2	-	-	-	779	722	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	10	8.8	0
HCM LOS	B	A	

Minor Lane/Major Mvmt	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	733	1054	-	-	-
HCM Lane V/C Ratio	0.023	0.089	-	-	-
HCM Control Delay (s)	10	8.8	0	-	-
HCM Lane LOS	B	A	A	-	-
HCM 95th %tile Q(veh)	0.1	0.3	-	-	-

Intersection	
Intersection Delay, s/veh	20.0
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	652	228	136	724
Demand Flow Rate, veh/h	669	247	138	732
Vehicles Circulating, veh/h	556	129	628	348
Vehicles Exiting, veh/h	524	637	597	28
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	30.0	5.1	7.1	18.2
Approach LOS	D	A	A	C

Lane	Left	Left	Left	Left
Designated Moves	LTR	LT	LTR	LTR
Assumed Moves	LTR	LT	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	669	247	138	732
Cap Entry Lane, veh/h	783	1210	727	968
Entry HV Adj Factor	0.975	0.922	0.986	0.989
Flow Entry, veh/h	652	228	136	724
Cap Entry, veh/h	763	1115	717	957
V/C Ratio	0.855	0.204	0.190	0.757
Control Delay, s/veh	30.0	5.1	7.1	18.2
LOS	D	A	A	C
95th %tile Queue, veh	10	1	1	7

Intersection	
Int Delay, s/veh	12.3

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	68	416	40	104	300	17
Future Vol, veh/h	68	416	40	104	300	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	9	1	0	2	2	0
Mvmt Flow	68	416	40	104	300	17

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	144	0	-	0	644	92
Stage 1	-	-	-	-	92	-
Stage 2	-	-	-	-	552	-
Critical Hdwy	4.19	-	-	-	6.42	6.2
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.281	-	-	-	3.518	3.3
Pot Cap-1 Maneuver	1397	-	-	-	437	971
Stage 1	-	-	-	-	932	-
Stage 2	-	-	-	-	577	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1397	-	-	-	409	971
Mov Cap-2 Maneuver	-	-	-	-	409	-
Stage 1	-	-	-	-	873	-
Stage 2	-	-	-	-	577	-

Approach	EB	WB	SE
HCM Control Delay, s	1.1	0	35.1
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SELn1
Capacity (veh/h)	1397	-	-	-	422
HCM Lane V/C Ratio	0.049	-	-	-	0.751
HCM Control Delay (s)	7.7	0	-	-	35.1
HCM Lane LOS	A	A	-	-	E
HCM 95th %tile Q(veh)	0.2	-	-	-	6.2

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	8	304	140	32	13	0
Future Vol, veh/h	8	304	140	32	13	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	11	0	0	0
Mvmt Flow	8	304	140	32	13	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	172	0	-	0	476	156
Stage 1	-	-	-	-	156	-
Stage 2	-	-	-	-	320	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1417	-	-	-	551	895
Stage 1	-	-	-	-	877	-
Stage 2	-	-	-	-	741	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1417	-	-	-	547	895
Mov Cap-2 Maneuver	-	-	-	-	547	-
Stage 1	-	-	-	-	871	-
Stage 2	-	-	-	-	741	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	11.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1417	-	-	-	547
HCM Lane V/C Ratio	0.006	-	-	-	0.024
HCM Control Delay (s)	7.6	0	-	-	11.7
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	736	100	620	800	4
Future Vol, veh/h	4	736	100	620	800	4
Conflicting Peds, #/hr	1	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	170	-	-	150
Veh in Median Storage, #	1	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	20	3	2	3	3	0
Mvmt Flow	4	736	100	620	800	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1312	-	801	0	-	0
Stage 1	801	-	-	-	-	-
Stage 2	511	-	-	-	-	-
Critical Hdwy	6.9	-	4.13	-	-	-
Critical Hdwy Stg 1	5.7	-	-	-	-	-
Critical Hdwy Stg 2	6.1	-	-	-	-	-
Follow-up Hdwy	3.69	-	2.219	-	-	-
Pot Cap-1 Maneuver	144	0	820	-	-	-
Stage 1	402	0	-	-	-	-
Stage 2	527	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	126	-	819	-	-	-
Mov Cap-2 Maneuver	233	-	-	-	-	-
Stage 1	353	-	-	-	-	-
Stage 2	526	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	20.7	1.4	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	819	-	233	-	-	-
HCM Lane V/C Ratio	0.122	-	0.017	-	-	-
HCM Control Delay (s)	10	-	20.7	0	-	-
HCM Lane LOS	B	-	C	A	-	-
HCM 95th %tile Q(veh)	0.4	-	0.1	-	-	-

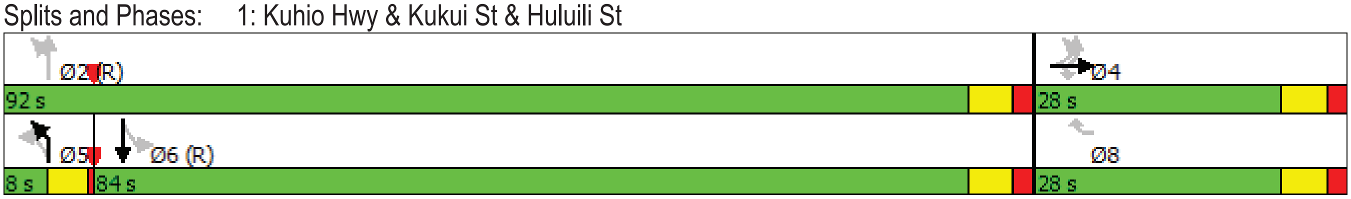
Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	20	8	36	8	60	56	548	16	3	580	32
Future Volume (vph)	16	20	8	36	8	60	56	548	16	3	580	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0		0			60		0	0		0
Storage Lanes		0		1			1		0	0		0
Taper Length (ft)		100					100			100		
Satd. Flow (prot)	0	0	1765	1561	1589	0	1745	1821	0	0	1770	0
Flt Permitted			0.961				0.397				0.998	
Satd. Flow (perm)	0	0	1489	1324	1423	0	679	1821	0	0	1766	0
Right Turn on Red				Yes	Yes				No			
Satd. Flow (RTOR)				64	340							
Link Speed (mph)			30					30			30	
Link Distance (ft)			417					1123			607	
Travel Time (s)			9.5					25.5			13.8	
Confl. Peds. (#/hr)	37	30		47	30	30	75		49	49		30
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	44	36	8	0	116	564	0	0	643	0
Turn Type	Perm	Perm	NA	Perm	Perm	custom	custom	NA		Perm	NA	
Protected Phases			4				5				6	
Permitted Phases	4	4		4	8	5	2	2		6		
Detector Phase	4	4	4	4	8	5	5	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	4.0	4.0	7.0		7.0	7.0	
Minimum Split (s)	27.0	27.0	27.0	27.0	27.0	8.0	8.0	26.0		34.0	34.0	
Total Split (s)	28.0	28.0	28.0	28.0	28.0	8.0	8.0	92.0		84.0	84.0	
Total Split (%)	23.3%	23.3%	23.3%	23.3%	23.3%	6.7%	6.7%	76.7%		70.0%	70.0%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.5	3.5	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	0.5	0.5	2.0		2.0	2.0	
Lost Time Adjust (s)			0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)			6.0	6.0	6.0		4.0	6.0			6.0	
Lead/Lag						Lead	Lead			Lag	Lag	
Lead-Lag Optimize?						Yes	Yes					
Recall Mode	None	None	None	None	None	None	None	C-Max		C-Max	C-Max	
Act Effct Green (s)			9.3	9.3	9.3		103.3	102.5			90.5	
Actuated g/C Ratio			0.08	0.08	0.08		0.86	0.85			0.75	
v/c Ratio			0.39	0.22	0.02		0.18	0.36			0.48	
Control Delay			61.6	6.9	0.1		2.4	3.4			8.2	
Queue Delay			0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay			61.6	6.9	0.1		2.4	3.4			8.2	
LOS			E	A	A		A	A			A	
Approach Delay			37.0					3.2			8.2	

Lane Group	SBR2
Lane Configurations	
Traffic Volume (vph)	28
Future Volume (vph)	28
Ideal Flow (vphpl)	1900
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	0
Flt Permitted	
Satd. Flow (perm)	0
Right Turn on Red	No
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	35
Peak Hour Factor	1.00
Heavy Vehicles (%)	0%
Shared Lane Traffic (%)	
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	
Minimum Split (s)	
Total Split (s)	
Total Split (%)	
Yellow Time (s)	
All-Red Time (s)	
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Approach LOS			D					A			A	
Queue Length 50th (ft)			33	0	0		11	85			181	
Queue Length 95th (ft)			71	12	0		25	147			302	
Internal Link Dist (ft)			337					1043			527	
Turn Bay Length (ft)							60					
Base Capacity (vph)			272	295	538		645	1556			1332	
Starvation Cap Reductn			0	0	0		0	0			0	
Spillback Cap Reductn			0	0	0		0	0			0	
Storage Cap Reductn			0	0	0		0	0			0	
Reduced v/c Ratio			0.16	0.12	0.01		0.18	0.36			0.48	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 70	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.48	
Intersection Signal Delay: 7.4	Intersection LOS: A
Intersection Capacity Utilization 95.3%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 1: Kuhio Hwy & Kukui St & Huluili St



Lane Group	SBR2
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Intersection	
Int Delay, s/veh	7.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	112	308	12	48	340	32
Future Vol, veh/h	112	308	12	48	340	32
Conflicting Peds, #/hr	0	4	4	0	0	3
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	4	4	6	1	0
Mvmt Flow	112	308	12	48	340	32

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	424	0	342	273
Stage 1	-	-	-	-	270	-
Stage 2	-	-	-	-	72	-
Critical Hdwy	-	-	4.14	-	6.41	6.2
Critical Hdwy Stg 1	-	-	-	-	5.41	-
Critical Hdwy Stg 2	-	-	-	-	5.41	-
Follow-up Hdwy	-	-	2.236	-	3.509	3.3
Pot Cap-1 Maneuver	-	-	1125	-	656	771
Stage 1	-	-	-	-	778	-
Stage 2	-	-	-	-	953	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1121	-	647	766
Mov Cap-2 Maneuver	-	-	-	-	647	-
Stage 1	-	-	-	-	767	-
Stage 2	-	-	-	-	953	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.6	17.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	656	-	-	1121	-
HCM Lane V/C Ratio	0.567	-	-	0.011	-
HCM Control Delay (s)	17.4	-	-	8.2	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	3.6	-	-	0	-

Intersection	
Int Delay, s/veh	12.9

Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	328	220	372	84	48	236
Future Vol, veh/h	328	220	372	84	48	236
Conflicting Peds, #/hr	15	0	0	15	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	3	1	2	2	1
Mvmt Flow	328	220	372	84	48	236

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	471	0	-	0	1305	429
Stage 1	-	-	-	-	429	-
Stage 2	-	-	-	-	876	-
Critical Hdwy	4.13	-	-	-	6.42	6.21
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.227	-	-	-	3.518	3.309
Pot Cap-1 Maneuver	1086	-	-	-	177	628
Stage 1	-	-	-	-	657	-
Stage 2	-	-	-	-	407	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1072	-	-	-	112	620
Mov Cap-2 Maneuver	-	-	-	-	112	-
Stage 1	-	-	-	-	422	-
Stage 2	-	-	-	-	402	-

Approach	EB	WB	SW
HCM Control Delay, s	5.9	0	47
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SWLn1
Capacity (veh/h)	1072	-	-	-	351
HCM Lane V/C Ratio	0.306	-	-	-	0.809
HCM Control Delay (s)	9.8	0	-	-	47
HCM Lane LOS	A	A	-	-	E
HCM 95th %tile Q(veh)	1.3	-	-	-	7

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	36	532	548	60	16	24
Future Vol, veh/h	36	532	548	60	16	24
Conflicting Peds, #/hr	2	0	0	2	0	58
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	13	3	1	0	0	6
Mvmt Flow	36	532	548	60	16	24

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	610	0	-	0	1184	638
Stage 1	-	-	-	-	580	-
Stage 2	-	-	-	-	604	-
Critical Hdwy	4.23	-	-	-	6.4	6.26
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.317	-	-	-	3.5	3.354
Pot Cap-1 Maneuver	917	-	-	-	211	469
Stage 1	-	-	-	-	564	-
Stage 2	-	-	-	-	550	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	915	-	-	-	198	444
Mov Cap-2 Maneuver	-	-	-	-	198	-
Stage 1	-	-	-	-	531	-
Stage 2	-	-	-	-	549	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	19
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	915	-	-	-	297
HCM Lane V/C Ratio	0.039	-	-	-	0.135
HCM Control Delay (s)	9.1	0	-	-	19
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	296	3	20	640	656	152
Future Volume (Veh/h)	296	3	20	640	656	152
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	296	3	20	640	656	152
Pedestrians	19					
Lane Width (ft)	11.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	2					
Right turn flare (veh)						
Median type				None	TWLTL	
Median storage veh)					2	
Upstream signal (ft)				607		
pX, platoon unblocked	0.93					
vC, conflicting volume	1355	675	675			
vC1, stage 1 conf vol	675					
vC2, stage 2 conf vol	680					
vCu, unblocked vol	1344	675	675			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	32	99	98			
cM capacity (veh/h)	437	450	910			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	299	20	640	656	152
Volume Left	296	20	0	0	0
Volume Right	3	0	0	0	152
cSH	437	910	1700	1700	1700
Volume to Capacity	0.68	0.02	0.38	0.39	0.09
Queue Length 95th (ft)	126	2	0	0	0
Control Delay (s)	29.2	9.0	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	29.2	0.3		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	0	2	0	12	380	652	12	12	608	5
Future Vol, veh/h	1	0	0	2	0	12	380	652	12	12	608	5
Conflicting Peds, #/hr	1	0	0	0	0	1	0	0	7	7	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
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	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	0	0	11	5	4	0	2	2	2
Mvmt Flow	1	0	0	2	0	12	380	652	12	12	608	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2060	2066	611	2060	2062	666	613	0	0	671	0	0
Stage 1	635	635	-	1425	1425	-	-	-	-	-	-	-
Stage 2	1425	1431	-	635	637	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.31	4.15	-	-	4.12	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.399	2.245	-	-	2.218	-	-
Pot Cap-1 Maneuver	41	55	497	41	55	444	952	-	-	919	-	-
Stage 1	470	476	-	170	203	-	-	-	-	-	-	-
Stage 2	170	202	-	470	475	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	27	32	497	28	32	441	952	-	-	913	-	-
Mov Cap-2 Maneuver	27	32	-	28	32	-	-	-	-	-	-	-
Stage 1	282	470	-	101	121	-	-	-	-	-	-	-
Stage 2	99	121	-	464	469	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	143.4	33.1	4.1	0.2
HCM LOS	F	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	952	-	-	27	142	913	-	-
HCM Lane V/C Ratio	0.399	-	-	0.037	0.099	0.013	-	-
HCM Control Delay (s)	11.3	-	-	143.4	33.1	9	-	-
HCM Lane LOS	B	-	-	F	D	A	-	-
HCM 95th %tile Q(veh)	1.9	-	-	0.1	0.3	0	-	-

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	8	1	0	3	2	384	0	0	0	0	200	4
Future Vol, veh/h	8	1	0	3	2	384	0	0	0	0	200	4
Conflicting Peds, #/hr	13	0	0	0	0	13	0	0	0	7	0	16
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	17	0	0	5	0	0	0	0	4	17
Mvmt Flow	8	1	0	3	2	384	0	0	0	0	200	4

Major/Minor	Minor2			Minor1						Major2		
Conflicting Flow All	424	225	218	210	227	20				7	0	0
Stage 1	218	218	-	7	7	-				-	-	-
Stage 2	206	7	-	203	220	-				-	-	-
Critical Hdwy	7.1	6.5	6.37	7.1	6.5	6.25				4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	-	-	-				-	-	-
Critical Hdwy Stg 2	-	-	-	6.1	5.5	-				-	-	-
Follow-up Hdwy	3.5	4	3.453	3.5	4	3.345				2.2	-	-
Pot Cap-1 Maneuver	544	678	786	752	676	1049				1627	-	-
Stage 1	789	726	-	-	-	-				-	-	-
Stage 2	-	-	-	804	725	-				-	-	-
Platoon blocked, %											-	-
Mov Cap-1 Maneuver	332	664	775	747	662	1031				1617	-	-
Mov Cap-2 Maneuver	332	664	-	747	662	-				-	-	-
Stage 1	789	716	-	-	-	-				-	-	-
Stage 2	-	-	-	803	715	-				-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	15.5	10.6	0
HCM LOS	C	B	

Minor Lane/Major Mvmt	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	352	1025	1617	-	-
HCM Lane V/C Ratio	0.026	0.38	-	-	-
HCM Control Delay (s)	15.5	10.6	0	-	-
HCM Lane LOS	C	B	A	-	-
HCM 95th %tile Q(veh)	0.1	1.8	0	-	-

Intersection	
Intersection Delay, s/veh	14.2
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	260	552	640	392
Demand Flow Rate, veh/h	278	564	640	407
Vehicles Circulating, veh/h	439	333	262	892
Vehicles Exiting, veh/h	860	569	455	5
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	7.9	11.5	11.5	26.6
Approach LOS	A	B	B	D

Lane	Left	Left	Left	Left
Designated Moves	LTR	LT	LTR	LTR
Assumed Moves	LTR	LT	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	278	564	640	407
Cap Entry Lane, veh/h	882	983	1056	556
Entry HV Adj Factor	0.937	0.979	1.000	0.964
Flow Entry, veh/h	260	552	640	392
Cap Entry, veh/h	826	962	1056	536
V/C Ratio	0.315	0.574	0.606	0.733
Control Delay, s/veh	7.9	11.5	11.5	26.6
LOS	A	B	B	D
95th %tile Queue, veh	1	4	4	6

Intersection	
Int Delay, s/veh	4.1

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	52	116	276	280	120	68
Future Vol, veh/h	52	116	276	280	120	68
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	1	2	0
Mvmt Flow	52	116	276	280	120	68

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	556	0	-	0	636	416
Stage 1	-	-	-	-	416	-
Stage 2	-	-	-	-	220	-
Critical Hdwy	4.1	-	-	-	6.42	6.2
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.3
Pot Cap-1 Maneuver	1025	-	-	-	442	641
Stage 1	-	-	-	-	666	-
Stage 2	-	-	-	-	817	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1025	-	-	-	418	641
Mov Cap-2 Maneuver	-	-	-	-	418	-
Stage 1	-	-	-	-	630	-
Stage 2	-	-	-	-	817	-

Approach	EB	WB	SE
HCM Control Delay, s	2.7	0	17.3
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SELn1
Capacity (veh/h)	1025	-	-	-	478
HCM Lane V/C Ratio	0.051	-	-	-	0.393
HCM Control Delay (s)	8.7	0	-	-	17.3
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	1.9

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	176	288	44	12	1
Future Vol, veh/h	4	176	288	44	12	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	1	1	0	0	0
Mvmt Flow	4	176	288	44	12	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	332	0	-	0	494	310
Stage 1	-	-	-	-	310	-
Stage 2	-	-	-	-	184	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1239	-	-	-	538	735
Stage 1	-	-	-	-	748	-
Stage 2	-	-	-	-	852	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1239	-	-	-	536	735
Mov Cap-2 Maneuver	-	-	-	-	536	-
Stage 1	-	-	-	-	745	-
Stage 2	-	-	-	-	852	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	11.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1239	-	-	-	547
HCM Lane V/C Ratio	0.003	-	-	-	0.024
HCM Control Delay (s)	7.9	0	-	-	11.7
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	6.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	24	360	664	748	446	78
Future Vol, veh/h	24	360	664	748	446	78
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	Yield
Storage Length	140	0	170	-	-	150
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	1	3	1
Mvmt Flow	24	360	664	748	446	78

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2148	446	446	0	-	0
Stage 1	446	-	-	-	-	-
Stage 2	1702	-	-	-	-	-
Critical Hdwy	6.6	6.23	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.319	2.2	-	-	-
Pot Cap-1 Maneuver	48	611	1125	-	-	-
Stage 1	649	-	-	-	-	-
Stage 2	136	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 20	611	1125	-	-	-
Mov Cap-2 Maneuver	426	-	-	-	-	-
Stage 1	266	-	-	-	-	-
Stage 2	136	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	18.7	6	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1125	-	426	611	-	-
HCM Lane V/C Ratio	0.59	-	0.056	0.589	-	-
HCM Control Delay (s)	12.7	-	14	19	-	-
HCM Lane LOS	B	-	B	C	-	-
HCM 95th %tile Q(veh)	4	-	0.2	3.8	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

TRAFFIC IMPACT ANALYSIS REPORT UPDATE

FOR THE PROPOSED

HOKUA PLACE

KAPA`A, KAUAI, HAWAII
TAX MAP KEY: (4) 4-3-03: 01

APPENDIX C

CAPACITY ANALYSIS WORKSHEETS

PEAK HOUR TRAFFIC WITHOUT PROJECT

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	9	27	9	41	1	9	5	751	14	3	824	41
Future Volume (vph)	9	27	9	41	1	9	5	751	14	3	824	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0		0			60		0	0		0
Storage Lanes		0		1			1		0	0		0
Taper Length (ft)		100					100			100		
Satd. Flow (prot)	0	0	1621	1501	1589	0	1630	1761	0	0	1800	0
Flt Permitted			0.962				0.320				0.998	
Satd. Flow (perm)	0	0	1602	1447	1542	0	547	1761	0	0	1797	0
Right Turn on Red				Yes	Yes				No			
Satd. Flow (RTOR)				76	246							
Link Speed (mph)			30					30			30	
Link Distance (ft)			417					1113			697	
Travel Time (s)			9.5					25.3			15.8	
Confl. Peds. (#/hr)	2	4		7	4	4	4		7	4		4
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	15%	0%	4%	0%	6%	9%	4%	0%	0%	1%	4%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	45	41	1	0	14	765	0	0	873	0
Turn Type	Perm	Perm	NA	Perm	Perm	custom	custom	NA		Perm	NA	
Protected Phases			4				5				6	
Permitted Phases	4	4		4	8	5	2	2		6		
Detector Phase	4	4	4	4	8	5	5	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	1.0	1.0	7.0		7.0	7.0	
Minimum Split (s)	27.0	27.0	27.0	27.0	27.0	5.0	5.0	26.0		34.0	34.0	
Total Split (s)	27.0	27.0	27.0	27.0	27.0	5.0	5.0	73.0		68.0	68.0	
Total Split (%)	27.0%	27.0%	27.0%	27.0%	27.0%	5.0%	5.0%	73.0%		68.0%	68.0%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	1.0	1.0	2.0		2.0	2.0	
Lost Time Adjust (s)			0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)			6.0	6.0	6.0		4.0	6.0			6.0	
Lead/Lag						Lead	Lead			Lag	Lag	
Lead-Lag Optimize?						Yes	Yes					
Recall Mode	None	None	None	None	None	None	None	C-Max		C-Max	C-Max	
Act Effct Green (s)			8.6	8.6	8.6		84.0	83.2			81.2	
Actuated g/C Ratio			0.09	0.09	0.09		0.84	0.83			0.81	
v/c Ratio			0.33	0.21	0.00		0.03	0.52			0.60	
Control Delay			48.8	5.1	0.0		2.1	5.1			7.9	
Queue Delay			0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay			48.8	5.1	0.0		2.1	5.1			7.9	
LOS			D	A	A		A	A			A	
Approach Delay			27.9					5.1			7.9	
Approach LOS			C					A			A	
Queue Length 50th (ft)			28	0	0		1	134			168	
Queue Length 95th (ft)			61	10	0		5	241			480	
Internal Link Dist (ft)			337					1033			617	
Turn Bay Length (ft)							60					

Lane Group	SBR2
Lane Configurations	
Traffic Volume (vph)	5
Future Volume (vph)	5
Ideal Flow (vphpl)	1900
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	0
Flt Permitted	
Satd. Flow (perm)	0
Right Turn on Red	No
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	4
Peak Hour Factor	1.00
Heavy Vehicles (%)	0%
Shared Lane Traffic (%)	
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	
Minimum Split (s)	
Total Split (s)	
Total Split (%)	
Yellow Time (s)	
All-Red Time (s)	
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)			336	363	518		520	1464			1458	
Starvation Cap Reductn			0	0	0		0	0			0	
Spillback Cap Reductn			0	0	0		0	0			0	
Storage Cap Reductn			0	0	0		0	0			0	
Reduced v/c Ratio			0.13	0.11	0.00		0.03	0.52			0.60	

Intersection Summary	
Area Type: Other	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.60	
Intersection Signal Delay: 7.6	Intersection LOS: A
Intersection Capacity Utilization 70.9%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Kuhio Hwy & Kukui St & Huluili St

Lane Group	SBR2
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Intersection	
Int Delay, s/veh	2.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	118	311	19	47	118	9
Future Vol, veh/h	118	311	19	47	118	9
Conflicting Peds, #/hr	0	0	0	0	1	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	6	17	0	6	9
Mvmt Flow	118	311	19	47	118	9

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	429	0	360	274
Stage 1	-	-	-	-	274	-
Stage 2	-	-	-	-	86	-
Critical Hdwy	-	-	4.27	-	6.46	6.29
Critical Hdwy Stg 1	-	-	-	-	5.46	-
Critical Hdwy Stg 2	-	-	-	-	5.46	-
Follow-up Hdwy	-	-	2.353	-	3.554	3.381
Pot Cap-1 Maneuver	-	-	1055	-	631	748
Stage 1	-	-	-	-	763	-
Stage 2	-	-	-	-	927	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1055	-	619	748
Mov Cap-2 Maneuver	-	-	-	-	619	-
Stage 1	-	-	-	-	749	-
Stage 2	-	-	-	-	926	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.4	12.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	627	-	-	1055	-
HCM Lane V/C Ratio	0.203	-	-	0.018	-
HCM Control Delay (s)	12.2	-	-	8.5	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.8	-	-	0.1	-

Intersection	
Int Delay, s/veh	4.6

Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	413	404	130	13	8	94
Future Vol, veh/h	413	404	130	13	8	94
Conflicting Peds, #/hr	7	0	0	7	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	1	5	20	0	0	8
Mvmt Flow	413	404	130	13	8	94

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	150	0	-	0	1374	144
Stage 1	-	-	-	-	144	-
Stage 2	-	-	-	-	1230	-
Critical Hdwy	4.11	-	-	-	6.4	6.28
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.209	-	-	-	3.5	3.372
Pot Cap-1 Maneuver	1437	-	-	-	162	888
Stage 1	-	-	-	-	888	-
Stage 2	-	-	-	-	279	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1428	-	-	-	100	883
Mov Cap-2 Maneuver	-	-	-	-	100	-
Stage 1	-	-	-	-	553	-
Stage 2	-	-	-	-	277	-

Approach	EB	WB	SW
HCM Control Delay, s	4.3	0	13.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SWLn1
Capacity (veh/h)	1428	-	-	-	547
HCM Lane V/C Ratio	0.289	-	-	-	0.186
HCM Control Delay (s)	8.5	0	-	-	13.1
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	1.2	-	-	-	0.7

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	9	803	211	13	13	27
Future Vol, veh/h	9	803	211	13	13	27
Conflicting Peds, #/hr	6	0	0	6	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	4	14	24	19
Mvmt Flow	9	803	211	13	13	27

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	230	0	-	0	1045	224
Stage 1	-	-	-	-	224	-
Stage 2	-	-	-	-	821	-
Critical Hdwy	4.1	-	-	-	6.64	6.39
Critical Hdwy Stg 1	-	-	-	-	5.64	-
Critical Hdwy Stg 2	-	-	-	-	5.64	-
Follow-up Hdwy	2.2	-	-	-	3.716	3.471
Pot Cap-1 Maneuver	1350	-	-	-	230	775
Stage 1	-	-	-	-	764	-
Stage 2	-	-	-	-	397	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1343	-	-	-	225	771
Mov Cap-2 Maneuver	-	-	-	-	225	-
Stage 1	-	-	-	-	751	-
Stage 2	-	-	-	-	395	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	14.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1343	-	-	-	431
HCM Lane V/C Ratio	0.007	-	-	-	0.093
HCM Control Delay (s)	7.7	0	-	-	14.2
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	389	2	18	760	864	91
Future Volume (Veh/h)	389	2	18	760	864	91
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	389	2	18	760	864	91
Pedestrians	8					
Lane Width (ft)	11.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	TWLTL	
Median storage veh)					2	
Upstream signal (ft)				697		
pX, platoon unblocked	0.84					
vC, conflicting volume	1668	872	872			
vC1, stage 1 conf vol	872					
vC2, stage 2 conf vol	796					
vCu, unblocked vol	1700	872	872			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	99	98			
cM capacity (veh/h)	359	350	776			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	391	18	760	864	91
Volume Left	389	18	0	0	0
Volume Right	2	0	0	0	91
cSH	359	776	1700	1700	1700
Volume to Capacity	1.09	0.02	0.45	0.51	0.05
Queue Length 95th (ft)	356	2	0	0	0
Control Delay (s)	107.8	9.7	0.0	0.0	0.0
Lane LOS	F	A			
Approach Delay (s)	107.8	0.2		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	19.9		
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	1	0	1	0	5	100	846	23	8	783	5
Future Vol, veh/h	0	1	0	1	0	5	100	846	23	8	783	5
Conflicting Peds, #/hr	3	0	0	0	0	3	0	0	16	16	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
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	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	0	0	11	5	4	0	2	2	2
Mvmt Flow	0	1	0	1	0	5	100	846	23	8	783	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1865	1887	786	1876	1878	877	788	0	0	885	0	0
Stage 1	802	802	-	1074	1074	-	-	-	-	-	-	-
Stage 2	1063	1085	-	802	804	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.31	4.15	-	-	4.12	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.399	2.245	-	-	2.218	-	-
Pot Cap-1 Maneuver	56	71	395	55	72	335	818	-	-	765	-	-
Stage 1	381	399	-	269	299	-	-	-	-	-	-	-
Stage 2	272	295	-	381	398	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	49	61	395	48	62	329	818	-	-	754	-	-
Mov Cap-2 Maneuver	49	61	-	48	62	-	-	-	-	-	-	-
Stage 1	335	395	-	233	259	-	-	-	-	-	-	-
Stage 2	235	255	-	376	394	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	65	27.4	1	0.1
HCM LOS	F	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	818	-	-	61	167	754	-	-
HCM Lane V/C Ratio	0.122	-	-	0.016	0.036	0.011	-	-
HCM Control Delay (s)	10	-	-	65	27.4	9.8	-	-
HCM Lane LOS	B	-	-	F	D	A	-	-
HCM 95th %tile Q(veh)	0.4	-	-	0.1	0.1	0	-	-

Intersection	
Int Delay, s/veh	3.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	1	14	0	2	104	0	0	0	0	231	9
Future Vol, veh/h	5	1	14	0	2	104	0	0	0	0	231	9
Conflicting Peds, #/hr	4	0	0	0	0	4	0	0	0	0	0	7
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	17	0	0	5	0	0	0	0	4	17
Mvmt Flow	5	1	14	0	2	104	0	0	0	0	231	9

Major/Minor	Minor2			Minor1						Major2		
Conflicting Flow All	300	243	243	243	247	4				0	0	0
Stage 1	243	243	-	0	0	-				-	-	-
Stage 2	57	0	-	243	247	-				-	-	-
Critical Hdwy	7.1	6.5	6.37	7.1	6.5	6.25				4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	-	-	-				-	-	-
Critical Hdwy Stg 2	-	-	-	6.1	5.5	-				-	-	-
Follow-up Hdwy	3.5	4	3.453	3.5	4	3.345				2.2	-	-
Pot Cap-1 Maneuver	656	662	760	715	659	1071				-	-	-
Stage 1	765	708	-	-	-	-				-	-	-
Stage 2	-	-	-	765	706	-				-	-	-
Platoon blocked, %											-	-
Mov Cap-1 Maneuver	585	658	755	701	655	1067				-	-	-
Mov Cap-2 Maneuver	585	658	-	701	655	-				-	-	-
Stage 1	765	704	-	-	-	-				-	-	-
Stage 2	-	-	-	750	702	-				-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	10.3	8.8	0
HCM LOS	B	A	

Minor Lane/Major Mvmt	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	699	1054	-	-	-
HCM Lane V/C Ratio	0.029	0.101	-	-	-
HCM Control Delay (s)	10.3	8.8	0	-	-
HCM Lane LOS	B	A	A	-	-
HCM 95th %tile Q(veh)	0.1	0.3	-	-	-

Intersection	
Intersection Delay, s/veh	38.7
Intersection LOS	E

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	730	256	116	812
Demand Flow Rate, veh/h	750	278	117	822
Vehicles Circulating, veh/h	624	144	705	391
Vehicles Exiting, veh/h	589	678	669	31
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	64.9	5.4	7.4	30.1
Approach LOS	F	A	A	D

Lane	Left	Left	Left	Left
Designated Moves	LTR	LT	LTR	LTR
Assumed Moves	LTR	LT	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	750	278	117	822
Cap Entry Lane, veh/h	730	1191	672	926
Entry HV Adj Factor	0.974	0.922	0.991	0.988
Flow Entry, veh/h	730	256	116	812
Cap Entry, veh/h	711	1099	667	915
V/C Ratio	1.027	0.233	0.174	0.888
Control Delay, s/veh	64.9	5.4	7.4	30.1
LOS	F	A	A	D
95th %tile Queue, veh	18	1	1	12

Intersection	
Int Delay, s/veh	7.8

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	80	490	353	20	47	122
Future Vol, veh/h	80	490	353	20	47	122
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Stop	Stop	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	2	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	9	1	2	0	0	2
Mvmt Flow	80	490	353	20	47	122

Major/Minor			Minor2		Major2	
Conflicting Flow All			216	122	0	0
Stage 1			216	-	-	-
Stage 2			0	-	-	-
Critical Hdwy			6.52	6.2	4.1	-
Critical Hdwy Stg 1			5.52	-	-	-
Critical Hdwy Stg 2			-	-	-	-
Follow-up Hdwy			4.018	3.3	2.2	-
Pot Cap-1 Maneuver			682	935	-	-
Stage 1			724	-	-	-
Stage 2			-	-	-	-
Platoon blocked, %						-
Mov Cap-1 Maneuver			0	935	-	-
Mov Cap-2 Maneuver			0	-	-	-
Stage 1			0	-	-	-
Stage 2			0	-	-	-

Approach	SE	NW
HCM Control Delay, s	11.4	
HCM LOS	B	

Minor Lane/Major Mvmt	NWL	NWT	SELn1
Capacity (veh/h)	-	-	935
HCM Lane V/C Ratio	-	-	0.399
HCM Control Delay (s)	-	-	11.4
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	1.9

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	8	358	165	38	15	0
Future Vol, veh/h	8	358	165	38	15	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	11	0	0	0
Mvmt Flow	8	358	165	38	15	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	203	0	-	0	558	184
Stage 1	-	-	-	-	184	-
Stage 2	-	-	-	-	374	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1381	-	-	-	494	864
Stage 1	-	-	-	-	852	-
Stage 2	-	-	-	-	700	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1381	-	-	-	491	864
Mov Cap-2 Maneuver	-	-	-	-	491	-
Stage 1	-	-	-	-	846	-
Stage 2	-	-	-	-	700	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	12.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1381	-	-	-	491
HCM Lane V/C Ratio	0.006	-	-	-	0.031
HCM Control Delay (s)	7.6	0	-	-	12.6
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	5	833	113	702	905	5
Future Vol, veh/h	5	833	113	702	905	5
Conflicting Peds, #/hr	1	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	170	-	-	150
Veh in Median Storage, #	1	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	20	3	2	3	3	0
Mvmt Flow	5	833	113	702	905	5

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1484	-	906	0	-	0
Stage 1	906	-	-	-	-	-
Stage 2	578	-	-	-	-	-
Critical Hdwy	6.9	-	4.13	-	-	-
Critical Hdwy Stg 1	5.7	-	-	-	-	-
Critical Hdwy Stg 2	6.1	-	-	-	-	-
Follow-up Hdwy	3.69	-	2.219	-	-	-
Pot Cap-1 Maneuver	110	0	749	-	-	-
Stage 1	357	0	-	-	-	-
Stage 2	486	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	93	-	748	-	-	-
Mov Cap-2 Maneuver	194	-	-	-	-	-
Stage 1	303	-	-	-	-	-
Stage 2	486	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	24	1.5	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	748	-	194	-	-	-
HCM Lane V/C Ratio	0.151	-	0.026	-	-	-
HCM Control Delay (s)	10.7	-	24	0	-	-
HCM Lane LOS	B	-	C	A	-	-
HCM 95th %tile Q(veh)	0.5	-	0.1	-	-	-

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	18	23	9	41	9	68	63	620	18	3	656	36
Future Volume (vph)	18	23	9	41	9	68	63	620	18	3	656	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0		0			60		0	0		0
Storage Lanes		0		1			1		0	0		0
Taper Length (ft)		100					100			100		
Satd. Flow (prot)	0	0	1765	1561	1589	0	1745	1821	0	0	1770	0
Flt Permitted			0.961				0.362				0.998	
Satd. Flow (perm)	0	0	1488	1324	1423	0	626	1821	0	0	1766	0
Right Turn on Red				Yes	Yes				No			
Satd. Flow (RTOR)				64	301							
Link Speed (mph)			30					30			30	
Link Distance (ft)			417					1123			607	
Travel Time (s)			9.5					25.5			13.8	
Confl. Peds. (#/hr)	37	30		47	30	30	75		49	49		30
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	50	41	9	0	131	638	0	0	727	0
Turn Type	Perm	Perm	NA	Perm	Perm	custom	custom	NA		Perm	NA	
Protected Phases			4				5				6	
Permitted Phases	4	4		4	8	5	2	2		6		
Detector Phase	4	4	4	4	8	5	5	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	4.0	4.0	7.0		7.0	7.0	
Minimum Split (s)	27.0	27.0	27.0	27.0	27.0	8.0	8.0	26.0		34.0	34.0	
Total Split (s)	27.0	27.0	27.0	27.0	27.0	8.0	8.0	93.0		85.0	85.0	
Total Split (%)	22.5%	22.5%	22.5%	22.5%	22.5%	6.7%	6.7%	77.5%		70.8%	70.8%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.5	3.5	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	0.5	0.5	2.0		2.0	2.0	
Lost Time Adjust (s)			0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)			6.0	6.0	6.0		4.0	6.0			6.0	
Lead/Lag						Lead	Lead			Lag	Lag	
Lead-Lag Optimize?						Yes	Yes					
Recall Mode	None	None	None	None	None	None	None	C-Max		C-Max	C-Max	
Act Effct Green (s)			9.7	9.7	9.7		102.9	102.1			89.8	
Actuated g/C Ratio			0.08	0.08	0.08		0.86	0.85			0.75	
v/c Ratio			0.42	0.25	0.02		0.22	0.41			0.55	
Control Delay			62.1	8.6	0.1		2.7	3.9			9.6	
Queue Delay			0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay			62.1	8.6	0.1		2.7	3.9			9.6	
LOS			E	A	A		A	A			A	
Approach Delay			38.0					3.7			9.6	
Approach LOS			D					A			A	
Queue Length 50th (ft)			38	0	0		13	105			226	
Queue Length 95th (ft)			77	18	0		29	184			385	
Internal Link Dist (ft)			337					1043			527	
Turn Bay Length (ft)							60					

Lane Group	SBR2
Lane Configurations	
Traffic Volume (vph)	32
Future Volume (vph)	32
Ideal Flow (vphpl)	1900
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	0
Flt Permitted	
Satd. Flow (perm)	0
Right Turn on Red	No
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	35
Peak Hour Factor	1.00
Heavy Vehicles (%)	0%
Shared Lane Traffic (%)	
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	
Minimum Split (s)	
Total Split (s)	
Total Split (%)	
Yellow Time (s)	
All-Red Time (s)	
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)			260	284	497		602	1549			1321	
Starvation Cap Reductn			0	0	0		0	0			0	
Spillback Cap Reductn			0	0	0		0	0			0	
Storage Cap Reductn			0	0	0		0	0			0	
Reduced v/c Ratio			0.19	0.14	0.02		0.22	0.41			0.55	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.55
Intersection Signal Delay: 8.3 Intersection LOS: A
Intersection Capacity Utilization 103.7% ICU Level of Service G
Analysis Period (min) 15

Splits and Phases: 1: Kuhio Hwy & Kukui St & Huluili St

Lane Group	SBR2
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Intersection	
Int Delay, s/veh	10.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	131	361	14	56	399	38
Future Vol, veh/h	131	361	14	56	399	38
Conflicting Peds, #/hr	0	4	4	0	0	3
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	4	4	6	1	0
Mvmt Flow	131	361	14	56	399	38

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	496	0	400	319
Stage 1	-	-	-	-	316	-
Stage 2	-	-	-	-	84	-
Critical Hdwy	-	-	4.14	-	6.41	6.2
Critical Hdwy Stg 1	-	-	-	-	5.41	-
Critical Hdwy Stg 2	-	-	-	-	5.41	-
Follow-up Hdwy	-	-	2.236	-	3.509	3.3
Pot Cap-1 Maneuver	-	-	1058	-	608	726
Stage 1	-	-	-	-	741	-
Stage 2	-	-	-	-	942	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1054	-	598	722
Mov Cap-2 Maneuver	-	-	-	-	598	-
Stage 1	-	-	-	-	728	-
Stage 2	-	-	-	-	942	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.7	24.7
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	607	-	-	1054	-
HCM Lane V/C Ratio	0.72	-	-	0.013	-
HCM Control Delay (s)	24.7	-	-	8.5	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	6	-	-	0	-

Intersection	
Int Delay, s/veh	46.8

Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	385	258	436	99	56	277
Future Vol, veh/h	385	258	436	99	56	277
Conflicting Peds, #/hr	15	0	0	15	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	3	1	2	2	1
Mvmt Flow	385	258	436	99	56	277

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	550	0	-	0	1529	501
Stage 1	-	-	-	-	501	-
Stage 2	-	-	-	-	1028	-
Critical Hdwy	4.13	-	-	-	6.42	6.21
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.227	-	-	-	3.518	3.309
Pot Cap-1 Maneuver	1015	-	-	-	129	572
Stage 1	-	-	-	-	609	-
Stage 2	-	-	-	-	345	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1002	-	-	-	69	565
Mov Cap-2 Maneuver	-	-	-	-	69	-
Stage 1	-	-	-	-	331	-
Stage 2	-	-	-	-	341	-

Approach	EB	WB	SW
HCM Control Delay, s	6.5	0	199.9
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SWLn1
Capacity (veh/h)	1002	-	-	-	256
HCM Lane V/C Ratio	0.384	-	-	-	1.301
HCM Control Delay (s)	10.8	0	-	-	199.9
HCM Lane LOS	B	A	-	-	F
HCM 95th %tile Q(veh)	1.8	-	-	-	17

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	42	624	643	70	19	28
Future Vol, veh/h	42	624	643	70	19	28
Conflicting Peds, #/hr	2	0	0	2	0	58
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	13	3	1	0	0	6
Mvmt Flow	42	624	643	70	19	28

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	715	0	-	0	1388	738
Stage 1	-	-	-	-	680	-
Stage 2	-	-	-	-	708	-
Critical Hdwy	4.23	-	-	-	6.4	6.26
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.317	-	-	-	3.5	3.354
Pot Cap-1 Maneuver	837	-	-	-	159	411
Stage 1	-	-	-	-	507	-
Stage 2	-	-	-	-	492	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	836	-	-	-	146	390
Mov Cap-2 Maneuver	-	-	-	-	146	-
Stage 1	-	-	-	-	467	-
Stage 2	-	-	-	-	491	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	24.3
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	836	-	-	-	233
HCM Lane V/C Ratio	0.05	-	-	-	0.202
HCM Control Delay (s)	9.5	0	-	-	24.3
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	332	3	22	718	736	170
Future Volume (Veh/h)	332	3	22	718	736	170
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	332	3	22	718	736	170
Pedestrians	19					
Lane Width (ft)	11.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	2					
Right turn flare (veh)						
Median type				None	TWLTL	
Median storage veh)					2	
Upstream signal (ft)				607		
pX, platoon unblocked	0.91					
vC, conflicting volume	1517	755	755			
vC1, stage 1 conf vol	755					
vC2, stage 2 conf vol	762					
vCu, unblocked vol	1519	755	755			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	16	99	97			
cM capacity (veh/h)	394	405	850			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	335	22	718	736	170
Volume Left	332	22	0	0	0
Volume Right	3	0	0	0	170
cSH	394	850	1700	1700	1700
Volume to Capacity	0.85	0.03	0.42	0.43	0.10
Queue Length 95th (ft)	202	2	0	0	0
Control Delay (s)	48.4	9.3	0.0	0.0	0.0
Lane LOS	E	A			
Approach Delay (s)	48.4	0.3		0.0	
Approach LOS	E				

Intersection Summary			
Average Delay	8.3		
Intersection Capacity Utilization	64.0%	ICU Level of Service	B
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	3.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	0	2	0	14	430	738	14	14	688	5
Future Vol, veh/h	1	0	0	2	0	14	430	738	14	14	688	5
Conflicting Peds, #/hr	1	0	0	0	0	1	0	0	7	7	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
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	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	0	0	11	5	4	0	2	2	2
Mvmt Flow	1	0	0	2	0	14	430	738	14	14	688	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2332	2338	691	2331	2333	753	693	0	0	759	0	0
Stage 1	719	719	-	1612	1612	-	-	-	-	-	-	-
Stage 2	1613	1619	-	719	721	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.31	4.15	-	-	4.12	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.399	2.245	-	-	2.218	-	-
Pot Cap-1 Maneuver	26	37	448	26	37	395	888	-	-	852	-	-
Stage 1	423	436	-	133	165	-	-	-	-	-	-	-
Stage 2	132	164	-	423	435	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	15	19	448	16	19	392	888	-	-	847	-	-
Mov Cap-2 Maneuver	15	19	-	16	19	-	-	-	-	-	-	-
Stage 1	218	429	-	68	85	-	-	-	-	-	-	-
Stage 2	66	84	-	416	428	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	261.5	47.7	4.7	0.2
HCM LOS	F	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	888	-	-	15	100	847	-	-
HCM Lane V/C Ratio	0.484	-	-	0.067	0.16	0.017	-	-
HCM Control Delay (s)	12.8	-	-	261.5	47.7	9.3	-	-
HCM Lane LOS	B	-	-	F	E	A	-	-
HCM 95th %tile Q(veh)	2.7	-	-	0.2	0.5	0.1	-	-

Intersection	
Int Delay, s/veh	7.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	1	0	2	3	434	0	0	0	0	226	5
Future Vol, veh/h	9	1	0	2	3	434	0	0	0	0	226	5
Conflicting Peds, #/hr	13	0	0	0	0	13	0	0	0	7	0	16
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	17	0	0	5	0	0	0	0	4	17
Mvmt Flow	9	1	0	2	3	434	0	0	0	0	226	5

Major/Minor	Minor2			Minor1						Major2		
Conflicting Flow All	477	252	245	236	254	20				7	0	0
Stage 1	245	245	-	7	7	-				-	-	-
Stage 2	232	7	-	229	247	-				-	-	-
Critical Hdwy	7.1	6.5	6.37	7.1	6.5	6.25				4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	-	-	-				-	-	-
Critical Hdwy Stg 2	-	-	-	6.1	5.5	-				-	-	-
Follow-up Hdwy	3.5	4	3.453	3.5	4	3.345				2.2	-	-
Pot Cap-1 Maneuver	502	655	758	723	653	1049				1627	-	-
Stage 1	763	707	-	-	-	-				-	-	-
Stage 2	-	-	-	778	706	-				-	-	-
Platoon blocked, %											-	-
Mov Cap-1 Maneuver	282	642	747	718	640	1031				1617	-	-
Mov Cap-2 Maneuver	282	642	-	718	640	-				-	-	-
Stage 1	763	697	-	-	-	-				-	-	-
Stage 2	-	-	-	777	696	-				-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	17.5	11.1	0
HCM LOS	C	B	

Minor Lane/Major Mvmt	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	299	1025	1617	-	-
HCM Lane V/C Ratio	0.033	0.428	-	-	-
HCM Control Delay (s)	17.5	11.1	0	-	-
HCM Lane LOS	C	B	A	-	-
HCM 95th %tile Q(veh)	0.1	2.2	0	-	-

Intersection	
Intersection Delay, s/veh	27.7
Intersection LOS	D

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	306	648	751	460
Demand Flow Rate, veh/h	326	661	751	476
Vehicles Circulating, veh/h	514	391	307	1046
Vehicles Exiting, veh/h	1008	667	533	6
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.8	16.8	16.9	72.9
Approach LOS	A	C	C	F

Lane	Left	Left	Left	Left
Designated Moves	LTR	LT	LTR	LTR
Assumed Moves	LTR	LT	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	326	661	751	476
Cap Entry Lane, veh/h	817	926	1009	475
Entry HV Adj Factor	0.939	0.980	1.000	0.966
Flow Entry, veh/h	306	648	751	460
Cap Entry, veh/h	767	907	1009	458
V/C Ratio	0.399	0.714	0.744	1.002
Control Delay, s/veh	9.8	16.8	16.9	72.9
LOS	A	C	C	F
95th %tile Queue, veh	2	6	7	13

Intersection	
Int Delay, s/veh	5.4

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	61	137	325	330	141	80
Future Vol, veh/h	61	137	325	330	141	80
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	1	2	0
Mvmt Flow	61	137	325	330	141	80

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	655	0	-	0	749	490
Stage 1	-	-	-	-	490	-
Stage 2	-	-	-	-	259	-
Critical Hdwy	4.1	-	-	-	6.42	6.2
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.3
Pot Cap-1 Maneuver	942	-	-	-	379	582
Stage 1	-	-	-	-	616	-
Stage 2	-	-	-	-	784	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	942	-	-	-	352	582
Mov Cap-2 Maneuver	-	-	-	-	352	-
Stage 1	-	-	-	-	573	-
Stage 2	-	-	-	-	784	-

Approach	EB	WB	SE
HCM Control Delay, s	2.8	0	23.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SELn1
Capacity (veh/h)	942	-	-	-	411
HCM Lane V/C Ratio	0.065	-	-	-	0.538
HCM Control Delay (s)	9.1	0	-	-	23.5
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	3.1

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	207	339	52	14	1
Future Vol, veh/h	5	207	339	52	14	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	1	1	0	0	0
Mvmt Flow	5	207	339	52	14	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	391	0	-	0	582	365
Stage 1	-	-	-	-	365	-
Stage 2	-	-	-	-	217	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1179	-	-	-	479	685
Stage 1	-	-	-	-	707	-
Stage 2	-	-	-	-	824	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1179	-	-	-	477	685
Mov Cap-2 Maneuver	-	-	-	-	477	-
Stage 1	-	-	-	-	703	-
Stage 2	-	-	-	-	824	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	12.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1179	-	-	-	487
HCM Lane V/C Ratio	0.004	-	-	-	0.031
HCM Control Delay (s)	8.1	0	-	-	12.6
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	8.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	27	404	745	839	503	85
Future Vol, veh/h	27	404	745	839	503	85
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	Yield
Storage Length	140	0	170	-	-	150
Veh in Median Storage, #	1	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	1	3	1
Mvmt Flow	27	404	745	839	503	85

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2413	503	503	0	-	0
Stage 1	503	-	-	-	-	-
Stage 2	1910	-	-	-	-	-
Critical Hdwy	6.6	6.23	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.319	2.2	-	-	-
Pot Cap-1 Maneuver	32	568	1072	-	-	-
Stage 1	612	-	-	-	-	-
Stage 2	104	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 10	568	1072	-	-	-
Mov Cap-2 Maneuver	231	-	-	-	-	-
Stage 1	187	-	-	-	-	-
Stage 2	104	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	25.2	7.3	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1072	-	231	568	-	-
HCM Lane V/C Ratio	0.695	-	0.117	0.711	-	-
HCM Control Delay (s)	15.6	-	22.6	25.4	-	-
HCM Lane LOS	C	-	C	D	-	-
HCM 95th %tile Q(veh)	6	-	0.4	5.8	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

TRAFFIC IMPACT ANALYSIS REPORT UPDATE

FOR THE PROPOSED

HOKUA PLACE

KAPA`A, KAUAI, HAWAII
TAX MAP KEY: (4) 4-3-03: 01

APPENDIX D

CAPACITY ANALYSIS WORKSHEETS

PEAK HOUR TRAFFIC WITH PROJECT

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	9	37	12	60	1	11	5	751	14	3	824	43
Future Volume (vph)	9	37	12	60	1	11	5	751	14	3	824	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0		0			60		0	0		0
Storage Lanes		0		1			1		0	0		0
Taper Length (ft)		100					100			100		
Satd. Flow (prot)	0	0	1613	1501	1589	0	1632	1760	0	0	1798	0
Flt Permitted			0.962				0.328				0.998	
Satd. Flow (perm)	0	0	1574	1420	1526	0	560	1760	0	0	1795	0
Right Turn on Red				Yes	Yes				No			
Satd. Flow (RTOR)				60	330							
Link Speed (mph)			30					30			30	
Link Distance (ft)			417					1113			697	
Travel Time (s)			9.5					25.3			15.8	
Confl. Peds. (#/hr)	2	4		7	4	4	4		7	4		4
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	15%	0%	4%	0%	6%	9%	4%	0%	0%	1%	4%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	58	60	1	0	16	765	0	0	875	0
Turn Type	Perm	Perm	NA	Perm	Perm	custom	custom	NA		Perm	NA	
Protected Phases			4				5				6	
Permitted Phases	4	4		4	8	5	2	2		6		
Detector Phase	4	4	4	4	8	5	5	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	1.0	1.0	7.0		7.0	7.0	
Minimum Split (s)	27.0	27.0	27.0	27.0	27.0	5.0	5.0	26.0		34.0	34.0	
Total Split (s)	30.0	30.0	30.0	30.0	30.0	6.0	6.0	180.0		174.0	174.0	
Total Split (%)	14.3%	14.3%	14.3%	14.3%	14.3%	2.9%	2.9%	85.7%		82.9%	82.9%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	1.0	1.0	2.0		2.0	2.0	
Lost Time Adjust (s)			0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)			6.0	6.0	6.0		4.0	6.0			6.0	
Lead/Lag						Lead	Lead			Lag	Lag	
Lead-Lag Optimize?						Yes	Yes					
Recall Mode	None	None	None	None	None	None	None	C-Max		C-Max	C-Max	
Act Effct Green (s)			13.1	13.1	13.1		186.9	184.9			179.0	
Actuated g/C Ratio			0.06	0.06	0.06		0.89	0.88			0.85	
v/c Ratio			0.59	0.42	0.00		0.03	0.49			0.57	
Control Delay			118.9	26.1	0.0		1.8	4.1			7.0	
Queue Delay			0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay			118.9	26.1	0.0		1.8	4.1			7.0	
LOS			F	C	A		A	A			A	
Approach Delay			71.7					4.0			7.0	
Approach LOS			E					A			A	
Queue Length 50th (ft)			80	0	0		2	180			342	
Queue Length 95th (ft)			136	56	0		6	284			505	
Internal Link Dist (ft)			337					1033			617	
Turn Bay Length (ft)							60					

Lane Group	SBR2
Lane Configurations	
Traffic Volume (vph)	5
Future Volume (vph)	5
Ideal Flow (vphpl)	1900
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	0
Flt Permitted	
Satd. Flow (perm)	0
Right Turn on Red	No
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	4
Peak Hour Factor	1.00
Heavy Vehicles (%)	0%
Shared Lane Traffic (%)	
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	
Minimum Split (s)	
Total Split (s)	
Total Split (%)	
Yellow Time (s)	
All-Red Time (s)	
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)			179	215	466		527	1549			1529	
Starvation Cap Reductn			0	0	0		0	0			0	
Spillback Cap Reductn			0	0	0		0	0			0	
Storage Cap Reductn			0	0	0		0	0			0	
Reduced v/c Ratio			0.32	0.28	0.00		0.03	0.49			0.57	

Intersection Summary	
Area Type: Other	
Cycle Length: 210	
Actuated Cycle Length: 210	
Offset: 202 (96%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.59	
Intersection Signal Delay: 10.0	Intersection LOS: A
Intersection Capacity Utilization 70.9%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Kuhio Hwy & Kukui St & Huluili St

Lane Group	SBR2
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Intersection	
Int Delay, s/veh	2.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	151	388	19	51	136	9
Future Vol, veh/h	151	388	19	51	136	9
Conflicting Peds, #/hr	0	0	0	0	1	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	6	17	0	6	9
Mvmt Flow	151	388	19	51	136	9

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	539	0	435	345
Stage 1	-	-	-	-	345	-
Stage 2	-	-	-	-	90	-
Critical Hdwy	-	-	4.27	-	6.46	6.29
Critical Hdwy Stg 1	-	-	-	-	5.46	-
Critical Hdwy Stg 2	-	-	-	-	5.46	-
Follow-up Hdwy	-	-	2.353	-	3.554	3.381
Pot Cap-1 Maneuver	-	-	958	-	571	682
Stage 1	-	-	-	-	708	-
Stage 2	-	-	-	-	924	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	958	-	559	682
Mov Cap-2 Maneuver	-	-	-	-	559	-
Stage 1	-	-	-	-	694	-
Stage 2	-	-	-	-	923	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.4	13.6
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	565	-	-	958	-
HCM Lane V/C Ratio	0.257	-	-	0.02	-
HCM Control Delay (s)	13.6	-	-	8.8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	1	-	-	0.1	-

Intersection	
Int Delay, s/veh	5.4

Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	540	514	152	13	8	108
Future Vol, veh/h	540	514	152	13	8	108
Conflicting Peds, #/hr	7	0	0	7	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	1	5	20	0	0	8
Mvmt Flow	540	514	152	13	8	108

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	172	0	-	0	1760	166
Stage 1	-	-	-	-	166	-
Stage 2	-	-	-	-	1594	-
Critical Hdwy	4.11	-	-	-	6.4	6.28
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.209	-	-	-	3.5	3.372
Pot Cap-1 Maneuver	1411	-	-	-	94	863
Stage 1	-	-	-	-	868	-
Stage 2	-	-	-	-	185	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1402	-	-	-	43	858
Mov Cap-2 Maneuver	-	-	-	-	43	-
Stage 1	-	-	-	-	398	-
Stage 2	-	-	-	-	184	-

Approach	EB	WB	SW
HCM Control Delay, s	4.7	0	19
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SWLn1
Capacity (veh/h)	1402	-	-	-	372
HCM Lane V/C Ratio	0.385	-	-	-	0.312
HCM Control Delay (s)	9.2	0	-	-	19
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	1.8	-	-	-	1.3

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	15	1040	247	13	13	31
Future Vol, veh/h	15	1040	247	13	13	31
Conflicting Peds, #/hr	6	0	0	6	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	4	14	24	19
Mvmt Flow	15	1040	247	13	13	31

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	266	0	-	0	1330	260
Stage 1	-	-	-	-	260	-
Stage 2	-	-	-	-	1070	-
Critical Hdwy	4.1	-	-	-	6.64	6.39
Critical Hdwy Stg 1	-	-	-	-	5.64	-
Critical Hdwy Stg 2	-	-	-	-	5.64	-
Follow-up Hdwy	2.2	-	-	-	3.716	3.471
Pot Cap-1 Maneuver	1310	-	-	-	153	739
Stage 1	-	-	-	-	735	-
Stage 2	-	-	-	-	299	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1303	-	-	-	147	735
Mov Cap-2 Maneuver	-	-	-	-	147	-
Stage 1	-	-	-	-	711	-
Stage 2	-	-	-	-	298	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	17.3
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1303	-	-	-	337
HCM Lane V/C Ratio	0.012	-	-	-	0.131
HCM Control Delay (s)	7.8	0	-	-	17.3
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	516	2	18	760	864	105
Future Volume (Veh/h)	516	2	18	760	864	105
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	516	2	18	760	864	105
Pedestrians	8					
Lane Width (ft)	11.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	TWLTL	
Median storage veh)					2	
Upstream signal (ft)				697		
pX, platoon unblocked	0.90					
vC, conflicting volume	1668	872	872			
vC1, stage 1 conf vol	872					
vC2, stage 2 conf vol	796					
vCu, unblocked vol	1686	872	872			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	99	98			
cM capacity (veh/h)	362	350	776			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	518	18	760	864	105
Volume Left	516	18	0	0	0
Volume Right	2	0	0	0	105
cSH	362	776	1700	1700	1700
Volume to Capacity	1.43	0.02	0.45	0.51	0.06
Queue Length 95th (ft)	669	2	0	0	0
Control Delay (s)	237.5	9.7	0.0	0.0	0.0
Lane LOS	F	A			
Approach Delay (s)	237.5	0.2		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	54.4		
Intersection Capacity Utilization	80.8%	ICU Level of Service	D
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	1	0	1	0	5	118	848	23	8	802	5
Future Vol, veh/h	0	1	0	1	0	5	118	848	23	8	802	5
Conflicting Peds, #/hr	3	0	0	0	0	3	0	0	16	16	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
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	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	0	0	11	5	4	0	2	2	2
Mvmt Flow	0	1	0	1	0	5	118	848	23	8	802	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1922	1944	805	1933	1935	879	807	0	0	887	0	0
Stage 1	821	821	-	1112	1112	-	-	-	-	-	-	-
Stage 2	1101	1123	-	821	823	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.31	4.15	-	-	4.12	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.399	2.245	-	-	2.218	-	-
Pot Cap-1 Maneuver	51	66	386	50	67	334	805	-	-	763	-	-
Stage 1	371	391	-	256	287	-	-	-	-	-	-	-
Stage 2	259	283	-	371	391	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	44	55	386	43	56	328	805	-	-	752	-	-
Mov Cap-2 Maneuver	44	55	-	43	56	-	-	-	-	-	-	-
Stage 1	316	387	-	215	241	-	-	-	-	-	-	-
Stage 2	217	238	-	366	387	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	71.7	29	1.2	0.1
HCM LOS	F	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	805	-	-	55	156	752	-	-
HCM Lane V/C Ratio	0.147	-	-	0.018	0.038	0.011	-	-
HCM Control Delay (s)	10.2	-	-	71.7	29	9.8	-	-
HCM Lane LOS	B	-	-	F	D	A	-	-
HCM 95th %tile Q(veh)	0.5	-	-	0.1	0.1	0	-	-

Intersection												
Int Delay, s/veh	2.9											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	1	14	0	2	122	0	0	0	0	308	9
Future Vol, veh/h	5	1	14	0	2	122	0	0	0	0	308	9
Conflicting Peds, #/hr	4	0	0	0	0	4	0	0	0	0	0	7
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	17	0	0	5	0	0	0	0	4	17
Mvmt Flow	5	1	14	0	2	122	0	0	0	0	308	9

Major/Minor	Minor2			Minor1						Major2		
Conflicting Flow All	386	320	320	320	324	4				0	0	0
Stage 1	320	320	-	0	0	-				-	-	-
Stage 2	66	0	-	320	324	-				-	-	-
Critical Hdwy	7.1	6.5	6.37	7.1	6.5	6.25				4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	-	-	-				-	-	-
Critical Hdwy Stg 2	-	-	-	6.1	5.5	-				-	-	-
Follow-up Hdwy	3.5	4	3.453	3.5	4	3.345				2.2	-	-
Pot Cap-1 Maneuver	576	600	687	637	597	1071				-	-	-
Stage 1	696	656	-	-	-	-				-	-	-
Stage 2	-	-	-	696	653	-				-	-	-
Platoon blocked, %											-	-
Mov Cap-1 Maneuver	504	596	683	623	593	1067				-	-	-
Mov Cap-2 Maneuver	504	596	-	623	593	-				-	-	-
Stage 1	696	652	-	-	-	-				-	-	-
Stage 2	-	-	-	681	649	-				-	-	-

Approach	EB			WB						SB		
HCM Control Delay, s	11			8.9						0		
HCM LOS	B			A								

Minor Lane/Major Mvmt	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	623	1053	-	-	-
HCM Lane V/C Ratio	0.032	0.118	-	-	-
HCM Control Delay (s)	11	8.9	0	-	-
HCM Lane LOS	B	A	A	-	-
HCM 95th %tile Q(veh)	0.1	0.4	-	-	-

Intersection	
Intersection Delay, s/veh	31.9
Intersection LOS	D

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	595	296	340	855
Demand Flow Rate, veh/h	611	327	349	866
Vehicles Circulating, veh/h	710	112	728	408
Vehicles Exiting, veh/h	564	965	593	31
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	42.1	5.7	14.5	40.7
Approach LOS	E	A	B	E

Lane	Left	Left	Left	Left
Designated Moves	LTR	LT	LTR	LTR
Assumed Moves	LTR	LT	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	611	327	349	866
Cap Entry Lane, veh/h	669	1231	657	910
Entry HV Adj Factor	0.973	0.906	0.974	0.988
Flow Entry, veh/h	595	296	340	855
Cap Entry, veh/h	651	1115	640	899
V/C Ratio	0.913	0.266	0.531	0.951
Control Delay, s/veh	42.1	5.7	14.5	40.7
LOS	E	A	B	E
95th %tile Queue, veh	12	1	3	15

Intersection	
Intersection Delay, s/veh	10.1
Intersection LOS	B

Approach	EB	WB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	176	569	516
Demand Flow Rate, veh/h	179	580	526
Vehicles Circulating, veh/h	224	56	504
Vehicles Exiting, veh/h	806	347	132
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	4.8	7.3	15.1
Approach LOS	A	A	C

Lane	Left	Left	Left
Designated Moves	LT	TR	LR
Assumed Moves	LT	TR	LR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	179	580	526
Cap Entry Lane, veh/h	1098	1303	825
Entry HV Adj Factor	0.981	0.981	0.981
Flow Entry, veh/h	176	569	516
Cap Entry, veh/h	1077	1279	810
V/C Ratio	0.163	0.445	0.637
Control Delay, s/veh	4.8	7.3	15.1
LOS	A	A	C
95th %tile Queue, veh	1	2	5

Intersection						
Int Delay, s/veh	1					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	684	175	3	142	33	24
Future Vol, veh/h	684	175	3	142	33	24
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	684	175	3	142	33	24

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	859	0	920	772
Stage 1	-	-	-	-	772	-
Stage 2	-	-	-	-	148	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	782	-	301	400
Stage 1	-	-	-	-	456	-
Stage 2	-	-	-	-	880	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	782	-	300	400
Mov Cap-2 Maneuver	-	-	-	-	300	-
Stage 1	-	-	-	-	454	-
Stage 2	-	-	-	-	880	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	17.9
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	335	-	-	782	-
HCM Lane V/C Ratio	0.17	-	-	0.004	-
HCM Control Delay (s)	17.9	-	-	9.6	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.6	-	-	0	-

Intersection	
Int Delay, s/veh	35.5

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	80	506	52	122	353	20
Future Vol, veh/h	80	506	52	122	353	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	9	1	0	2	2	0
Mvmt Flow	80	506	52	122	353	20

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	174	0	-	0	779	113
Stage 1	-	-	-	-	113	-
Stage 2	-	-	-	-	666	-
Critical Hdwy	4.19	-	-	-	6.42	6.2
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.281	-	-	-	3.518	3.3
Pot Cap-1 Maneuver	1361	-	-	-	364	945
Stage 1	-	-	-	-	912	-
Stage 2	-	-	-	-	511	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1361	-	-	-	~ 334	945
Mov Cap-2 Maneuver	-	-	-	-	~ 334	-
Stage 1	-	-	-	-	837	-
Stage 2	-	-	-	-	511	-

Approach	EB	WB	SE
HCM Control Delay, s	1.1	0	106.1
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SELn1
Capacity (veh/h)	1361	-	-	-	346
HCM Lane V/C Ratio	0.059	-	-	-	1.078
HCM Control Delay (s)	7.8	0	-	-	106.1
HCM Lane LOS	A	A	-	-	F
HCM 95th %tile Q(veh)	0.2	-	-	-	13.6

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	8	358	165	38	15	0
Future Vol, veh/h	8	358	165	38	15	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	11	0	0	0
Mvmt Flow	8	358	165	38	15	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	203	0	-	0	558	184
Stage 1	-	-	-	-	184	-
Stage 2	-	-	-	-	374	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1381	-	-	-	494	864
Stage 1	-	-	-	-	852	-
Stage 2	-	-	-	-	700	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1381	-	-	-	491	864
Mov Cap-2 Maneuver	-	-	-	-	491	-
Stage 1	-	-	-	-	846	-
Stage 2	-	-	-	-	700	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	12.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1381	-	-	-	491
HCM Lane V/C Ratio	0.006	-	-	-	0.031
HCM Control Delay (s)	7.6	0	-	-	12.6
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	570	0	5	67	0	16
Future Vol, veh/h	570	0	5	67	0	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	570	0	5	67	0	16

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	570	0	647	570
Stage 1	-	-	-	-	570	-
Stage 2	-	-	-	-	77	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1002	-	436	521
Stage 1	-	-	-	-	566	-
Stage 2	-	-	-	-	946	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1002	-	434	521
Mov Cap-2 Maneuver	-	-	-	-	434	-
Stage 1	-	-	-	-	563	-
Stage 2	-	-	-	-	946	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	12.1
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	521	-	-	1002	-
HCM Lane V/C Ratio	0.031	-	-	0.005	-
HCM Control Delay (s)	12.1	-	-	8.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	6	971	136	702	905	6
Future Vol, veh/h	6	971	136	702	905	6
Conflicting Peds, #/hr	1	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	170	-	-	150
Veh in Median Storage, #	1	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	20	3	2	3	3	0
Mvmt Flow	6	971	136	702	905	6

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1530	-	906	0	-	0
Stage 1	906	-	-	-	-	-
Stage 2	624	-	-	-	-	-
Critical Hdwy	6.9	-	4.13	-	-	-
Critical Hdwy Stg 1	5.7	-	-	-	-	-
Critical Hdwy Stg 2	6.1	-	-	-	-	-
Follow-up Hdwy	3.69	-	2.219	-	-	-
Pot Cap-1 Maneuver	103	0	749	-	-	-
Stage 1	357	0	-	-	-	-
Stage 2	459	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	84	-	748	-	-	-
Mov Cap-2 Maneuver	178	-	-	-	-	-
Stage 1	292	-	-	-	-	-
Stage 2	459	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	25.9	1.8	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	748	-	178	-	-	-
HCM Lane V/C Ratio	0.182	-	0.034	-	-	-
HCM Control Delay (s)	10.9	-	25.9	0	-	-
HCM Lane LOS	B	-	D	A	-	-
HCM 95th %tile Q(veh)	0.7	-	0.1	-	-	-

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	18	34	11	48	9	74	63	620	18	3	656	42
Future Volume (vph)	18	34	11	48	9	74	63	620	18	3	656	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0		0			60		0	0		0
Storage Lanes		0		1			1		0	0		0
Taper Length (ft)		100					100			100		
Satd. Flow (prot)	0	0	1763	1561	1589	0	1745	1821	0	0	1767	0
Flt Permitted			0.960				0.358				0.998	
Satd. Flow (perm)	0	0	1485	1324	1423	0	619	1821	0	0	1763	0
Right Turn on Red				Yes	Yes				No			
Satd. Flow (RTOR)				64	301							
Link Speed (mph)			30					30			30	
Link Distance (ft)			417					1123			607	
Travel Time (s)			9.5					25.5			13.8	
Confl. Peds. (#/hr)	37	30		47	30	30	75		49	49		30
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	63	48	9	0	137	638	0	0	733	0
Turn Type	Perm	Perm	NA	Perm	Perm	custom	custom	NA		Perm	NA	
Protected Phases			4				5				6	
Permitted Phases	4	4		4	8	5	2	2		6		
Detector Phase	4	4	4	4	8	5	5	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	4.0	4.0	7.0		7.0	7.0	
Minimum Split (s)	27.0	27.0	27.0	27.0	27.0	8.0	8.0	26.0		34.0	34.0	
Total Split (s)	27.0	27.0	27.0	27.0	27.0	8.0	8.0	93.0		85.0	85.0	
Total Split (%)	22.5%	22.5%	22.5%	22.5%	22.5%	6.7%	6.7%	77.5%		70.8%	70.8%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.5	3.5	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	0.5	0.5	2.0		2.0	2.0	
Lost Time Adjust (s)			0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)			6.0	6.0	6.0		4.0	6.0			6.0	
Lead/Lag						Lead	Lead			Lag	Lag	
Lead-Lag Optimize?						Yes	Yes					
Recall Mode	None	None	None	None	None	None	None	C-Max		C-Max	C-Max	
Act Effct Green (s)			10.6	10.6	10.6		102.0	101.2			88.7	
Actuated g/C Ratio			0.09	0.09	0.09		0.85	0.84			0.74	
v/c Ratio			0.48	0.27	0.02		0.23	0.42			0.56	
Control Delay			63.3	11.1	0.1		3.0	4.2			10.5	
Queue Delay			0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay			63.3	11.1	0.1		3.0	4.2			10.5	
LOS			E	B	A		A	A			B	
Approach Delay			40.7					4.0			10.5	
Approach LOS			D					A			B	
Queue Length 50th (ft)			47	0	0		15	112			241	
Queue Length 95th (ft)			92	25	0		33	198			413	
Internal Link Dist (ft)			337					1043			527	
Turn Bay Length (ft)							60					

Lane Group	SBR2
Lane Configurations	
Traffic Volume (vph)	32
Future Volume (vph)	32
Ideal Flow (vphpl)	1900
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	0
Flt Permitted	
Satd. Flow (perm)	0
Right Turn on Red	No
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	35
Peak Hour Factor	1.00
Heavy Vehicles (%)	0%
Shared Lane Traffic (%)	
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	
Minimum Split (s)	
Total Split (s)	
Total Split (%)	
Yellow Time (s)	
All-Red Time (s)	
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)			259	284	497		593	1535			1303	
Starvation Cap Reductn			0	0	0		0	0			0	
Spillback Cap Reductn			0	0	0		0	0			0	
Storage Cap Reductn			0	0	0		0	0			0	
Reduced v/c Ratio			0.24	0.17	0.02		0.23	0.42			0.56	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.56	
Intersection Signal Delay: 9.4	Intersection LOS: A
Intersection Capacity Utilization 104.3%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 1: Kuhio Hwy & Kukui St & Huluili St

Lane Group	SBR2
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Intersection	
Int Delay, s/veh	22.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	151	410	14	68	485	38
Future Vol, veh/h	151	410	14	68	485	38
Conflicting Peds, #/hr	0	4	4	0	0	3
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	4	4	6	1	0
Mvmt Flow	151	410	14	68	485	38

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	565	0	456	363
Stage 1	-	-	-	-	360	-
Stage 2	-	-	-	-	96	-
Critical Hdwy	-	-	4.14	-	6.41	6.2
Critical Hdwy Stg 1	-	-	-	-	5.41	-
Critical Hdwy Stg 2	-	-	-	-	5.41	-
Follow-up Hdwy	-	-	2.236	-	3.509	3.3
Pot Cap-1 Maneuver	-	-	997	-	564	686
Stage 1	-	-	-	-	708	-
Stage 2	-	-	-	-	930	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	994	-	554	682
Mov Cap-2 Maneuver	-	-	-	-	554	-
Stage 1	-	-	-	-	695	-
Stage 2	-	-	-	-	930	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.5	49.9
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	562	-	-	994	-
HCM Lane V/C Ratio	0.931	-	-	0.014	-
HCM Control Delay (s)	49.9	-	-	8.7	0
HCM Lane LOS	E	-	-	A	A
HCM 95th %tile Q(veh)	11.8	-	-	0	-

Intersection	
Int Delay, s/veh	160.2

Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	455	327	534	99	56	343
Future Vol, veh/h	455	327	534	99	56	343
Conflicting Peds, #/hr	15	0	0	15	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	3	3	1	2	2	1
Mvmt Flow	455	327	534	99	56	343

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	648	0	-	0	1836	599
Stage 1	-	-	-	-	599	-
Stage 2	-	-	-	-	1237	-
Critical Hdwy	4.13	-	-	-	6.42	6.21
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.227	-	-	-	3.518	3.309
Pot Cap-1 Maneuver	933	-	-	-	83	503
Stage 1	-	-	-	-	549	-
Stage 2	-	-	-	-	274	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	921	-	-	-	~ 32	496
Mov Cap-2 Maneuver	-	-	-	-	~ 32	-
Stage 1	-	-	-	-	215	-
Stage 2	-	-	-	-	270	-

Approach	EB	WB	SW
HCM Control Delay, s	7.4	0	$ 714
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SWLn1
Capacity (veh/h)	921	-	-	-	163
HCM Lane V/C Ratio	0.494	-	-	-	2.448
HCM Control Delay (s)	12.7	0	-	-	$ 714
HCM Lane LOS	B	A	-	-	F
HCM 95th %tile Q(veh)	2.8	-	-	-	33.9

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	52	763	807	70	19	39
Future Vol, veh/h	52	763	807	70	19	39
Conflicting Peds, #/hr	2	0	0	2	0	58
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	13	3	1	0	0	6
Mvmt Flow	52	763	807	70	19	39

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	879	0	-	0	1711	902
Stage 1	-	-	-	-	844	-
Stage 2	-	-	-	-	867	-
Critical Hdwy	4.23	-	-	-	6.4	6.26
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.317	-	-	-	3.5	3.354
Pot Cap-1 Maneuver	724	-	-	-	101	331
Stage 1	-	-	-	-	425	-
Stage 2	-	-	-	-	415	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	723	-	-	-	88	314
Mov Cap-2 Maneuver	-	-	-	-	88	-
Stage 1	-	-	-	-	371	-
Stage 2	-	-	-	-	414	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	36.5
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	723	-	-	-	171
HCM Lane V/C Ratio	0.072	-	-	-	0.339
HCM Control Delay (s)	10.4	0	-	-	36.5
HCM Lane LOS	B	A	-	-	E
HCM 95th %tile Q(veh)	0.2	-	-	-	1.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	402	3	22	718	736	236
Future Volume (Veh/h)	402	3	22	718	736	236
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	402	3	22	718	736	236
Pedestrians	19					
Lane Width (ft)	11.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	2					
Right turn flare (veh)						
Median type				None	TWLTL	
Median storage veh)					2	
Upstream signal (ft)				607		
pX, platoon unblocked	0.90					
vC, conflicting volume	1517	755	755			
vC1, stage 1 conf vol	755					
vC2, stage 2 conf vol	762					
vCu, unblocked vol	1519	755	755			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	99	97			
cM capacity (veh/h)	394	405	850			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	405	22	718	736	236
Volume Left	402	22	0	0	0
Volume Right	3	0	0	0	236
cSH	394	850	1700	1700	1700
Volume to Capacity	1.03	0.03	0.42	0.43	0.14
Queue Length 95th (ft)	326	2	0	0	0
Control Delay (s)	85.7	9.3	0.0	0.0	0.0
Lane LOS	F	A			
Approach Delay (s)	85.7	0.3		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	16.5		
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	4.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	0	0	0	14	516	744	14	14	695	5
Future Vol, veh/h	1	0	0	0	0	14	516	744	14	14	695	5
Conflicting Peds, #/hr	1	0	0	0	0	1	0	0	7	7	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
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	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	0	0	11	5	4	0	2	2	2
Mvmt Flow	1	0	0	0	0	14	516	744	14	14	695	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2517	2523	698	2516	2518	759	700	0	0	765	0	0
Stage 1	726	726	-	1790	1790	-	-	-	-	-	-	-
Stage 2	1791	1797	-	726	728	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.31	4.15	-	-	4.12	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.399	2.245	-	-	2.218	-	-
Pot Cap-1 Maneuver	19	28	444	19	28	392	883	-	-	848	-	-
Stage 1	419	433	-	105	135	-	-	-	-	-	-	-
Stage 2	104	134	-	419	432	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	10	11	444	10	11	389	883	-	-	843	-	-
Mov Cap-2 Maneuver	10	11	-	10	11	-	-	-	-	-	-	-
Stage 1	174	426	-	43	56	-	-	-	-	-	-	-
Stage 2	42	55	-	412	425	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	$ 401.7	14.6	5.9	0.2
HCM LOS	F	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	883	-	-	10	389	843	-	-
HCM Lane V/C Ratio	0.584	-	-	0.1	0.036	0.017	-	-
HCM Control Delay (s)	14.6	-	-	$ 401.7	14.6	9.3	-	-
HCM Lane LOS	B	-	-	F	B	A	-	-
HCM 95th %tile Q(veh)	3.9	-	-	0.3	0.1	0.1	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	8.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	1	0	3	2	520	0	0	0	0	275	5
Future Vol, veh/h	9	1	0	3	2	520	0	0	0	0	275	5
Conflicting Peds, #/hr	13	0	0	0	0	13	0	0	0	7	0	16
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	17	0	0	5	0	0	0	0	4	17
Mvmt Flow	9	1	0	3	2	520	0	0	0	0	275	5

Major/Minor	Minor2			Minor1						Major2		
Conflicting Flow All	568	301	294	285	303	20				7	0	0
Stage 1	294	294	-	7	7	-				-	-	-
Stage 2	274	7	-	278	296	-				-	-	-
Critical Hdwy	7.1	6.5	6.37	7.1	6.5	6.25				4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	-	-	-				-	-	-
Critical Hdwy Stg 2	-	-	-	6.1	5.5	-				-	-	-
Follow-up Hdwy	3.5	4	3.453	3.5	4	3.345				2.2	-	-
Pot Cap-1 Maneuver	437	615	711	671	613	1049				1627	-	-
Stage 1	719	673	-	-	-	-				-	-	-
Stage 2	-	-	-	733	672	-				-	-	-
Platoon blocked, %											-	-
Mov Cap-1 Maneuver	211	603	701	666	601	1031				1617	-	-
Mov Cap-2 Maneuver	211	603	-	666	601	-				-	-	-
Stage 1	719	664	-	-	-	-				-	-	-
Stage 2	-	-	-	732	663	-				-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	21.7	12.1	0
HCM LOS	C	B	

Minor Lane/Major Mvmt	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	226	1025	1617	-	-
HCM Lane V/C Ratio	0.044	0.512	-	-	-
HCM Control Delay (s)	21.7	12.1	0	-	-
HCM Lane LOS	C	B	A	-	-
HCM 95th %tile Q(veh)	0.1	3	0	-	-

Intersection	
Intersection Delay, s/veh	29.8
Intersection LOS	D

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	242	823	650	510
Demand Flow Rate, veh/h	253	847	650	528
Vehicles Circulating, veh/h	734	151	317	992
Vehicles Exiting, veh/h	786	816	670	6
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	11.3	14.2	13.3	84.7
Approach LOS	B	B	B	F

Lane	Left	Left	Left	Left
Designated Moves	LTR	LT	LTR	LTR
Assumed Moves	LTR	LT	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	253	847	650	528
Cap Entry Lane, veh/h	653	1183	999	502
Entry HV Adj Factor	0.956	0.971	1.000	0.965
Flow Entry, veh/h	242	823	650	510
Cap Entry, veh/h	624	1149	999	484
V/C Ratio	0.388	0.716	0.651	1.052
Control Delay, s/veh	11.3	14.2	13.3	84.7
LOS	B	B	B	F
95th %tile Queue, veh	2	7	5	16

Intersection	
Intersection Delay, s/veh	14.8
Intersection LOS	B

Approach	EB	WB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	892	635	259
Demand Flow Rate, veh/h	910	648	264
Vehicles Circulating, veh/h	142	389	437
Vehicles Exiting, veh/h	559	663	600
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	16.0	16.1	7.4
Approach LOS	C	C	A

Lane	Left	Left	Left
Designated Moves	LT	TR	LR
Assumed Moves	LT	TR	LR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	910	648	264
Cap Entry Lane, veh/h	1194	928	884
Entry HV Adj Factor	0.980	0.981	0.981
Flow Entry, veh/h	892	635	259
Cap Entry, veh/h	1170	910	867
V/C Ratio	0.762	0.698	0.299
Control Delay, s/veh	16.0	16.1	7.4
LOS	C	C	A
95th %tile Queue, veh	8	6	1

Intersection	
Int Delay, s/veh	7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	207	78	11	423	245	7
Future Vol, veh/h	207	78	11	423	245	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	207	78	11	423	245	7

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	285	0	691	246
Stage 1	-	-	-	-	246	-
Stage 2	-	-	-	-	445	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1277	-	410	793
Stage 1	-	-	-	-	795	-
Stage 2	-	-	-	-	646	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1277	-	405	793
Mov Cap-2 Maneuver	-	-	-	-	405	-
Stage 1	-	-	-	-	786	-
Stage 2	-	-	-	-	646	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	26.7
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	411	-	-	1277	-
HCM Lane V/C Ratio	0.613	-	-	0.009	-
HCM Control Delay (s)	26.7	-	-	7.8	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	4	-	-	0	-

Intersection	
Int Delay, s/veh	5.5

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	61	144	338	330	141	80
Future Vol, veh/h	61	144	338	330	141	80
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	1	2	0
Mvmt Flow	61	144	338	330	141	80

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	668	0	-	0	769	503
Stage 1	-	-	-	-	503	-
Stage 2	-	-	-	-	266	-
Critical Hdwy	4.1	-	-	-	6.42	6.2
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.3
Pot Cap-1 Maneuver	931	-	-	-	369	573
Stage 1	-	-	-	-	607	-
Stage 2	-	-	-	-	779	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	931	-	-	-	343	573
Mov Cap-2 Maneuver	-	-	-	-	343	-
Stage 1	-	-	-	-	564	-
Stage 2	-	-	-	-	779	-

Approach	EB	WB	SE
HCM Control Delay, s	2.7	0	24.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SELn1
Capacity (veh/h)	931	-	-	-	401
HCM Lane V/C Ratio	0.066	-	-	-	0.551
HCM Control Delay (s)	9.1	0	-	-	24.5
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	3.2

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	207	339	52	14	1
Future Vol, veh/h	5	207	339	52	14	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	1	1	0	0	0
Mvmt Flow	5	207	339	52	14	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	391	0	-	0	582	365
Stage 1	-	-	-	-	365	-
Stage 2	-	-	-	-	217	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1179	-	-	-	479	685
Stage 1	-	-	-	-	707	-
Stage 2	-	-	-	-	824	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1179	-	-	-	477	685
Mov Cap-2 Maneuver	-	-	-	-	477	-
Stage 1	-	-	-	-	703	-
Stage 2	-	-	-	-	824	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	12.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1179	-	-	-	487
HCM Lane V/C Ratio	0.004	-	-	-	0.031
HCM Control Delay (s)	8.1	0	-	-	12.6
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	198	0	13	405	0	7
Future Vol, veh/h	198	0	13	405	0	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	198	0	13	405	0	7

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	198	0	629	198
Stage 1	-	-	-	-	198	-
Stage 2	-	-	-	-	431	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1375	-	446	843
Stage 1	-	-	-	-	835	-
Stage 2	-	-	-	-	655	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1375	-	441	843
Mov Cap-2 Maneuver	-	-	-	-	441	-
Stage 1	-	-	-	-	825	-
Stage 2	-	-	-	-	655	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	9.3
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	843	-	-	1375	-
HCM Lane V/C Ratio	0.008	-	-	0.009	-
HCM Control Delay (s)	9.3	-	-	7.6	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection	
Int Delay, s/veh	12

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	30	447	872	839	503	99
Future Vol, veh/h	30	447	872	839	503	99
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	Yield
Storage Length	140	0	170	-	-	150
Veh in Median Storage, #	1	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	1	3	1
Mvmt Flow	30	447	872	839	503	99

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2667	503	503	0	-	0
Stage 1	503	-	-	-	-	-
Stage 2	2164	-	-	-	-	-
Critical Hdwy	6.6	6.23	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.319	2.2	-	-	-
Pot Cap-1 Maneuver	~ 22	568	1072	-	-	-
Stage 1	612	-	-	-	-	-
Stage 2	75	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 4	568	1072	-	-	-
Mov Cap-2 Maneuver	120	-	-	-	-	-
Stage 1	114	-	-	-	-	-
Stage 2	75	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	31.7	10.7	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1072	-	120	568	-	-
HCM Lane V/C Ratio	0.813	-	0.25	0.787	-	-
HCM Control Delay (s)	21.1	-	44.7	30.8	-	-
HCM Lane LOS	C	-	E	D	-	-
HCM 95th %tile Q(veh)	9.5	-	0.9	7.4	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

TRAFFIC IMPACT ANALYSIS REPORT UPDATE

FOR THE PROPOSED

HOKUA PLACE

KAPA`A, KAUAI, HAWAII
TAX MAP KEY: (4) 4-3-03: 01

APPENDIX E

CAPACITY ANALYSIS WORKSHEETS

PEAK HOUR TRAFFIC WITH PROJECT

WITH IMPROVEMENTS

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	9	37	12	60	1	11	5	751	14	3	824	43
Future Volume (vph)	9	37	12	60	1	11	5	751	14	3	824	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0		0			60		0	0		0
Storage Lanes		0		1			1		0	0		0
Taper Length (ft)		100					100			100		
Satd. Flow (prot)	0	0	1613	1501	1589	0	1632	1761	0	0	1800	0
Flt Permitted			0.962				0.347				0.998	
Satd. Flow (perm)	0	0	1598	1451	1545	0	594	1761	0	0	1797	0
Right Turn on Red				Yes	Yes				No			
Satd. Flow (RTOR)				60	198							
Link Speed (mph)			30					30			30	
Link Distance (ft)			417					1113			697	
Travel Time (s)			9.5					25.3			15.8	
Confl. Peds. (#/hr)	2	4		7	4	4	4		7	4		4
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	15%	0%	4%	0%	6%	9%	4%	0%	0%	1%	4%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	58	60	1	0	16	765	0	0	875	0
Turn Type	Perm	Perm	NA	Perm	Perm	custom	custom	NA		Perm	NA	
Protected Phases			4								6	
Permitted Phases	4	4		4	8	2	2	2		6		
Detector Phase	4	4	4	4	8	2	2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Minimum Split (s)	27.0	27.0	27.0	27.0	27.0	26.0	26.0	26.0		34.0	34.0	
Total Split (s)	27.0	27.0	27.0	27.0	27.0	53.0	53.0	53.0		53.0	53.0	
Total Split (%)	33.8%	33.8%	33.8%	33.8%	33.8%	66.3%	66.3%	66.3%		66.3%	66.3%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)			0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)			6.0	6.0	6.0		6.0	6.0			6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	Max	Max	Max		Max	Max	
Act Effct Green (s)			8.4	8.4	8.4		55.6	55.6			55.6	
Actuated g/C Ratio			0.12	0.12	0.12		0.77	0.77			0.77	
v/c Ratio			0.31	0.27	0.00		0.03	0.56			0.63	
Control Delay			32.8	11.4	0.0		3.8	7.0			8.2	
Queue Delay			0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay			32.8	11.4	0.0		3.8	7.0			8.2	
LOS			C	B	A		A	A			A	
Approach Delay			21.9					7.0			8.2	
Approach LOS			C					A			A	
Queue Length 50th (ft)			25	0	0		2	132			166	
Queue Length 95th (ft)			53	30	0		7	257			330	
Internal Link Dist (ft)			337					1033			617	
Turn Bay Length (ft)							60					

Lane Group	SBR2
Lane Configurations	
Traffic Volume (vph)	5
Future Volume (vph)	5
Ideal Flow (vphpl)	1900
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	0
Flt Permitted	
Satd. Flow (perm)	0
Right Turn on Red	No
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	4
Peak Hour Factor	1.00
Heavy Vehicles (%)	0%
Shared Lane Traffic (%)	
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	
Minimum Split (s)	
Total Split (s)	
Total Split (%)	
Yellow Time (s)	
All-Red Time (s)	
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)			468	467	592		458	1359			1387	
Starvation Cap Reductn			0	0	0		0	0			0	
Spillback Cap Reductn			0	0	0		0	0			0	
Storage Cap Reductn			0	0	0		0	0			0	
Reduced v/c Ratio			0.12	0.13	0.00		0.03	0.56			0.63	

Intersection Summary	
Area Type: Other	
Cycle Length: 80	
Actuated Cycle Length: 72	
Natural Cycle: 70	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.63	
Intersection Signal Delay: 8.6	Intersection LOS: A
Intersection Capacity Utilization 70.9%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Kuhio Hwy & Kukui St & Huluili St

Lane Group	SBR2
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	516	2	18	760	864	105
Future Volume (Veh/h)	516	2	18	760	864	105
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	516	2	18	760	864	105
Pedestrians	8					
Lane Width (ft)	11.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	TWLTL	
Median storage veh)					2	
Upstream signal (ft)				697		
pX, platoon unblocked	0.79					
vC, conflicting volume	1668	872	872			
vC1, stage 1 conf vol	872					
vC2, stage 2 conf vol	796					
vCu, unblocked vol	1713	872	872			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	99	98			
cM capacity (veh/h)	388	350	776			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	518	18	760	864	105
Volume Left	516	18	0	0	0
Volume Right	2	0	0	0	105
cSH	387	776	1700	1700	1700
Volume to Capacity	1.34	0.02	0.45	0.51	0.06
Queue Length 95th (ft)	608	2	0	0	0
Control Delay (s)	196.5	9.7	0.0	0.0	0.0
Lane LOS	F	A			
Approach Delay (s)	196.5	0.2		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	45.0		
Intersection Capacity Utilization	80.8%	ICU Level of Service	D
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	12.9
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	595	296	340	855
Demand Flow Rate, veh/h	611	327	349	866
Vehicles Circulating, veh/h	710	112	728	408
Vehicles Exiting, veh/h	306	965	593	31
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	23.9	5.4	11.1	8.5
Approach LOS	C	A	B	A

Lane	Left	Left	Left	Left	Bypass
Designated Moves	LTR	LT	LTR	LT	R
Assumed Moves	LTR	LT	LTR	LT	R
RT Channelized					Free
Lane Util	1.000	1.000	1.000	1.000	
Follow-Up Headway, s	2.535	2.535	2.535	2.535	
Critical Headway, s	4.328	4.328	4.328	4.328	258
Entry Flow, veh/h	611	327	349	608	1919
Cap Entry Lane, veh/h	777	1291	765	1004	0.990
Entry HV Adj Factor	0.973	0.906	0.974	0.987	255
Flow Entry, veh/h	595	296	340	600	1900
Cap Entry, veh/h	756	1170	745	991	0.134
V/C Ratio	0.787	0.253	0.456	0.606	0.0
Control Delay, s/veh	23.9	5.4	11.1	12.1	A
LOS	C	A	B	B	0
95th %tile Queue, veh	8	1	2	4	

Intersection	
Int Delay, s/veh	19

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	339	16	52	113	9	52	28	506	14	1	0
Future Vol, veh/h	9	339	16	52	113	9	52	28	506	14	1	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	-	-	Yield	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	0	0	2	2	9	2	1	2	2	2
Mvmt Flow	9	339	16	52	113	9	52	28	506	14	1	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	122	0	0	339	0	0	587	591	347	593	579	118
Stage 1	-	-	-	-	-	-	365	365	-	222	222	-
Stage 2	-	-	-	-	-	-	222	226	-	371	357	-
Critical Hdwy	4.12	-	-	4.1	-	-	7.19	6.52	6.21	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.19	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.19	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.581	4.018	3.309	3.518	4.018	3.318
Pot Cap-1 Maneuver	1465	-	-	1231	-	-	411	420	698	417	426	934
Stage 1	-	-	-	-	-	-	640	623	-	780	720	-
Stage 2	-	-	-	-	-	-	765	717	-	649	628	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1465	-	-	1231	-	-	394	398	698	104	403	934
Mov Cap-2 Maneuver	-	-	-	-	-	-	394	398	-	104	403	-
Stage 1	-	-	-	-	-	-	635	618	-	774	688	-
Stage 2	-	-	-	-	-	-	730	685	-	169	623	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	2.4	34.9	43.2
HCM LOS			D	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	676	1465	-	-	1231	-	-	109
HCM Lane V/C Ratio	0.867	0.006	-	-	0.042	-	-	0.138
HCM Control Delay (s)	34.9	7.5	0	-	8.1	0	-	43.2
HCM Lane LOS	D	A	A	-	A	A	-	E
HCM 95th %tile Q(veh)	10.2	0	-	-	0.1	-	-	0.5

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	6	971	136	702	905	6
Future Vol, veh/h	6	971	136	702	905	6
Conflicting Peds, #/hr	1	0	0	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	170	-	-	150
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	20	3	2	3	3	0
Mvmt Flow	6	971	136	702	905	6

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1530	-	906	0	-	0
Stage 1	906	-	-	-	-	-
Stage 2	624	-	-	-	-	-
Critical Hdwy	6.9	-	4.13	-	-	-
Critical Hdwy Stg 1	5.7	-	-	-	-	-
Critical Hdwy Stg 2	6.1	-	-	-	-	-
Follow-up Hdwy	3.69	-	2.219	-	-	-
Pot Cap-1 Maneuver	103	0	749	-	-	-
Stage 1	357	0	-	-	-	-
Stage 2	459	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	84	-	748	-	-	-
Mov Cap-2 Maneuver	220	-	-	-	-	-
Stage 1	292	-	-	-	-	-
Stage 2	459	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	21.8	1.8	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	748	-	220	-	-	-
HCM Lane V/C Ratio	0.182	-	0.027	-	-	-
HCM Control Delay (s)	10.9	-	21.8	0	-	-
HCM Lane LOS	B	-	C	A	-	-
HCM 95th %tile Q(veh)	0.7	-	0.1	-	-	-

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	18	34	11	48	9	74	63	620	18	3	656	42
Future Volume (vph)	18	34	11	48	9	74	63	620	18	3	656	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0		0			60		0	0		0
Storage Lanes		0		1			1		0	0		0
Taper Length (ft)		100					100			100		
Satd. Flow (prot)	0	0	1763	1561	1589	0	1745	1824	0	0	1777	0
Flt Permitted			0.960				0.322				0.998	
Satd. Flow (perm)	0	0	1601	1410	1479	0	573	1824	0	0	1773	0
Right Turn on Red				Yes	Yes				No			
Satd. Flow (RTOR)				109	184							
Link Speed (mph)			30					30			30	
Link Distance (ft)			417					1123			607	
Travel Time (s)			9.5					25.5			13.8	
Confl. Peds. (#/hr)	37	30		47	30	30	75		49	49		30
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	63	48	9	0	137	638	0	0	733	0
Turn Type	Perm	Perm	NA	Perm	Perm	custom	custom	NA		Perm	NA	
Protected Phases			4				5				6	
Permitted Phases	4	4		4	8	5	2	2		6		
Detector Phase	4	4	4	4	8	5	5	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	4.0	4.0	7.0		7.0	7.0	
Minimum Split (s)	27.0	27.0	27.0	27.0	27.0	8.0	8.0	26.0		34.0	34.0	
Total Split (s)	27.0	27.0	27.0	27.0	27.0	8.0	8.0	43.0		35.0	35.0	
Total Split (%)	38.6%	38.6%	38.6%	38.6%	38.6%	11.4%	11.4%	61.4%		50.0%	50.0%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.5	3.5	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	0.5	0.5	2.0		2.0	2.0	
Lost Time Adjust (s)			0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)			6.0	6.0	6.0		4.0	6.0			6.0	
Lead/Lag						Lead	Lead			Lag	Lag	
Lead-Lag Optimize?						Yes	Yes					
Recall Mode	None	None	None	None	None	None	None	C-Max		C-Max	C-Max	
Act Effct Green (s)			8.5	8.5	8.5		54.1	53.3			44.1	
Actuated g/C Ratio			0.12	0.12	0.12		0.77	0.76			0.63	
v/c Ratio			0.32	0.18	0.03		0.24	0.46			0.66	
Control Delay			32.0	1.8	0.1		4.0	5.9			16.7	
Queue Delay			0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay			32.0	1.8	0.1		4.0	5.9			16.7	
LOS			C	A	A		A	A			B	
Approach Delay			18.9					5.5			16.7	
Approach LOS			B					A			B	
Queue Length 50th (ft)			26	0	0		13	96			218	
Queue Length 95th (ft)			57	3	0		31	187			#475	
Internal Link Dist (ft)			337					1043			527	
Turn Bay Length (ft)							60					

Lane Group	SBR2
Lane Configurations	
Traffic Volume (vph)	32
Future Volume (vph)	32
Ideal Flow (vphpl)	1900
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	0
Flt Permitted	
Satd. Flow (perm)	0
Right Turn on Red	No
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	35
Peak Hour Factor	1.00
Heavy Vehicles (%)	0%
Shared Lane Traffic (%)	
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	
Minimum Split (s)	
Total Split (s)	
Total Split (%)	
Yellow Time (s)	
All-Red Time (s)	
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	

Lane Group	EBL2	EBL	EBT	EBR	WBR2	NBL2	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)			480	499	572		561	1387			1116	
Starvation Cap Reductn			0	0	0		0	0			0	
Spillback Cap Reductn			0	0	0		0	0			0	
Storage Cap Reductn			0	0	0		0	0			0	
Reduced v/c Ratio			0.13	0.10	0.02		0.24	0.46			0.66	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 11.4 Intersection LOS: B
Intersection Capacity Utilization 104.3% ICU Level of Service G
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Kuhio Hwy & Kukui St & Huluili St

Lane Group	SBR2
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	402	3	22	718	736	236
Future Volume (Veh/h)	402	3	22	718	736	236
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	402	3	22	718	736	236
Pedestrians	19					
Lane Width (ft)	11.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	2					
Right turn flare (veh)						
Median type				None	TWLTL	
Median storage veh)					2	
Upstream signal (ft)				607		
pX, platoon unblocked	0.85					
vC, conflicting volume	1517	755	755			
vC1, stage 1 conf vol	755					
vC2, stage 2 conf vol	762					
vCu, unblocked vol	1520	755	755			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	5	99	97			
cM capacity (veh/h)	422	405	850			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	405	22	718	736	236
Volume Left	402	22	0	0	0
Volume Right	3	0	0	0	236
cSH	422	850	1700	1700	1700
Volume to Capacity	0.96	0.03	0.42	0.43	0.14
Queue Length 95th (ft)	283	2	0	0	0
Control Delay (s)	65.9	9.3	0.0	0.0	0.0
Lane LOS	F	A			
Approach Delay (s)	65.9	0.3		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	12.7		
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	13.7
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	242	823	650	510
Demand Flow Rate, veh/h	253	847	650	528
Vehicles Circulating, veh/h	734	151	317	992
Vehicles Exiting, veh/h	699	816	670	6
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.1	12.5	11.2	20.9
Approach LOS	A	B	B	C

Lane	Left	Left	Left	Left	Bypass
Designated Moves	LTR	LT	LTR	LT	R
Assumed Moves	LTR	LT	LTR	LT	R
RT Channelized					Free
Lane Util	1.000	1.000	1.000	1.000	
Follow-Up Headway, s	2.535	2.535	2.535	2.535	
Critical Headway, s	4.328	4.328	4.328	4.328	87
Entry Flow, veh/h	253	847	650	441	1976
Cap Entry Lane, veh/h	761	1249	1085	611	0.962
Entry HV Adj Factor	0.956	0.971	1.000	0.965	84
Flow Entry, veh/h	242	823	650	426	1900
Cap Entry, veh/h	727	1213	1085	590	0.044
V/C Ratio	0.333	0.678	0.599	0.722	0.0
Control Delay, s/veh	9.1	12.5	11.2	25.1	A
LOS	A	B	B	D	0
95th %tile Queue, veh	1	6	4	7	

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	5	137	71	338	301	28	38	24	144	5	9	1
Future Vol, veh/h	5	137	71	338	301	28	38	24	144	5	9	1
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	-	-	Yield	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	0	0	1	2	0	2	2	2	2	2
Mvmt Flow	5	137	71	338	301	28	38	24	144	5	9	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	329	0	0	137	0	0	1179	1188	173	1150	1138	315
Stage 1	-	-	-	-	-	-	183	183	-	991	991	-
Stage 2	-	-	-	-	-	-	996	1005	-	159	147	-
Critical Hdwy	4.12	-	-	4.1	-	-	7.1	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.5	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1231	-	-	1459	-	-	169	188	871	175	201	725
Stage 1	-	-	-	-	-	-	823	748	-	296	324	-
Stage 2	-	-	-	-	-	-	297	319	-	843	775	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1231	-	-	1459	-	-	125	134	871	99	143	725
Mov Cap-2 Maneuver	-	-	-	-	-	-	125	134	-	99	143	-
Stage 1	-	-	-	-	-	-	819	744	-	295	232	-
Stage 2	-	-	-	-	-	-	204	228	-	678	771	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	4.2	21.3	36
HCM LOS			C	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	426	1231	-	-	1459	-	-	131
HCM Lane V/C Ratio	0.484	0.004	-	-	0.232	-	-	0.115
HCM Control Delay (s)	21.3	7.9	0	-	8.2	0	-	36
HCM Lane LOS	C	A	A	-	A	A	-	E
HCM 95th %tile Q(veh)	2.7	0	-	-	0.9	-	-	0.4

Intersection	
Int Delay, s/veh	8.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	30	447	872	839	503	99
Future Vol, veh/h	30	447	872	839	503	99
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	140	0	170	-	-	150
Veh in Median Storage, #	1	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	1	3	1
Mvmt Flow	30	447	872	839	503	99

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2667	-	503	0	-	0
Stage 1	503	-	-	-	-	-
Stage 2	2164	-	-	-	-	-
Critical Hdwy	6.6	-	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-
Follow-up Hdwy	3.5	-	2.2	-	-	-
Pot Cap-1 Maneuver	~ 22	0	1072	-	-	-
Stage 1	612	0	-	-	-	-
Stage 2	75	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 4	-	1072	-	-	-
Mov Cap-2 Maneuver	120	-	-	-	-	-
Stage 1	114	-	-	-	-	-
Stage 2	75	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	44.9	11.4	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1072	-	120	-	-	-
HCM Lane V/C Ratio	0.813	-	0.25	-	-	-
HCM Control Delay (s)	22.4	-	44.9	0	-	-
HCM Lane LOS	C	-	E	A	-	-
HCM 95th %tile Q(veh)	11.7	-	1	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

THE TRAFFIC MANAGEMENT CONSULTANT

Randall S. Okaneku, P.E., Principal * 1188 Bishop Street, Suite 1907 * Honolulu, Hawaii 96813
Telephone: (808) 536-0223 * Facsimile: (808) 537-2985 * Email: TMCHawaii@aol.com

TMC Job No. 201708
October 3, 2017

State of Hawaii
Department of Transportation
Highways Division-Kauai District
1720 Haleukana Street
Lihu`e, Kauai, Hawai`i 96766

Attn.: Mr. Larry Dill, P.E., District Engineer

Dear Mr. Dill:

Subject: Traffic Impact Analysis Report Update
For the Proposed Hokua Place
Tax Map Key: (4) 4-3-003: Portion of 001
Kapa`a, Kauai, Hawaii

Thank you for the review comments in your letter, dated September 29, 2017, on the subject traffic study. Our responses follow:

Comment No. 1

Noted.

Comment No. 2

Noted.

Comment No. 3

The AM and PM Peak Hour Traffic Without Project rows of Table 6 summarize the capacity analysis under existing roadway conditions. The AM and PM Peak Hour Traffic With Project rows of Table 6 summarize the capacity analysis with the recommended site access improvements under Section V.B. of the TIAR Update. The AM and PM Peak Hour Traffic With Project – Improved rows in Table 6 summarize the capacity analysis of the recommended traffic improvements under Section V.A. of the TIAR Update.

Comment No. 4

Noted.

Comment No. 5

Noted.

If you require clarification on any of the above material or have any other questions, please do not hesitate to call me.

Very truly yours,

The Traffic Management Consultant

By

Randall S. Okaneku, P. E.
Principal

DAVID Y. IGE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
KAUAI DISTRICT
1720 HALEUKANA STREET
LIHUE, HAWAII 96766

FORD N. FUCHIGAMI
DIRECTOR

Deputy Directors
JADE T. BUTAY
ROSS M. HIGASHI
EDWIN H. SNIFFEN
DARRELL T. YOUNG

IN REPLY REFER TO:

HWAY-K 4.170445

September 29, 2017

Randall S. Okaneku, P.E.
The Traffic Management Consultant
1188 Bishop Street, Suite 1907
Honolulu, Hawaii 96813

Dear Mr. Okaneku:

Subject: Traffic Impact Analysis Report Update
Hokua Place
Kapa'a, Kawaihau District, Island of Kaua'i
TMK: (4) 4-3-03: Por. 001

Thank you for submitting the updated Traffic Impact Analysis Report(TIAR) update that was transmitted via email on June 15, 2017. We have circulated the TIAR for comment through the Highways Division Planning Branch as well as the Traffic Branch. We have also reviewed the comments provided by the County of Kauai Department of Public Works Engineering Division on September 1, 2017.

The combined comments for the Hawaii Department of Transportation Highways Division are as follows:

1. The report discussed the projects that are proposed in the Kapaa Transportation Solutions Report dated August 2015. It should be noted that these projects may not be completed on schedule. Therefore, they should not be considered in this report.
2. It is understood that the proposed Road A will be funded and constructed by the developer.
3. Please clarify the scenarios in Table 7, Summary of Capacity Analysis. What assumed improvements are completed for AM/PM peak hour traffic without project, with project, and with project-improved.
4. Section V of the TIAR recommends traffic improvements without the project. Although these recommendations are appreciated, they are not a consideration for this development.
5. We concur with the comments provided by the County of Kauai Department of Engineering Division.

Please contact Raymond McCormick at 808-241-3015 by telephone or by email at Raymond.j.mccormick@hawaii.gov if you have comments or questions regarding this letter.

Sincerely,

Larry Dill, P.E.
District Engineer
For

THE TRAFFIC MANAGEMENT CONSULTANT

Randall S. Okaneku, P.E., Principal * 1188 Bishop Street, Suite 1907 * Honolulu, Hawaii 96813
Telephone: (808) 536-0223 * Facsimile: (808) 537-2985 * Email: TMCHawaii@aol.com

TMC Job No. 201708
October 3, 2017

Department of Public Works
County of Kauai
4444 Rice Street, Suite 275
Lihu`e, Kauai, Hawai`i 96766

Attn.: Mr. Michael Moule, P.E., Chief, Engineering Division

Dear Mr. Moule:

Subject: Traffic Impact Analysis Report Update
For the Proposed Hokua Place
Tax Map Key: (4) 4-3-003: Portion of 001
Kapa`a, Kauai, Hawaii

Thank you for the thorough review comments in your letter, dated September 1, 2017, on the subject traffic study. Our responses follow:

Comment No. 1 – Introduction, Project Description

a. Concur. The design of the intersection between the Phase 1 access road and Olohena Road, mauka of its intersection with Ka`apuni Road, will include the appropriate vertical and horizontal sight distances in accordance with the AASHTO A Policy on Geometric Design of Highways and Streets and the Hawaii Statewide Uniform Design Manual for Streets and Highways.

Comment No. 2 – Existing Roadways

a. Concur. The stated speed limits are intended to provide guidance to the design of the intersection of Road A and the Kapa`a Bypass Road.

b. Concur.

c. Concur.

Comment No. 3 – Existing Peak Hour Traffic Volumes and Operation Conditions

a. Noted. The traffic impact analysis is based upon the methodology presented in the Highway Capacity Manual (HCM). The HCM methodology consists of a series of mathematical calculations to determine roadway capacity, vehicle delay, vehicle queuing, etc. The LOS concept was defined in the HCM to translate the results of the complex calculations into a simplified "A" through "F" grading system.

b. Corrected. The second sentence in the last paragraph on Page 10 should read “South of Ulu Street, Kuhio Highway carried over 1,700 vph…”.

c. Corrected. The revised Figure 6 is attached. The PM peak hour of traffic from 3:45 PM to 4:45 PM on March 15, 2015 was selected for the intersection of Kuhio Highway and the Kapa`a Bypass Road because it corresponded with of the commuter PM peak hour traffic at the intersections in Kapa`a Town. The revised traffic data sheets for the intersection of Kuhio Highway and Kapa`a Bypass Road also are attached.

d. LOS, by definition, is the result of a series of mathematical calculations. For the purpose of the traffic impact analysis, the HCM methodology provides a common basis for comparing future traffic conditions without the proposed project and future traffic conditions with the proposed project.

Comment No. 4 – Kapa`a Transportation Solutions

a. Noted. The Kapa`a Transportation Solutions, cited in the TIAR Update, is dated August 2015. Please transmit the latest version of the Kapa`a traffic study.

b. Noted.

Comment No. 5 – Trip Generation Characteristics

a. Noted. The revised Table 6 is shown below:

Table 1. Hokua Place Trip Generation Characteristics

Land Use (ITE Code)	Units	AM Peak Hour (vph)			PM Peak Hour (vph)		
		Enter	Exit	Total	Enter	Exit	Total
Single-Family Phase 1 (265)	16 DU	5	16	21	13	7	20
Single-Family Phase 2 (265)	100 DU	20	60	80	66	38	104
Condominium/ Townhouse (230)	700 DU	52	256	308	244	120	364
Retail Center (820)	8,000 SFGFA	21	13	34	53	57	110
	Pass-By	0	0	0	(-)45	(-)45	(-)90
Total External Trips		**98**	**345**	**443**	**331**	**177**	**509**

b. The ITE Trip Generation Handbook cites a 9,000-square foot retail center, where 20 percent of the trip generation were primary trips. Comparing the retail center to smaller convenience markets, the Trip Generation Handbook listed sites where the primary trip percentages ranged from 8 percent to 28 percent of the PM peak period trip generation. The retail center is described in the DEIS as a neighborhood-oriented commercial center. Therefore, it is reasonable to assume that a significant portion of the retail trips will be generated from within the proposed project, which can be defined as “internal capture” or “diverted trips”.

Comment No. 6 – Site Access Improvements

a. Noted. The AM and PM peak hour traffic demands at the Olohena Road intersections at the Phase 1 Driveway and at Road A do not meet the AASHTO left-turn lane guidelines. During the AM peak hour of traffic, the advancing (mauka bound) volumes on Olohena Road do not meet the AASHTO minimum requirements. The left-turn demands at Road A and at the Phase 1 Driveway do not meet the AASHTO minimum left-turn volumes, during the PM peak hour of traffic. The Olohena Road intersections at Road A and the Phase 1 Driveway are expected to operate at satisfactory LOS during the AM peak hour of traffic. The Phase 1 Driveway also is expected to operate at satisfactory LOS at Olohena Road, during the PM peak hour of traffic. Road A is expected to operate at LOS “D”, during the PM peak hour of traffic. However, the average delay of 26.7 seconds/vehicle on Road A is in the upper range of LOS “D”. Therefore, a median refuge lane at Road A was not recommended at this time. Furthermore, separate left-turn and right-turn lanes on Road A would not improve the LOS.

Comment No. 7 – Traffic Assignment

a. The traffic assignment for the proposed project was primarily based upon the direction of peak hour traffic at the roundabout intersection of the Kapa`a Bypass Road and Olohena Road, where only about one third of Olohena Road traffic turns to/from the south leg of the Kapa`a Bypass Road. The Phase 2 development is concentrated on the makai half of the project site. Only the trips generated from the mauka-most portion of the site and the estimated AM peak hour school trips are expected to use the mauka access of Road A at Olohena Road.

b. The peak hour trip destinations, mauka of the Ka`apuni Road/Olohena Road intersection, are virtually nil, as observed in mauka bound/makai bound directional splits on Olohena Road. The retail trips generated from the mauka neighboring communities are represented in the “pass-by” trips using Road A.

Comment No. 8 – Figures 11 through 14 (Traffic Assignment)

a. The diverted peak hour trips on Road A are depicted on the attached Figures 12.1 and 14.1.

b. The revised Figure 11 is attached.

c. The revised Figure 13 is attached.

d. The revised Figure 14 is attached.

Comment No. 9 – PM Peak Hour Traffic Analysis With Project

a. The recommendation of extending the median refuge lane/two-way left-turn lane in Section V.A.7. of the TIAR Update is expected to mitigate the “bottle-neck” on Kuhio Highway, north of Lehua Street. Ultimately, the improvement of the north leg of the Kapa`a Bypass Road from a one-way roadway to a two-way bypass road is expected to improve traffic operations in Kapa`a Town.

Comment No. 10 – Recommendation of Traffic Improvements Without Project

a. Noted.

Comment No. 11 – Recommendation of Traffic Improvements With Project

a. Noted. While the MUTCD does not provide warrants for roundabout intersections, it does advise that a roundabout intersection can be considered as an alternative to traffic signal control. Based upon the TIAR Update, the intersection of Olohena Road and Road A is not expected to warrant all-way stop controls or traffic signals. Therefore, a roundabout intersection was not considered. However, a reassessment of the traffic operations at the Road A intersection at Olohena Road may be considered after the project is fully built out and occupied. A roundabout intersection was considered at the intersection of Olohena Road, Ka`apuni Road, and Kaehulua Road. However, based upon a preliminary assessment of the horizontal and vertical alignments of the intersecting roadways, it was determined that a roundabout intersection would not be feasible. The realignment of Kaehulua Road to form a four-legged intersection with the Olohena Road and Ka`apuni Road was recommended in Section V.A.6.

If you require clarification on any of the above material or have any other questions, please do not hesitate to call me.

Very truly yours,

The Traffic Management Consultant

By

Randall S. Okaneku, P. E.
Principal

Attachments:
- Figure 6-Revised
- Kuhio Hwy Kapa`a Bypass Rd Traffic Count Data-Revised
- Figure 12.1
- Figure 14.1
- Figure 11-Revised
- Figure 13-Revised
- Figure 14-Revised

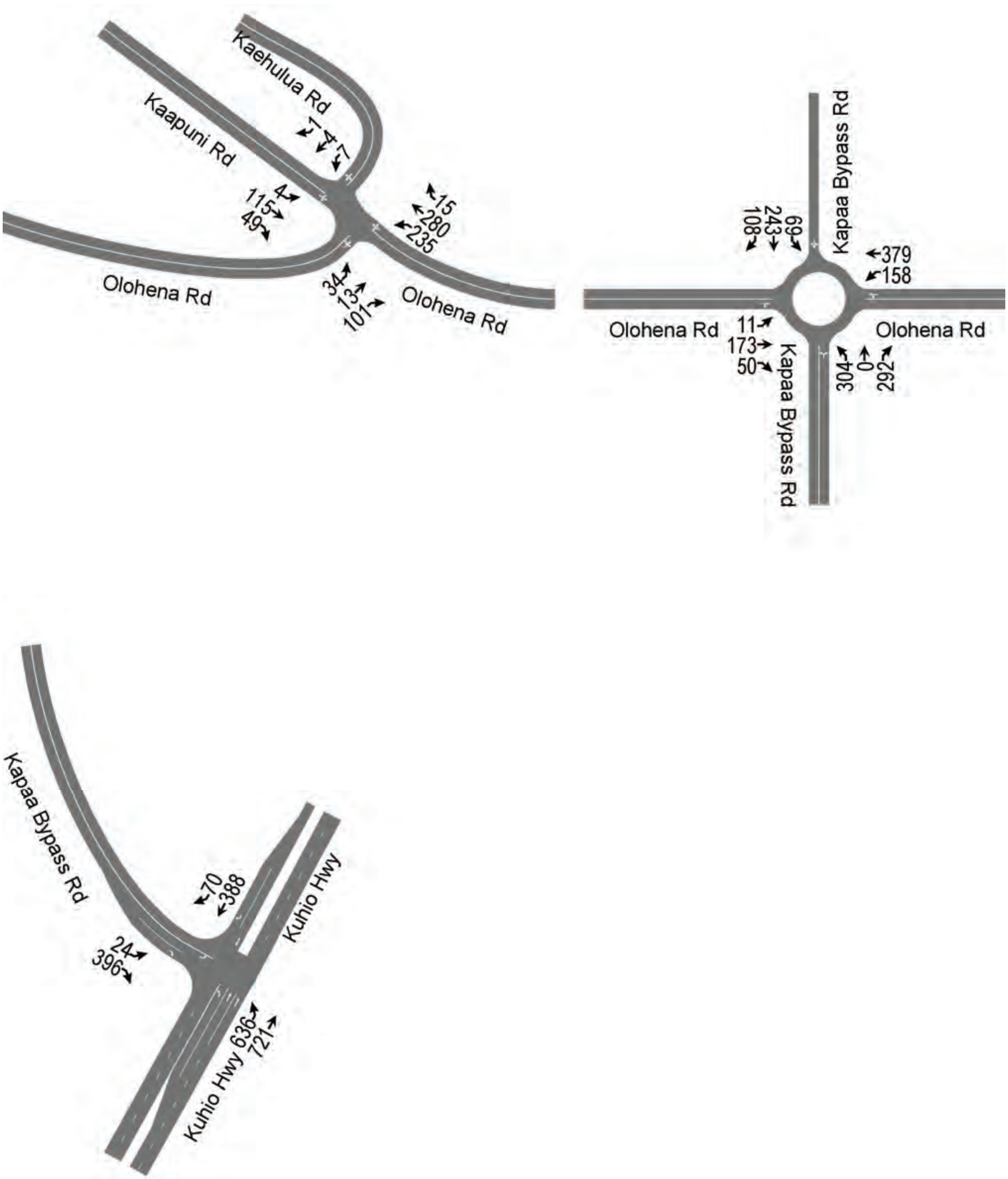


Figure 6. Existing PM Peak Hour Traffic (Cont'd.)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Count Name: Kuhio Hwy Kapaa Bypass 3-15-17 to 3-17-17
Site Code: Hokua Place
Start Date: 03/15/2017

Turning Movement Data

	Kapaa Bypass Rd				Kuhio Hwy				Kuhio Hwy					
	Koko Head Bound				Mauka Bound				Makai Bound					
Start Time	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
3:00 PM	1	105	0	106	99	191	0	290	0	106	5	0	111	507
3:15 PM	3	100	0	103	122	210	0	332	0	88	7	0	95	530
3:30 PM	8	93	0	101	120	207	0	327	0	73	8	0	81	509
3:45 PM	8	104	0	112	148	201	0	349	0	88	21	0	109	570
Hourly Total	20	402	0	422	489	809	0	1298	0	355	41	0	396	2116
4:00 PM	1	108	0	109	168	161	0	329	0	91	16	0	107	545
4:15 PM	9	94	0	103	154	172	0	326	0	97	14	0	111	540
4:30 PM	6	90	0	96	166	187	0	353	0	112	19	0	131	580
4:45 PM	2	95	0	97	146	176	0	322	0	112	15	0	127	546
Hourly Total	18	387	0	405	634	696	0	1330	0	412	64	0	476	2211
5:00 PM	5	88	0	93	149	232	0	381	0	138	27	0	165	639
5:15 PM	2	91	0	93	149	192	0	341	0	152	25	0	177	611
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	7	179	0	186	298	424	0	722	0	290	52	0	342	1250
6:30 AM	0	78	0	78	14	124	0	138	0	203	0	0	203	419
6:45 AM	2	116	0	118	8	124	0	132	0	190	1	0	191	441
Hourly Total	2	194	0	196	22	248	0	270	0	393	1	0	394	860
7:00 AM	1	161	0	162	20	129	0	149	0	233	0	0	233	544
7:15 AM	1	184	0	185	25	155	0	180	0	200	1	0	201	566
7:30 AM	2	152	0	154	24	152	0	176	0	167	0	0	167	497
7:45 AM	1	155	1	156	33	180	0	213	0	135	0	0	135	504
Hourly Total	5	652	1	657	102	616	0	718	0	735	1	0	736	2111
8:00 AM	0	150	0	150	24	187	0	211	0	132	1	0	133	494
8:15 AM	3	131	0	134	21	177	0	198	0	165	0	0	165	497
8:30 AM	3	130	0	133	33	191	0	224	0	161	1	0	162	519
8:45 AM	1	108	0	109	25	209	0	234	0	189	0	0	189	532
Hourly Total	7	519	0	526	103	764	0	867	0	647	2	0	649	2042
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	5	103	0	108	97	217	0	314	0	96	6	0	102	524
3:15 PM	8	117	0	125	131	156	0	287	0	84	9	0	93	505
3:30 PM	6	83	0	89	138	227	0	365	1	76	8	0	85	539
3:45 PM	2	87	1	89	119	182	0	301	0	76	7	0	83	473
Hourly Total	21	390	1	411	485	782	0	1267	1	332	30	0	363	2041
4:00 PM	2	122	0	124	126	152	0	278	0	96	7	0	103	505
4:15 PM	6	109	1	115	136	158	0	294	0	95	6	0	101	510
4:30 PM	6	96	1	102	143	174	0	317	0	78	2	0	80	499
4:45 PM	5	93	0	98	138	181	0	319	0	83	6	0	89	506
Hourly Total	19	420	2	439	543	665	0	1208	0	352	21	0	373	2020
5:00 PM	2	98	0	100	146	204	0	350	0	85	3	0	88	538
5:15 PM	4	113	0	117	121	159	0	280	0	92	2	0	94	491
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	6	211	0	217	267	363	0	630	0	177	5	0	182	1029
6:30 AM	0	82	0	82	11	115	0	126	0	185	0	0	185	393
6:45 AM	0	89	0	89	10	126	0	136	0	164	3	0	167	392
Hourly Total	0	171	0	171	21	241	0	262	0	349	3	0	352	785
7:00 AM	1	131	0	132	17	133	0	150	0	219	1	0	220	502
7:15 AM	3	168	0	171	32	158	0	190	0	182	3	0	185	546
7:30 AM	1	125	0	126	40	146	0	186	0	166	2	0	168	480
7:45 AM	1	123	0	124	30	165	0	195	0	138	0	0	138	457
Hourly Total	6	547	0	553	119	602	0	721	0	705	6	0	711	1985
8:00 AM	4	116	0	120	20	169	0	189	0	150	0	0	150	459
8:15 AM	1	125	0	126	28	158	0	186	0	133	2	0	135	447
Grand Total	116	4313	4	4429	3131	6537	0	9668	1	5030	228	0	5259	19356
Approach %	2.6	97.4	-	-	32.4	67.6	-	-	0.0	95.6	4.3	-	-	-
Total %	0.6	22.3	-	22.9	16.2	33.8	-	49.9	0.0	26.0	1.2	-	27.2	-
Lights	114	4214	-	4328	3083	6353	-	9436	1	4901	225	-	5127	18891
% Lights	98.3	97.7	-	97.7	98.5	97.2	-	97.6	100.0	97.4	98.7	-	97.5	97.6
Mediums	2	91	-	93	47	171	-	218	0	115	3	-	118	429
% Mediums	1.7	2.1	-	2.1	1.5	2.6	-	2.3	0.0	2.3	1.3	-	2.2	2.2
Articulated Trucks	0	8	-	8	1	13	-	14	0	14	0	-	14	36
% Articulated Trucks	0.0	0.2	-	0.2	0.0	0.2	-	0.1	0.0	0.3	0.0	-	0.3	0.2
All Pedestrians	-	-	4	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Kuhio Hwy [Makai]

Exit	Enter	Total
6467	5127	11594
173	118	291
13	14	27
0	0	0
6653	**5259**	**11912**

RT	Th	LT	Ped
225	4901	1	0
3	115	0	0
0	14	0	0
0	0	0	0
228	**5030**	**1**	**0**

Kapaa Bypass Rd [KKHD]

Exit	Enter	Total
3308	4328	7636
50	93	143
1	8	9
0	0	0
3359	**4429**	**7788**

LT	RT	Ped
114	4214	0
2	91	0
0	8	0
0	0	4
116	**4313**	**4**

03/15/2017 3:00 PM
Ending At
03/17/2017 8:30 AM

Lights
Mediums
Articulated Trucks
All Pedestrians

Fake Approach [Ewa]

Exit	Enter	Total
1	0	1
0	0	0
0	0	0
0	0	0
1	**0**	**1**

LT	Th	Ped
3083	6353	0
47	171	0
1	13	0
0	0	0
3131	**6537**	**0**

Exit	Enter	Total
9115	9436	18551
206	218	424
22	14	36
0	0	0
9343	**9668**	**19011**

Kuhio Hwy [Mauka]

Turning Movement Data Plot

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (3:45 PM)

Start Time	Kapaa Bypass Rd Koko Head Bound				Kuhio Hwy Mauka Bound				Kuhio Hwy Makai Bound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
3:45 PM	8	104	0	112	148	201	0	349	0	88	21	0	109	570
4:00 PM	1	108	0	109	168	161	0	329	0	91	16	0	107	545
4:15 PM	9	94	0	103	154	172	0	326	0	97	14	0	111	540
4:30 PM	6	90	0	96	166	187	0	353	0	112	19	0	131	580
Total	24	396	0	420	636	721	0	1357	0	388	70	0	458	2235
Approach %	5.7	94.3	-	-	46.9	53.1	-	-	0.0	84.7	15.3	-	-	-
Total %	1.1	17.7	-	18.8	28.5	32.3	-	60.7	0.0	17.4	3.1	-	20.5	-
PHF	0.667	0.917	-	0.938	0.946	0.897	-	0.961	0.000	0.866	0.833	-	0.874	0.963
Lights	24	390	-	414	633	712	-	1345	0	377	69	-	446	2205
% Lights	100.0	98.5	-	98.6	99.5	98.8	-	99.1	-	97.2	98.6	-	97.4	98.7
Mediums	0	6	-	6	3	9	-	12	0	11	1	-	12	30
% Mediums	0.0	1.5	-	1.4	0.5	1.2	-	0.9	-	2.8	1.4	-	2.6	1.3
Articulated Trucks	0	0	-	0	0	0	-	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	-	0.0	0.0	0.0	-	0.0	-	0.0	0.0	-	0.0	0.0
All Pedestrians	-	-	0	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Peak Hour Data

03/15/2017 3:45 PM
Ending At
03/15/2017 4:45 PM

Lights
Mediums
Articulated Trucks
All Pedestrians

Kuhio Hwy [Makai]

Exit	Enter	Total
736	446	1182
9	12	21
0	0	0
0	0	0
745	**458**	**1203**

RT	Th	LT	Ped
69	377	0	0
1	11	0	0
0	0	0	0
0	0	0	0
70	**388**	**0**	**0**

Kapaa Bypass Rd [KKHD]

Exit	Enter	Total
702	414	1116
4	6	10
0	0	0
0	0	0
706	**420**	**1126**

LT	RT	Ped
24	390	0
0	6	0
0	0	0
0	0	0
24	**396**	**0**

Fake Approach [Ewa]

Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

LT	Th	Ped
633	712	0
3	9	0
0	0	0
0	0	0
636	**721**	**0**

Kuhio Hwy [Mauka]

Exit	Enter	Total
767	1345	2112
17	12	29
0	0	0
0	0	0
784	**1357**	**2141**

Turning Movement Peak Hour Data Plot (3:45 PM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (7:00 AM)

Start Time	Kapaa Bypass Rd Koko Head Bound				Kuhio Hwy Mauka Bound				Kuhio Hwy Makai Bound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
7:00 AM	1	161	0	162	20	129	0	149	0	233	0	0	233	544
7:15 AM	1	184	0	185	25	155	0	180	0	200	1	0	201	566
7:30 AM	2	152	0	154	24	152	0	176	0	167	0	0	167	497
7:45 AM	1	155	1	156	33	180	0	213	0	135	0	0	135	504
Total	5	652	1	657	102	616	0	718	0	735	1	0	736	2111
Approach %	0.8	99.2	-	-	14.2	85.8	-	-	0.0	99.9	0.1	-	-	-
Total %	0.2	30.9	-	31.1	4.8	29.2	-	34.0	0.0	34.8	0.0	-	34.9	-
PHF	0.625	0.886	-	0.888	0.773	0.856	-	0.843	0.000	0.789	0.250	-	0.790	0.932
Lights	4	635	-	639	100	600	-	700	0	711	1	-	712	2051
% Lights	80.0	97.4	-	97.3	98.0	97.4	-	97.5	-	96.7	100.0	-	96.7	97.2
Mediums	1	14	-	15	2	16	-	18	0	23	0	-	23	56
% Mediums	20.0	2.1	-	2.3	2.0	2.6	-	2.5	-	3.1	0.0	-	3.1	2.7
Articulated Trucks	0	3	-	3	0	0	-	0	0	1	0	-	1	4
% Articulated Trucks	0.0	0.5	-	0.5	0.0	0.0	-	0.0	-	0.1	0.0	-	0.1	0.2
All Pedestrians	-	-	1	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Peak Hour Data

03/16/2017 7:00 AM
Ending At
03/16/2017 8:00 AM

Lights
Mediums
Articulated Trucks
All Pedestrians

Kuhio Hwy [Makai]

Exit	Enter	Total
604	712	1316
17	23	40
0	1	1
0	0	0
621	**736**	**1357**

RT	Th	LT	Ped
1	711	0	0
0	23	0	0
0	1	0	0
0	0	0	0
1	**735**	**0**	**0**

Kapaa Bypass Rd [KKHD]

Exit	Enter	Total
101	639	740
2	15	17
0	3	3
0	0	0
103	**657**	**760**

LT	RT	Ped
4	635	0
1	14	0
0	3	0
0	0	1
5	**652**	**1**

Fake Approach [Ewa]

Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

Kuhio Hwy [Mauka]

LT	Th	Ped
100	600	0
2	16	0
0	0	0
0	0	0
102	**616**	**0**

Exit	Enter	Total
1346	700	2046
37	18	55
4	0	4
0	0	0
1387	**718**	**2105**

Turning Movement Peak Hour Data Plot (7:00 AM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (4:15 PM)

Start Time	Kapaa Bypass Rd Koko Head Bound				Kuhio Hwy Mauka Bound				Kuhio Hwy Makai Bound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
4:15 PM	6	109	1	115	136	158	0	294	0	95	6	0	101	510
4:30 PM	6	96	1	102	143	174	0	317	0	78	2	0	80	499
4:45 PM	5	93	0	98	138	181	0	319	0	83	6	0	89	506
5:00 PM	2	98	0	100	146	204	0	350	0	85	3	0	88	538
Total	19	396	2	415	563	717	0	1280	0	341	17	0	358	2053
Approach %	4.6	95.4	-	-	44.0	56.0	-	-	0.0	95.3	4.7	-	-	-
Total %	0.9	19.3	-	20.2	27.4	34.9	-	62.3	0.0	16.6	0.8	-	17.4	-
PHF	0.792	0.908	-	0.902	0.964	0.879	-	0.914	0.000	0.897	0.708	-	0.886	0.954
Lights	19	385	-	404	558	710	-	1268	0	337	17	-	354	2026
% Lights	100.0	97.2	-	97.3	99.1	99.0	-	99.1	-	98.8	100.0	-	98.9	98.7
Mediums	0	11	-	11	5	7	-	12	0	4	0	-	4	27
% Mediums	0.0	2.8	-	2.7	0.9	1.0	-	0.9	-	1.2	0.0	-	1.1	1.3
Articulated Trucks	0	0	-	0	0	0	-	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	-	0.0	0.0	0.0	-	0.0	-	0.0	0.0	-	0.0	0.0
All Pedestrians	-	-	2	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Count Name: Kuhio Hwy Kapaa Bypass 3-15-17 to 3-17-17
Site Code: Hokua Place
Start Date: 03/15/2017

Kuhio Hwy [Makai]

Exit	Enter	Total
729	354	1083
7	4	11
0	0	0
0	0	0
736	**358**	**1094**

RT	Th	LT	Ped
17	337	0	0
0	4	0	0
0	0	0	0
0	0	0	0
17	**341**	**0**	**0**

Kapaa Bypass Rd [KKHD]

Exit	Enter	Total
575	404	979
5	11	16
0	0	0
0	0	0
580	**415**	**995**

LT	RT	Ped
19	385	0
0	11	0
0	0	0
0	0	2
19	**396**	**2**

Peak Hour Data

03/16/2017 4:15 PM
Ending At
03/16/2017 5:15 PM

Lights
Mediums
Articulated Trucks
All Pedestrians

Fake Approach [Ewa]

Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

LT	Th	Ped
558	710	0
5	7	0
0	0	0
0	0	0
563	**717**	**0**

Exit	Enter	Total
722	1268	1990
15	12	27
0	0	0
0	0	0
737	**1280**	**2017**

Kuhio Hwy [Mauka]

Turning Movement Peak Hour Data Plot (4:15 PM)

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Turning Movement Peak Hour Data (7:00 AM)

Start Time	Kapaa Bypass Rd Koko Head Bound				Kuhio Hwy Mauka Bound				Kuhio Hwy Makai Bound					
	Left-Turn	Right-Turn	Peds	App. Total	Left-Turn	Thru	Peds	App. Total	Left-Turn	Thru	Right-Turn	Peds	App. Total	Int. Total
7:00 AM	1	131	0	132	17	133	0	150	0	219	1	0	220	502
7:15 AM	3	168	0	171	32	158	0	190	0	182	3	0	185	546
7:30 AM	1	125	0	126	40	146	0	186	0	166	2	0	168	480
7:45 AM	1	123	0	124	30	165	0	195	0	138	0	0	138	457
Total	6	547	0	553	119	602	0	721	0	705	6	0	711	1985
Approach %	1.1	98.9	-	-	16.5	83.5	-	-	0.0	99.2	0.8	-	-	-
Total %	0.3	27.6	-	27.9	6.0	30.3	-	36.3	0.0	35.5	0.3	-	35.8	-
PHF	0.500	0.814	-	0.808	0.744	0.912	-	0.924	0.000	0.805	0.500	-	0.808	0.909
Lights	5	535	-	540	113	569	-	682	0	688	6	-	694	1916
% Lights	83.3	97.8	-	97.6	95.0	94.5	-	94.6	-	97.6	100.0	-	97.6	96.5
Mediums	1	10	-	11	5	29	-	34	0	15	0	-	15	60
% Mediums	16.7	1.8	-	2.0	4.2	4.8	-	4.7	-	2.1	0.0	-	2.1	3.0
Articulated Trucks	0	2	-	2	1	4	-	5	0	2	0	-	2	9
% Articulated Trucks	0.0	0.4	-	0.4	0.8	0.7	-	0.7	-	0.3	0.0	-	0.3	0.5
All Pedestrians	-	-	0	-	-	-	0	-	-	-	-	0	-	-
% All Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-

The Traffic Management Consultant
1188 Bishop Street, Suite 1907

Honolulu, Hawaii, United States 96813
808-536-0223 tmchawaii@aol.com

Kuhio Hwy [Makai]

Exit	Enter	Total
574	694	1268
30	15	45
4	2	6
0	0	0
608	**711**	**1319**

RT	Th	LT	Ped
6	688	0	0
0	15	0	0
0	2	0	0
0	0	0	0
6	**705**	**0**	**0**

Peak Hour Data

Kapaa Bypass Rd [KKHD]

Exit	Enter	Total
119	540	659
5	11	16
1	2	3
0	0	0
125	**553**	**678**

LT	RT	Ped
5	535	0
1	10	0
0	2	0
0	0	0
6	**547**	**0**

03/17/2017 7:00 AM
Ending At
03/17/2017 8:00 AM

Lights
Mediums
Articulated Trucks
All Pedestrians

Fake Approach [Ewa]

Exit	Enter	Total
0	0	0
0	0	0
0	0	0
0	0	0
0	**0**	**0**

LT	Th	Ped
113	569	0
5	29	0
1	4	0
0	0	0
119	**602**	**0**

Exit	Enter	Total
1223	682	1905
25	34	59
4	5	9
0	0	0
1252	**721**	**1973**

Kuhio Hwy [Mauka]

Turning Movement Peak Hour Data Plot (7:00 AM)

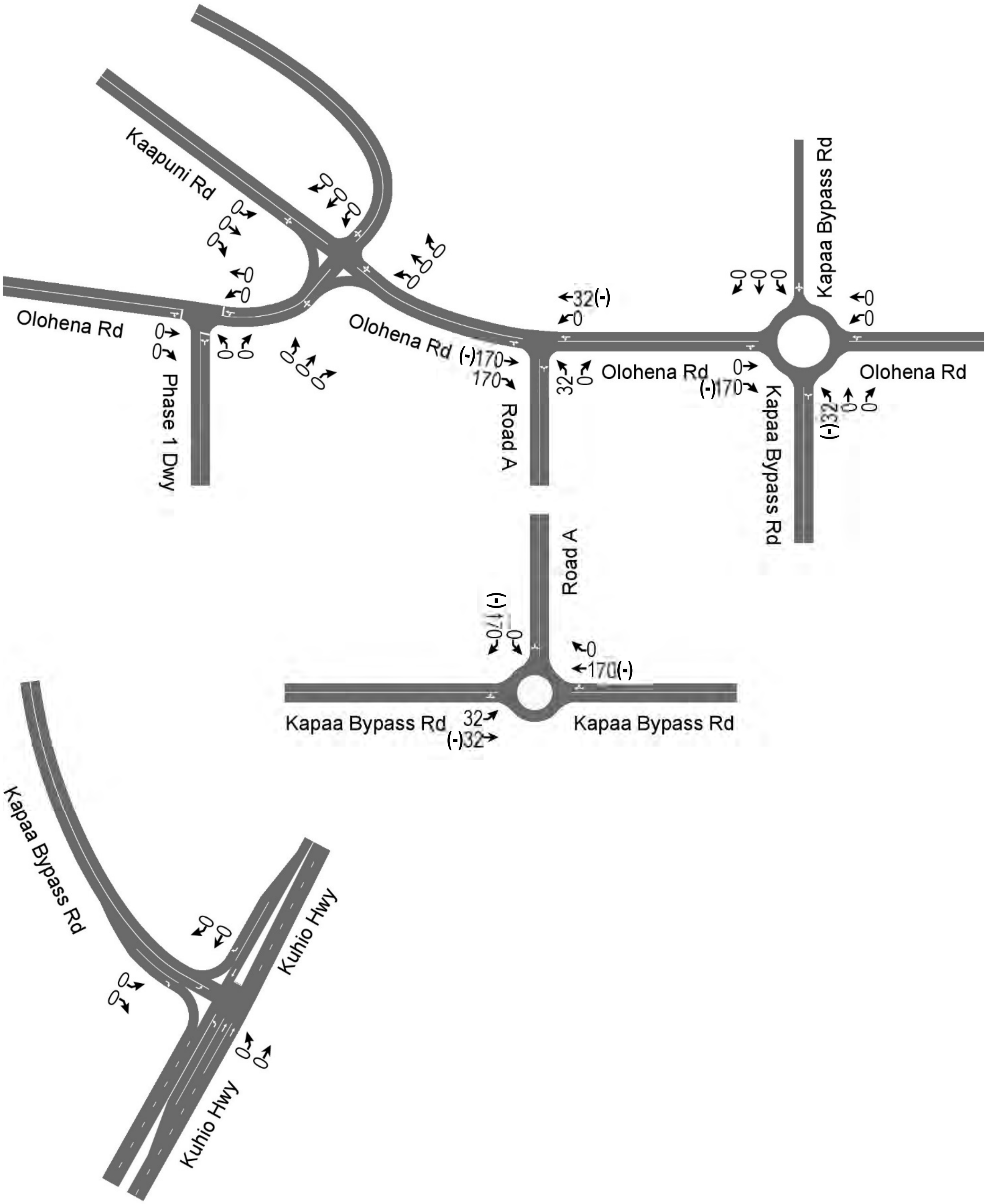


Figure 12.1 AM Peak Hour Diverted Traffic Assignment

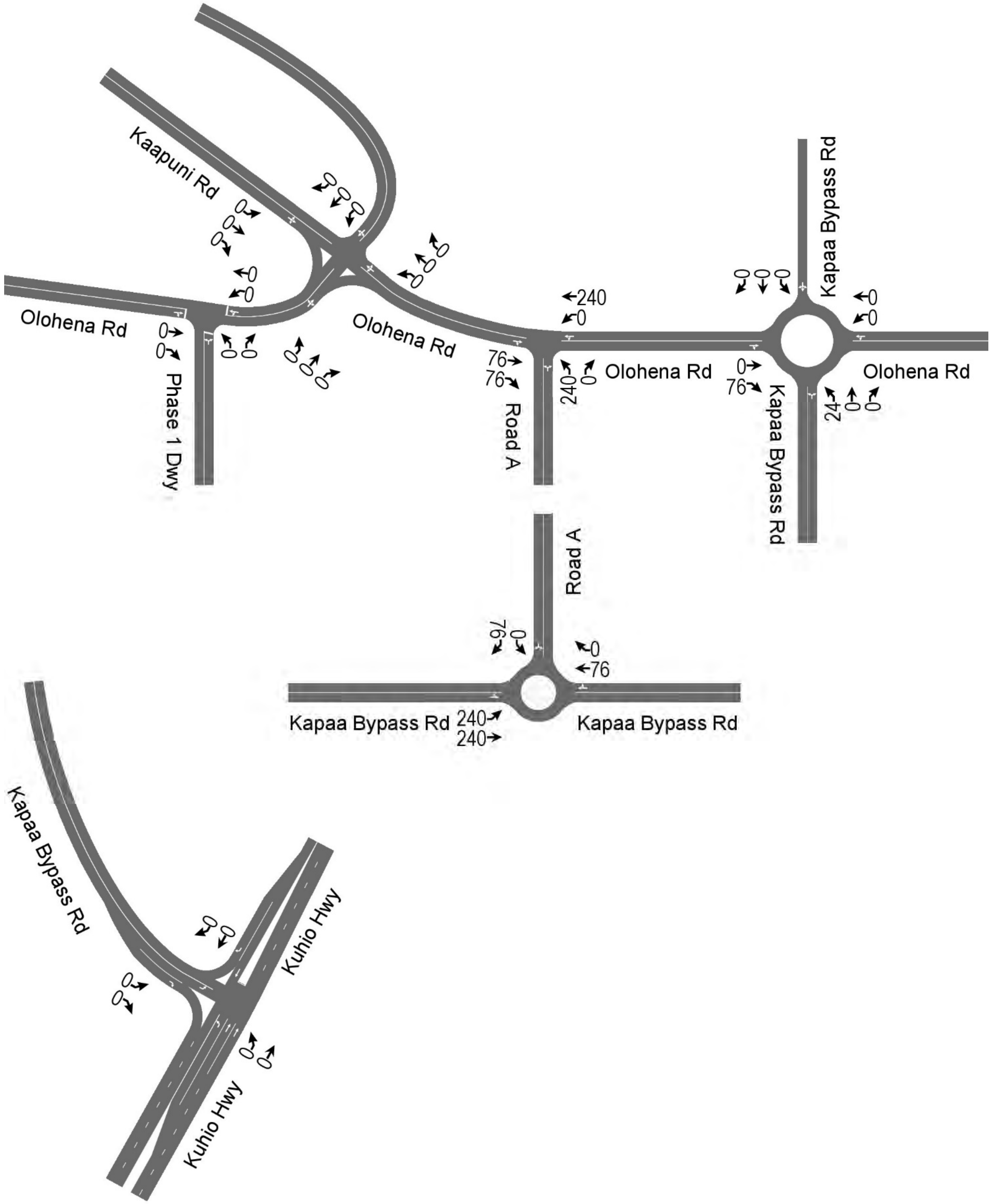


Figure 14.1 PM Peak Hour Diverted Traffic Assignment

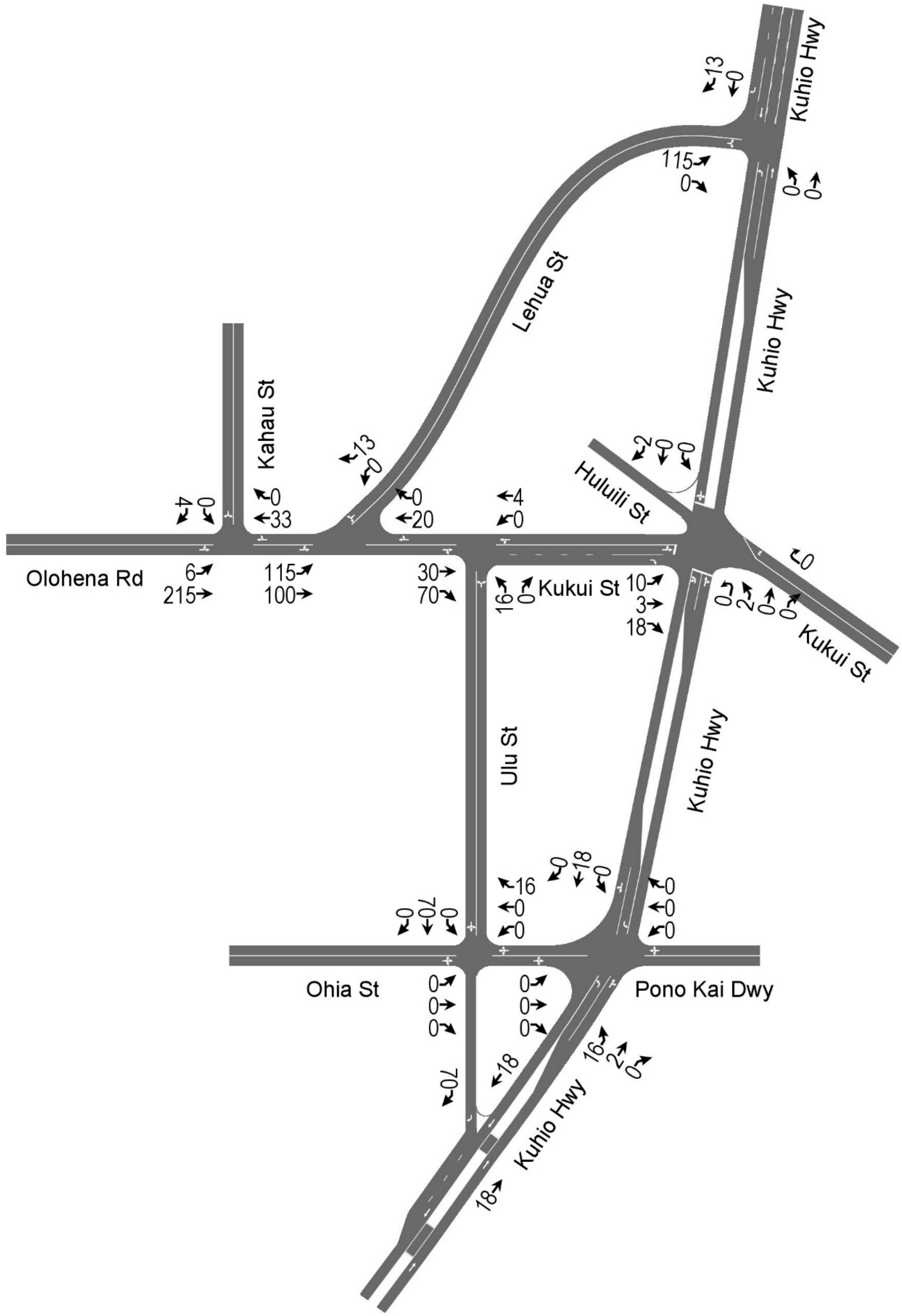


Figure 11. AM Peak Hour Site Traffic Assignment

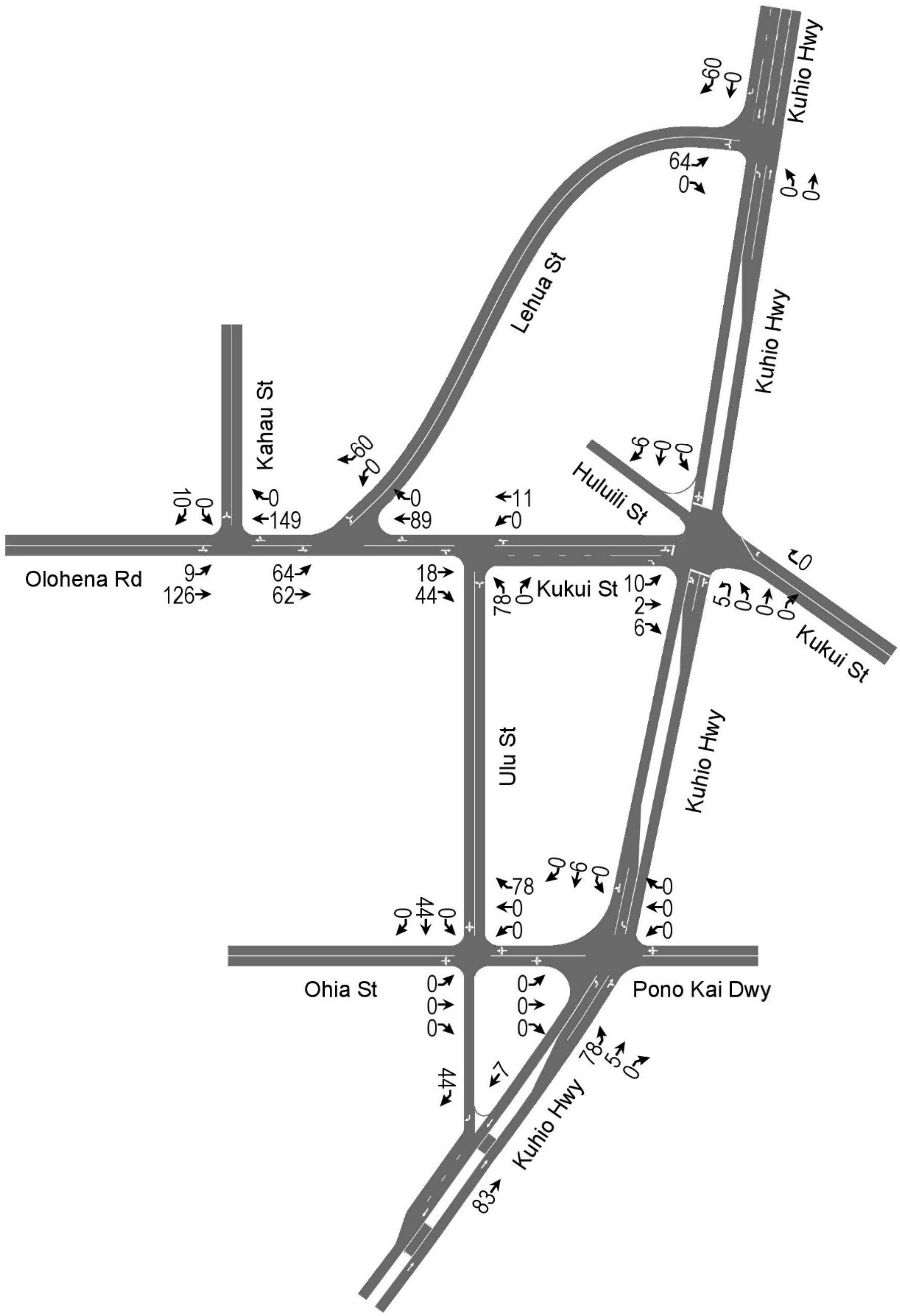


Figure 13. PM Peak Hour Site Traffic Assignment

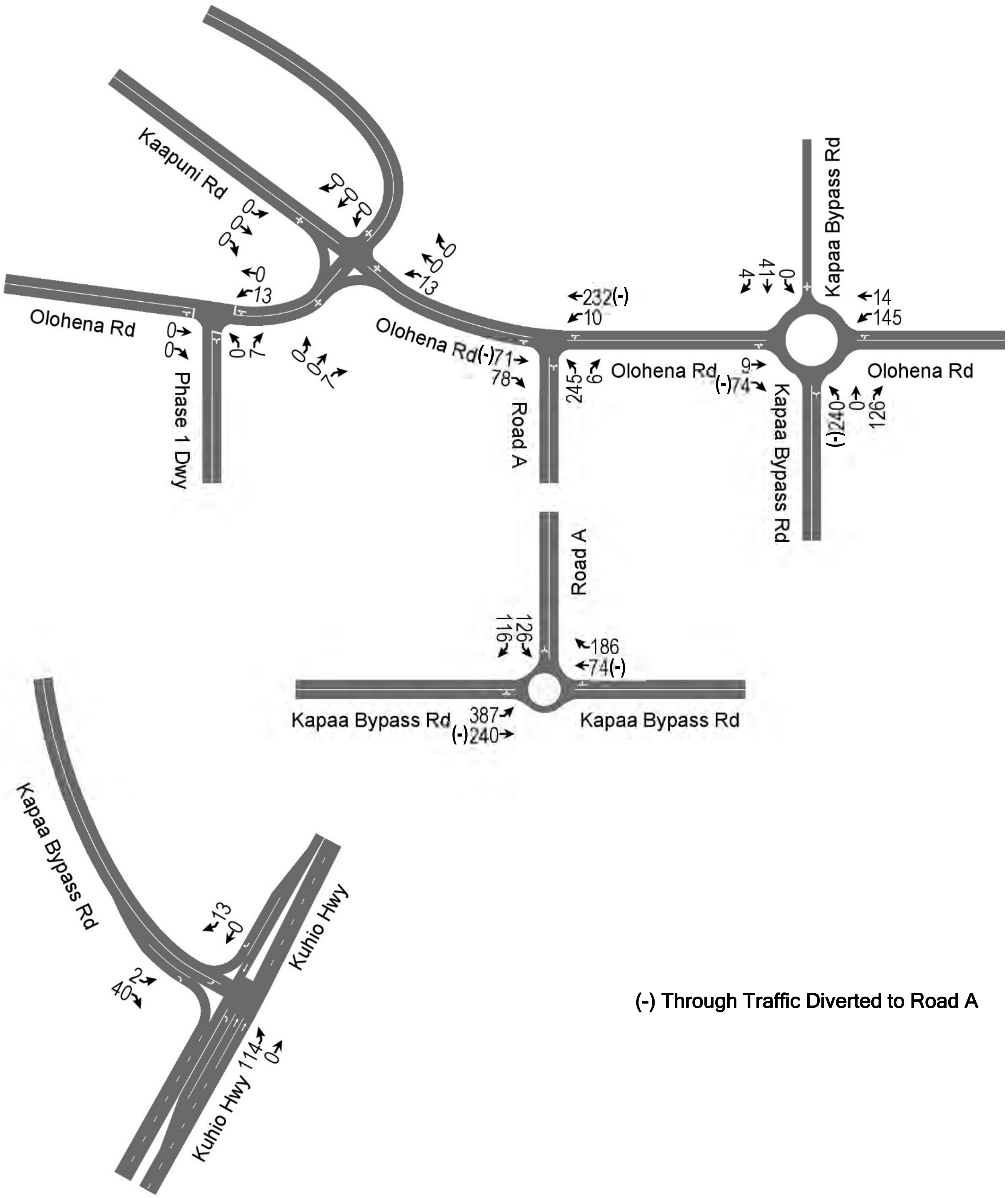


Figure 14. PM Peak Hour Site Traffic Assignment (Cont'd.)

Bernard P. Carvalho, Jr.
Mayor

Wallace G. Rezentes, Jr.
Managing Director

Lyle Tabata
Acting County Engineer

DEPARTMENT OF PUBLIC WORKS
County of Kaua'i, State of Hawai'i
4444 Rice Street, Suite 275, Līhu'e, Hawai'i 96766
TEL (808) 241-4992 FAX (808) 241-6604

September 1, 2017

Randall S. Okaneku, P. E.
The Traffic Management Consultant
1188 Bishop Street, Suite 1907
Honolulu, Hawaii 96813

SUBJECT: Traffic Impact Analysis Report Update
For the Proposed Hokua Place
Kapa`a, Kawaihau District, Island of Kaua'i
TMK: (4) 4-3-03: Por. 001

Dear Mr. Okaneku:

The Engineering Division of the Department of Public Works received the subject Traffic Impact Analysis Report (TIAR) Update that was transmitted via email on June 15, 2017. We appreciate the opportunity to review the TIAR and offer the following comments on the TIAR:

1. **Introduction, Project Description:**
   a. The TIAR indicates that the driveway for phase 1 is proposed to be located on Olohena Road mauka of its intersection with Ka'apuni Road. We have concerns with a proposed intersection at this location, including the proximity to the intersection of Ka'apuni Road as well as concerns about intersection sight distance due to nearby horizontal and vertical curves. Prior to approval of a driveway at this location, additional information will need to be provided about this driveway location, to show that appropriate sight lines can be achieved and that no safety or other problems will be created by the proximity to the intersection of Olohena Road and Ka'apuni Road.
2. **Existing Conditions, Roadways:**
   a. The report states that the Kapa'a Bypass Road speed limit is reduced to 25 mph south of the proposed intersection with Road A. The report should also mention that further south the speed limit is again increased to 35 mph.
   b. The report incorrectly indicates that the posted speed limit for Olohena Road is reduced to 15 mph as it approaches Kapa'a Middle School. The correct statement should be that there is a 15 mph school zone within the vicinity of Kapa'a Middle School during school hours.
   c. Kukui Street and Ulu Street should both be described as collector streets.

3. **Existing Conditions, Existing Peak Hour Traffic Volumes and Operating Conditions:**
    a. The language throughout this segment of the TIAR indicates that intersections "operated at LOS…." However, if we understand correctly, the LOS values given are based on the analysis of the traffic conditions, not actual empirical observations of delay for vehicles at these intersections. The TIAR should instead use language such as "calculated to operate at LOS …." This is an important distinction given that observations of Kūhiō Highway during peak hours of traffic appear to show LOS along the highway worse than the LOS A for movements along Kūhiō Highway as reported in the TIAR, potentially due to other factors than the control delay at the intersections.
    b. Check the traffic volume of 1,500 shown on page 10 for Kūhiō Highway south of Ulu Street in the PM Peak. The volumes shown in Figure 6 do not match.
    c. Figure 6 (Existing PM Peak Hour Traffic) has an error for the southbound through movement on Kūhiō Highway at the Kapaʻa Bypass Road. The figure shows an hourly volume of 38, which is way too low for this through movement. The data shown for this intersection in figure 6 does not appear to match either of the two PM peak hour traffic count plots (or their average) in the appendix.
    d. Related to comment "a" above recommending different language for the calculated LOS values, we recommend that the TIAR include some statements comparing the observed traffic conditions with the calculated delays and level of service, ideally offering explanations for the difference in observed level of service and calculated level of service.
4. **Future Traffic Conditions, Kapaʻa Transportation Solutions:**
    a. Page 17 of the TIAR refers to removal of on-street parking on Kūhiō Highway. The Kapaʻa Transportation Solutions study rejected any potential solutions that removed parking on Kūhiō Highway, since such a change would be detrimental to the economic vitality, multimodal, and safety goals of the study. Removal of parking should not be discussed in the TIAR, as HDOT is not considering removal of parking to add travel lanes or turn lanes.
    b. With respect to a new connector road in the approximate location of Road A, page 18 of the TIAR states, "The construction cost of the connector road was estimated at $25,824,000." The costs in the Kapaʻa Transportation Solutions report include right-of-way costs as well as construction cost; therefore it is misleading to state that the full cost shown in the study is the estimated construction cost.
5. **Traffic Impact Analysis, Trip Generation Characteristics:**
    a. The project description in the TIAR's introduction states that there are 700 multi-family dwelling units, but the trip generation calculations are based on 800 multi-family dwelling units. This discrepancy must be corrected, and the accurate trip generation should be reflected in the study.
    b. The pass-by trip percentage of 81.2% is too high, especially given the relatively small amount of traffic traveling through the development on Road A. The diverted volume of 45 vehicles represents approximately 15% of the estimated through vehicles on Road A during the PM Peak Hour. The 8,000 square feet of the Hokua Place shopping center is outside of the sample size in the pass-by trip

chart for shopping centers in the ITE Trip Generation Handbook. A pass-by trip percentage of approximately 30% or 40% would be more reasonable, given the data available in the Trip Generation Handbook. It would also be reasonable for the TIAR to include a calculation of an internal capture rate for trips between the retail portion and the residential portion of the Hokua Place development. However, the combination of the traffic reduction for internal capture and pass-by trips should still be less than 81%.

6. **Traffic Impact Analysis, Site Access Improvements:**
    a. The recommendations for the stop controlled Tee-intersections of Olohena Road with Road A and the phase 1 driveway do not include any statements regarding the recommended lane assignments for these new intersections. The methodologies section of the report describes the use of AASHTO Left-Turn Lane Guidelines, but no such analyses are included in the TIAR for left turn lanes on Olohena Road at these intersections. We believe that at a minimum, a left turn lane would be necessary on Olohena Road at Road A, but analyses must be provided for both intersections. A median refuge lane should also be included on Olohena Road to facilitate the left-turn movement from Road A to Olohena Road. In addition, we believe that Road A should have two approach lanes at Olohena Road, one for right turn movements and one for left turn movements.
7. **Traffic Impact Analysis, Traffic Assignment:**
    a. In the previous TIAR for this project, no traffic was assigned to the left turn movement from southbound Road A to eastbound Kapaʻa Bypass (and likewise for the right turn from the Kapaʻa Bypass to Road A). In our earlier comments, we recommended that some traffic be assigned to these movements. In almost a complete reversal, the current TIAR assigned nearly all of the traffic to these movements. In the current TIAR, only about 5% to 10% of the project traffic that goes through the existing Kapaʻa Bypass roundabout is assigned to go through the intersection of Road A and Olohena Road. A more equitable distribution of traffic should be made, to accurately represent the traffic impact on Olohena Road.
    b. The TIAR assigns no traffic between the project and Olohena Road or Kaʻapuni Road north of the project (Wailua Homesteads and Upper Kapahi area). There are relatively few destinations on those roads for the residential traffic from the project, but a small amount of residential traffic is likely to travel to those areas. In addition, much of the traffic generated by the retail portion of the development would have its origin or destination in the residential areas of Wailua Homesteads and Upper Kapahi area. A reasonable (albeit small) amount of traffic must be assigned to those areas.
8. **Figures 11 Through 14 (Traffic Assignment)**
    a. For clarity, the TIAR must show the reassignment of existing traffic on separate figures from the figures for traffic assignment from this project.
    b. On Figure 11, the 989 vehicles shown for northbound Kūhiō Highway at Ulu Street is incorrect. It appears that this volume should be 20.
    c. On Figure 13, the 1,274 vehicles shown for northbound Kūhiō Highway at Ulu Street is incorrect. It appears that this volume should be 92.
    d. On Figure 14, the 30 vehicles shown for the Kapaʻa Bypass Road left turn and the

447 vehicles for the Kapa'a Byapss Road right turn appear to be incorrect.

9. **Traffic Impact Analysis, PM Peak Hour Traffic Analysis With Project:**
    a. We recommend that the TIAR further analyze and discuss the impact of the project on the intersection of Kūhi'ō Highway and Lehua Street and recommend measures to mitigate this impact. The TIAR states that "Makai bound Lehua Street is expected to continue at LOS F at Kūhiō Highway during the PM peak hour of traffic with the proposed project." However, Table 7 shows the PM peak hour of traffic without the project to be LOS E. Additionally, while the AM peak hour of traffic with the project continues to be LOS F, the delay increases significantly.
10. **Recommendations and Conclusions, Recommended Traffic Improvements Without Project:**
    a. Item number 3 recommends restricting parking along Kūhiō Highway within Kapa'a Town in order to provide additional through lanes or left turn lanes on Kūhiō Highway. This should not be recommended in the TIAR, because HDOT is not considering removal of parking to add travel lanes. Removal of parking has been determined to be detrimental to businesses and the economic vitality of Kapa'a Town. Discussion of parking removal on Kūhiō Highway in Kapa'a Town should also be removed from other sections of the report, including the conclusions.
11. **Recommendations and Conclusions, Recommended Traffic Improvements With Project:**
    a. Our comments above include several concerns about the intersection of Road A and Olohena Road, including the possibility that additional traffic should be assigned to this intersection. We are concerned that the one-way stop control Tee-intersection proposed will not be sufficient to address traffic operations and safety at intersection. The installation of a roundabout at this intersection shall be evaluated as part of the TIAR, including traffic operations analysis for a roundabout as well as a safety comparison of a roundabout and a one-way stop control intersection. The federal Manual on Uniform Traffic Control Devices (MUTCD) does not include traffic warrants for roundabouts. However, evaluation of the MUTCD's multi-way stop control warrants and/or signal warrants would be instructive with respect to evaluating whether a one-way stop control intersection would be sufficient or if a roundabout is needed instead. Alternatively, we may also accept an evaluation of the need for a roundabout based on roundabout evaluation guidelines from another jurisdiction or research document.

       Consideration should also be given to the construction of a roundabout that combines the intersections of Olohena Road with Ka'apuni Road and Road A (with Kaehulua Road designed as a T intersection with either Ka'apuni Road or Olohena Road). Traffic operations analysis of a roundabout that combines these intersections shall be included in the TIAR.

The comments in this letter should not be construed to be inclusive of all County of Kaua'i recommendations for road improvements required to be constructed as part of the Hokua Place project. Recommendations and requirements for road improvements will be included as part of future review phases for the project, such as zoning amendments, subdivision applications, and construction plan review. If you have any questions or need additional information, please contact me at (808) 241-4891 or Stanford Iwamoto at (808) 241-4896.

Very truly yours,

MICHAEL MOULE, P.E.
Chief, Engineering Division

MM/SI

Copies to: DPW-Design & Permitting
Lyle Tabata, Acting County Engineer
Larry Dill, HDOT Kaua'i District Engineer

REFERENCES

Palmer, D. D. 2003. Hawai`i's Ferns and Fern Allies. University of Hawai`i Press, Honolulu.

USFWS (United States Fish and Wildlife Service). 1999a. U.S. Fish and Wildlife Service species list, plants. March 23, 1999. Pacific Islands Office, Honolulu, HI.

USFWS (United States Fish and Wildlife Service). 1999b. Endangered and threatened wildlife and plants. 50 CFR 17.11 and 17.12. December 31, 1999.

USFWS (United States Fish and Wildlife Service). 2004. Hawaiian Islands Plants: Updated June 15, 2004, Listed and Candidate Species, as Designated under the U.S. Endangered Species Act. 17pp.

USFWS (United States Fish and Wildlife Service). 2010. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for 48 Species on Kaua'i and Designation of Critical Habitat. Federal Register Vol. 75, No. 70, April 13, 2010, pages 1895919008

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1990. Manual of the flowering plants of Hawaii. 2 vols. University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publication 83.

Exhibit K

Biological Surveys
Conducted on the Kapa'a Highlands Phase II Project Site
TMK: (4)-3-003:001, Island of Kaua'i, Hawai'i

Biological Surveys Conducted on the Kapa‘a Highlands Phase II Project Site, TMK: (4)-3-003:001, Island of Kaua‘i, Hawai‘i

Prepared by:

Reginald E. David
Rana Biological CÂ»Äµ¼º»¹, Inc.
P.O. Box 1371
Ë´º¾µ´ÌËÂ»´ , Hawai‘i 96745

&

Prepared for:
Greg Allen
Ë´³´ ‘a Highlands

May 24, 2012

Table of Contents

Executive Summary

Biological field surveys were conducted on an approximately 97-acre parcel of land identified as Tax Map Key (4) 3-8-003:001 located in Kapa'a, Island of Kaua'i. The owners are proposing to develop these lands as Phase II of the Kapa'a Highlands subdivision

The primary purpose of the surveys was to determine if there are any botanical, avian and terrestrial mammalian species currently listed, or proposed for listing under either federal or State of Hawai'i endangered species statutes within or adjacent to the study area. The avian and mammalian surveys were conducted May 21, 2012, and the botanical survey was conducted on April 19 and May 7, 2012.

No species currently proposed or listed as threatened or endangered under either the federal or state of Hawaii endangered species statutes was documented during the course of the biological surveys conducted on the subject property in April and May, 2012.

There is no federally delineated Critical Habitat for any species present on or adjacent to the project area. Thus the development and operation of the proposed project will not result in impacts to federally designated Critical Habitat. There is no equivalent statute under State law.

Potential Impacts to Protected Species

Botanical

As all of the plant species recorded are either naturalized species or common indigenous species it is not expected that the development and operation of the proposed subdivision will result in deleterious impacts to any botanical species currently listed or proposed for listing under either federal or State of Hawai'i endangered species statutes.

Seabirds

The principal potential impact that construction and operation of the Kapa'a Highlands Phase II project poses to protected seabirds is the increased threat that birds will be downed after becoming disoriented by lights associated with the project during the nesting season. The two main ways that outdoor lighting could pose a threat to these nocturnally flying seabirds is if, 1) during construction it is deemed expedient, or necessary to conduct nighttime construction activities, and 2) following build-out, the potential operation of streetlights and exterior safety and security lighting.

Hawaiian hoary bat

The principal potential impact that the development of the Kapa'a Highlands Phase II project poses to bats is during the clearing and grubbing phases of construction as vegetation is removed. The removal of vegetation within the project site may temporarily displace individual bats, which may use the vegetation as a roosting location. As bats use multiple roosts within their home territories, the potential disturbance resulting from the removal of the vegetation is likely to be minimal. During the pupping season, females

carrying their pups may be less able to rapidly vacate a roost site as the vegetation is cleared. Additionally, adult female bats sometimes leave their pups in the roost tree while they forage. Very small pups may be unable to flee a tree that is being felled. Potential adverse effects from such disturbance can be avoided or minimized by not clearing woody vegetation taller than 4.6 meters (15-feet), between June 15 and September 15, the period in which bats are potentially at risk from vegetation clearing.

Introduction and Background

An avian and mammalian survey was conducted on an approximately 97-acre parcel of land identified as Tax Map Key (4) 3-8-003:001 located in Kapa'a, Island of Kaua'i (Figure 1). The owners are proposing to develop these lands as Phase II of the Kapa'a Highlands subdivision.

This report describes the methods used and the results of the avian and terrestrial mammalian surveys conducted on the project site by this author and a summary of the results of the botanical surveys conducted on the site by Wood and Kirkpatrick (2012)[1]. Both surveys were conducted as part of the environmental disclosure process associated with the proposed project.

The primary purpose of the surveys was to determine if there are any botanical, avian and terrestrial mammalian species currently listed, or proposed for listing under either federal or State of Hawai'i endangered species statutes within or adjacent to the study area. The federal and State of Hawai'i listed species status follows species identified in the following referenced documents, (Department of Land and Natural Resources (DLNR) 1998; U. S. Fish & Wildlife Service (USFWS) 2005, 2012). The avian and mammalian surveys were conducted May 21, 2012, and the botanical survey was conducted on April 19 and May 7, 2012.

Hawaiian and scientific names are italicized in the text. A glossary of technical terms and acronyms used in the document, which may be unfamiliar to the reader, are included at the end of the narrative text.

General Site Description

The approximately 97 acre project site is bound to the north by Olohena Road (SR 581) and Kapa'a Middle School, to the east and south by the Kapa'a Bypass Road and to the west by undeveloped land and a new solar power generating facility (Figure 1). The site is made up of gently rolling hills that attain a maximum elevation of ~ 45 meters above mean sea level in the northwestern corner, sloping *makai* in an east-southeast direction down to an elevation of approximately ~ 6 meters ASL at the intersection of Olohena Road and the Kapa'a Bypass Road.

The site has a long history of sugar cultivation, followed by use as cattle pasturage. The vegetation currently on the site is dominated almost to the exclusion of native species by Guinea grass (*Panicum maximum*), *koa haole* (*Leucaena leucocephala*), lantana (*Lantana camara*), with Java plum trees (*Syzygium cuminii*), doted across the landscape (Figure 2). The southwestern boundary of the site has fairly dense stands of *hau* (*Hibiscus tiliaceus)* along the boundary (Figure 3).

[1] Wood, K.R., and M. Kirkpatrick. 2012. Botanical Survey Kapa'a Highlands Phase II TMK (4) 4-3-003:001 Kaua'i, Hawai'i April-May 20212, is appended to this document as Appendix A.

Figure 2 – Typical Guinea grass/koa haole shrub vegetation looking nortwest

Figure 3 – Hau bushes along southwestern bounday

Methods

Plant names mostly follow *Manual of the Flowering Plants of Hawai'i* (Wagner et al., 1990, 1999). The avian phylogenetic order and nomenclature used in this report follows the *AOU Check-List of North American Birds* (American Ornithologists' Union, 1998), and the 42nd through the 52nd supplements to the Check-List (American Ornithologists' Union, 2000; Banks et al., 2002, 2003, 2004, 2005, 2006, 2007, 2008; Chesser et al., 2009, 2010, 2011). Mammalian species scientific names follow (Tomich, 1986). Place names follow (Pukui et al., 1974).

Botanical Survey Methods

The botanical survey was conducted using a pedestrian (walking) transect methodology to cover the project area. Wood and Kirkpatrick's methodologies are detailed in Appendix A.

Avian Survey Methods

A total of six avian point count stations were sited roughly equidistant from each other within the project site. Six-minute point counts were made at each of the count stations. Each station was counted once. Field observations were made with the aid of Leica 8 X 42 binoculars and by listening for vocalizations. Point counts were concentrated during the early morning hours, the peak of daily bird activity. Time not spent counting was used to search the remainder of the project site for species and habitats that were not detected during count sessions.

Mammalian Survey Methods

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or *'ōpe'ape'a* as it is known locally, all terrestrial mammals currently found on the Island of Kaua'i are alien species, and most are ubiquitous. The survey for terrestrial mammalian species was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. No trapping program or heterodyne bat detection survey methods were used during the course of this survey. A running tally was kept of all terrestrial vertebrate mammalian species detected within the project area during time spent within the project site.

Results

Botanical Survey

A total of 44 species of vascular plants were identified from the survey area. Three of the species detected *moa* (*Psilotum nudum*), *hau* (*Hibiscus tiliaceus*) and *'uhaloa* (*Waltheria indica*) are common indigenous species in the Islands. One species *kukui* (*Aleurites moluccana*) is a Polynesian introduction (Wood and Kirkpatrick, 2012).

Wood and Kirkpatrick did not detect any botanical species currently listed as endangered or threatened under either federal or State of Hawai'i endangered species statutes. For a detailed description of their findings please see Appendix A.

Avian Survey Results

A total of 193 individual birds of 17 species, representing 13 separate families, were recorded during station counts (Table 1). All 17 species recorded are alien to the Hawaiian Islands (Table 1).

Avian diversity and densities were in keeping with the location of the property and the habitat presently on the site. Four species, House Finch (*Carpodacus mexicanus*), Nutmeg Mannikin (*Lonchura punctulata*), Japanese White-eye (*Zosterops japonicus*) and Zebra Dove (*Geopelia striata*) accounted for slightly more than 45 percent of all birds recorded during station counts. The most commonly recorded species was House Finch, which accounted for 14 percent of the total number of individual birds recorded. An average of 32 individual birds was recorded per station count; a number that is about average for point counts in this area on the Island of Kaua'i.

No avian species currently proposed or listed under either the State of Hawai'i or federal endangered species statutes was detected during the course of this survey, nor would they be expected given the habitat currently present on the site.

Mammalian Survey Results

Four terrestrial mammalian species were detected while on the site. Numerous dogs (*Canis f. familiaris*) were heard barking from areas adjacent to the site. Tracks and scat of pig (*Sus s. scrofa*) were encountered within the site. Tracks, and scat of both horse (*Equss c. caballus*) and cow (*Bos taurus*), were also encountered within the site.

Table 1 – Avian Species Kapa'a Highlands Phase II Point Counts

Common Name	*Scientific Name*	*ST*	*RA*
	GALLIFORMES		
	PHASIANIDAE – Pheasants & Partridges		
	Phasianinae – Pheasants & Allies		
Red Junglefowl	*Gallus gallus*	A	1.50
	PELECANIFORMES		
	ARDEIDAE - Herons, Bitterns & Allies		
Cattle Egret	*Bubulcus ibis*	A	0.83
	COLUMBIDAE - Pigeons & Doves		
Spotted Dove	*Streptopelia chinensis*	A	2.00
Zebra Dove	*Geopelia striata*	A	2.67
	PASSERIFORMES		
	CETTIIDAE - Cettia Warblers & Allies		
Japanese Bush-Warbler	*Cettia diphone*	A	1.17
	ZOSTEROPIDAE - White-eyes		
Japanese White-eye	*Zosterops japonicus*	A	1.17
	TIMALIIDAE - Babblers		
Chinese Hwamei	*Garrulax canorus*	A	0.50
	TURDIDAE - Thrushes		
White-rumped Shama	*Copsychus malabaricus*	A	1.17
	STURNIDAE - Starlings		
Common Myna	*Acridotheres tristis*	A	2.50
	EMBERIZIDAE - Emberizids		
Red-crested Cardinal	*Paroaria coronata*	A	1.00
	CARDINALIDAE - Cardinals Saltators & Allies		
Northern Cardinal	*Cardinalis cardinalis*	A	1.67
	ICTERIDAE - Blackbirds		
Western Meadowlark	*Sturnella neglecta*	A	0.67
	FRINGILLIDAE - Fringilline and Carduleline Finches & Allies		
	Carduelinae - Carduline Finches		
House Finch	*Carpodacus mexicanus*	A	4.50
	ESTRILDIDAE - Estrildid Finches		
	Estrildinae - Estrildine Finches		
Red Avadavat	*Amandava amandava*	A	0.56
Nutmeg Mannikin	*Lonchura punctulata*	A	4.33
Chestnut Munia	*Lonchura atricapilla*	A	2.17
Java Sparrow	*Padda oryzivora*	A	1.33

Key to Table 1
ST Status
A Alien – Introduced to the Hawaiian Islands by humans
RA Relative Abundance - Number of birds detected divided by the number of count stations (6)

Discussion

Botanical Resources

Only nine percent of the plant species (~4/~44) detected on the subject property were either indigenous or early Polynesian introductions. This proportion is remarkably low for lowland areas on Kaua'i, and graphically illustrates the highly disturbed and depauperate nature of the native vegetation present on this site. Please see Appendix A for a more detailed discussion of the botanical resources present on the site.

Avian Resources

The findings of the avian survey are consistent with the location of the property, and the habitat present on the site. As previously stated all of the avian species detected during the course of this survey are alien to the Hawaiian Islands.

Although not detected during this survey, the endangered Hawaiian Petrel (*Pterodroma sandwichensis*), and the threatened endemic sub-species of the Newell's Shearwater (*Puffinus auricularis newelli*) have been recorded over-flying the project site between April and the end of November each year (David, 1995; Morgan *et al*., 2003, 2004; David and Planning Solutions 2008). Additionally, the Save Our Shearwaters Program has recovered both species from the general project area on an annual basis over the past three decades (Morgan *et al*., 2003, 2004; David and Planning Solutions, 2008; Save our Shearwater Program, 2012).

The petrel is listed as endangered, and the shearwater as threatened under both Federal and State of Hawai'i endangered species statutes. The primary cause of mortality in both Hawaiian Petrels and Newell's Shearwaters is thought to be predation by alien mammalian species at the nesting colonies (USFWS 1983, Simons and Hodges 1998, Ainley *et al*., 2001). Collision with man-made structures is considered to be the second most significant cause of mortality of these seabird species in Hawai'i. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds can collide with manmade structures, and if they are not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Hadley 1961; Telfer 1979; Sincock 1981; Reed *et al.*, 1985; Telfer *et al.*, 1987; Cooper and Day, 1998; Podolsky *et al*. 1998; Ainley *et al.,* 2001; Hue *et al.,* 2001; Day *et al* 2003). There are no nesting colonies nor appropriate nesting habitat for either of these listed seabird species within the current study site.

Following build out it is probable that cleared areas, especially those that are landscaped as lawns, and or parking lots will provide loafing habitat for Pacific Golden-Plover (*Pluvialis fulva*). The plover is an indigenous migratory shorebird species which nests in the high Arctic during the late spring and summer months, returning to Hawai'i and the Tropical Pacific to spend the fall and winter months each year. They usually leave Hawai'i for their

trip back to the Arctic in late April or the very early part of May each year. This species is a common site around the state during the late fall and winter months.

Mammalian Resources

The findings of the mammalian survey are consistent with the location of the property and the habitat currently present on the site. We did not record Hawaiian hoary bats overflying the site. Hawaiian hoary bats are widely distributed in the lowland areas on the Island of Kaua'i, and have been documented in and around almost all areas that still have some dense vegetation (Tomich, 1986; USFWS 1998, David, 2012).

Although no rodents were detected during the course of this survey, it is virtually certain one or more of the four established alien muridae found on Kaua'i, roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), European house mouse (*Mus musculus domesticus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*) use various resources found within the general project area. All of these introduced rodents are deleterious to native ecosystems and the native faunal species dependant on them.

Potential Impacts to Protected Species

Botanical

As all of the plant species recorded are either naturalized species or common indigenous species it is not expected that the development and operation of the proposed subdivision will result in deleterious impacts to any botanical species currently listed or proposed for listing under either federal or State of Hawai'i endangered species statutes.

Seabirds

The principal potential impact that construction and operation of the Kapa'a Highlands Phase II project poses to protected seabirds is the increased threat that birds will be downed after becoming disoriented by lights associated with the project during the nesting season. The two main ways that outdoor lighting could pose a threat to these nocturnally flying seabirds is if, 1) during construction it is deemed expedient, or necessary to conduct nighttime construction activities, and 2) following build-out, the potential operation of streetlights and exterior safety and security lighting.

Hawaiian hoary bat

The principal potential impact that the development of the Kapa'a Highlands Phase II project poses to bats is during the clearing and grubbing phases of construction as vegetation is removed. The removal of vegetation within the project site may temporarily displace individual bats, which may use the vegetation as a roosting location. As bats use multiple roosts within their home territories, the potential disturbance resulting from the removal of the vegetation is likely to be minimal. During the pupping season, females carrying their pups may be less able to rapidly vacate a roost site as the vegetation is cleared. Additionally, adult female bats sometimes leave their pups in the roost tree while they forage. Very small pups may be unable to flee a tree that is being felled. Potential adverse effects from such disturbance can be avoided or minimized by not clearing woody vegetation taller than 4.6 meters (15-feet), between June 15 and September 15, the period in which bats are potentially at risk from vegetation clearing.

Critical Habitat

There is no federally delineated Critical Habitat for any species present on or adjacent to the project area. Thus the development and operation of the proposed project will not result in impacts to federally designated Critical Habitat. There is no equivalent statute under State law.

Recommendations

- All exterior lights installed in conjunction with the proposed project should be shielded to reduce the potential for interactions of nocturnally flying seabirds with external lights and man-made structures (Reed *et al.*, 1985; Telfer *et al.*, 1987). Any lighting fixtures that meet the "Dark Skies" guidelines are appropriate.

- It is recommended that woody vegetation taller than 4.6 meters (15-feet), not be cleared between June 1 and September 15, the period in which bats are potentially at risk from vegetation clearing.

- It is recommended that, where appropriate and practicable, native plant species be used in landscaping efforts. Not only is this ecologically prudent, but also if the appropriate plants are used, it will also likely save maintenance and water costs over the long term.

Glossary

Alien – Introduced to Hawai'i by humans
Commensal – Animals that share human food and lodgings, such as rats, mice cats and dogs.
Crepuscular – Twilight hours
Endangered – Listed and protected under the Endangered Species Act of 1973, as amended (ESA) as an endangered species
Endemic – Native to the Hawaiian Islands and unique to Hawai'i
Indigenous – Native to the Hawaiian Islands, but also found elsewhere naturally
*maka*i – Down-slope, towards the ocean
Muridae – Rodents, including rats, mice and voles, one of the most diverse families of mammals
Naturalized – A plant or animal that has become established in an area that it is not indigenous to
Nocturnal – Night-time, after dark
'Ōpe'ape'a – Endemic endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*)
Pelagic – An animal that spends its life at sea – in this case seabirds that only return to land to nest and rear their young
Phylogenetic – The evolutionary order that organisms are arranged by
Ruderal – Disturbed, rocky, rubbishy areas, such as old agricultural fields and rock piles
Sign – Biological term referring to tracks, scat, rubbing, odor, marks, nests, and other signs created by animals by which their presence may be detected
Threatened – Listed and protected under the ESA as a threatened species.

ASL – Above mean sea level
DLNR – Hawai'i State Department of Land & Natural Resources
DOFAW – Division of Forestry and Wildlife
ESA – Endangered Species Act of 1973, as amended
TMK – Tax Map Key
USFWS – United State Fish & Wildlife Service

Literature Cited

Ainley, D. G, R. Podolsky, L. Deforest, G. Spencer, and N. Nur. 2001. The Status and Population Trends of the Newell's Shearwater on Kaua'i: Insights from Modeling, *in*: Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna.* Studies in Avian Biology No. 22: Cooper's Ornithological Society, Allen Press, Lawrence, Kansas. (Pg. 108-123).

American Ornithologist's Union. 1998. *Check-list of North American Birds*. 7th edition. AOU. Washington D.C. 829pp.

______. 2000. Forty-second supplement to the American Ornithologist's Union *Check-list of North American Birds.* Auk 117:847-858.

Banks, R. C., C. Cicero, J. L. Dunn, A. W. Kratter, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2002. Forty-third supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 119:897-906.

______. 2003 Forty-fourth supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 120:923-931.

______. 2004 Forty-fifth supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 121:985-995.

______. 2005 Forty-sixth supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 122:1031-1031.

______. 2006 Forty-seventh supplement to the American Ornithologist's Union *Check-list of North American Birds*. Auk 123:926-936.

Banks, R. C., C. R. Terry Chesser, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2007 Forty-eighth supplement to the American Ornithologist Union *Check-list of North American Birds*. Auk 124:1109-1115.

Banks, R. C., C. R. Terry Chesser, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz, and K. Winker. 2008 Forty-ninth supplement to the American Ornithologist Union *Check-list of North American Birds*. Auk 125:758-768.

Chesser, R. T., R. C. Banks, F. K. Barker, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz, and K. Winker. 2009. Fiftieth supplement to the American Ornithologist Union *Check-list of North American Birds*. Auk 126:1-10.

______. 2010. Fifty-first supplement to the American Ornithologist Union *Check-list of North American Birds.* Auk 127:726-744.

Chesser, R. T., R. C. Banks, F. K. Barker, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz, and K. Winker. 2011. Fifty-second supplement to the American Ornithologist Union *Check-list of North American Birds*. Auk 128: 600-613.

Cooper, B. A and R. H. Day. 1994. Kauai endangered seabird study. Volume 1: Interactions of Dark-rumped Petrels and Newell's Shearwaters with utility structures on Kauai, Hawaii: Final Report, TR-105847-V1, Electric Power Research Institute, Palo Alto, California.

Cooper, B. A and R. H. Day. 1998. Summer Behavior and Mortality of Dark-rumped Petrels and Newells' Shearwaters at Power Lines on Kauai. Colonial Waterbirds, 21 (1): 11-19.

Day, R. H., B. Cooper, and T. C. Telfer. 2003. Decline of Townsend's (Newell's Shearwaters (*Puffinus auricularis newelli*) on Kauai, Hawaii. The Auk 120: 669-679.

David, R. E. 2012. Unpublished field notes – Kaua'i 1980 - 2012.

David, R. E., R. H. Day, and B. A. Cooper 2002. Results of Newell's Shearwater Surveys at the Kaluahonu, Moalepe and Anahola Memorial Colonies, Island of Kaua'i, Hawai'i, July 2002. Prepared for Planning Solutions, Inc., and Kaua'i Electric.

David, R. E., and Planning Solutions 2008. 2007 Save Our Shearwaters Program End of Year Report: Prepared for: Kaua'i Island Utility Cooperative & The Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife.

Department of Land and Natural Resources (DLNR). 1998. Indigenous Wildlife, Endangered And Threatened Wildlife And Plants, And Introduced Wild Birds. Department of Land and Natural Resources. State of Hawaii. Administrative Rule §13-134-1 through §13-134-10, dated March 02, 1998.

Hadley, T. H. 1961. Shearwater calamity on Kauai. Elepaio 21:60.

Hawai'i Department of Land and Natural Resources (HDLNR). 1998. Indigenous Wildlife, Endangered and Threatened Wildlife and Plants, and Introduced Wild Birds. State of Hawai'i. Administrative Rule §13-134-1 through §13-134-10.

Hue, D., C. Glidden, J. Lippert, L. Schnell, J. MacIvor and J. Meisler. 2001. Habitat Use and Limiting Factors in a Population of Hawaiian Dark-rumped Petrels on Mauna Loa, Hawai'i. , *in:* : Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna*. Studies in Avian Biology No. 22. Cooper's Ornithological Society, Allen Press, Lawrence, Kansas (Pg. 234-242).

Morgan, C., P. White, and R. E. David. 2003. Habitat Conservation Plan: Kaua'i Island Utility Cooperative: Working Paper No. 2 - Data Analysis: Interpreting the Save Our Shearwaters Bird Recovery Database (1979-2002) for Habitat Conservation Planning. Prepared for: Kaua'i Island Utility Cooperative.

______. 2004 Habitat Conservation Plan: Kaua'i Island Utility Cooperative: Data Report and

Analysis: Save Our Shearwaters Bird Program 2003 Update. Prepared for: Kaua'i Island Utility Cooperative.

Podolsky, R., D.G. Ainley, G. Spencer, L. de Forest, and N. Nur. 1998. "Mortality of Newell's Shearwaters Caused by Collisions with Urban Structures on Kaua'i". Colonial Waterbirds 21:20-34.

Pukui , M. K., S. H. Elbert, and E. T. Mookini 1976. *Place Names of Hawaii*. University of Hawaii Press. Honolulu, Hawai'i. 289 pp.

Reed, J. R., J. L Sincock, and J. P. Hailman 1985. Light Attraction in Endangered Procellariform Birds: Reduction by Shielding Upward Radiation. Auk 102: 377-383.

Save our Shearwaters 2012. Unpublished SOS data 1979 – 2011.

Simons, T. R., and C. N. Hodges. 1998. Dark-rumped Petrel (*Pterodroma phaeopygia*). *In* A. Poole and F. Gill (editors). The Birds of North America, No. 345. The Academy of Natural Sciences, Philadelphia, PA. and the American Ornithologists Union, Washington, D.C.

Sincock, J. L. 1981. Saving the Newell ' s Shearwater. Pages 76-78 in Proceedings of the Hawaii Forestry and Wildllife Conference, 2-4 October 1980. Department of Land and Natural Resources, State of Hawaii, Honolulu.

Telfer, T. C. 1979. Successful Newell's Shearwater Salvage on Kauai. 'Elepaio 39:71

Telfer, T. C. , J. L. Sincock, G. V. Byrd, and J. R. Reed. 1987. Attraction of Hawaiian seabirds to lights: Conservation efforts and effects of moon phase. Wildlife Society Bulletin 15:406-413.

Tomich, P.Q. 1986. *Mammals in Hawaii*. Bishop Museum Press. Honolulu, Hawaii. 37 pp.

U.S. Fish & Wildlife Service (USFWS) 1983. Hawaiian Dark-Rumped Petrel & Newell's Manx Shearwater Recovery Plan. USFWS, Portland, Oregon. February 1983.

______. Recovery Plan for the Hawaiian Hoary Bat. U.S. Fish & Wildlife Service, Portland, Oregon.

______. 2005. Endangered and Threatened Wildlife and Plants. 50CFR 17:11 and 17:12 (Tuesday, November 1, 2005).

______. 2012. USFWS Threatened and Endangered Species System (TESS), online at http://ecos.fws.gov/tess_public/StartTESS.do Last accessed on May22, 2012.

Wagner, W.L., D.R Herbst, and S.H. Sohmer. 1990. *Manual of the Flowering Plants of Hawai'i*. University of Hawaii Press, Honolulu, Hawaii 1854 pp.

Wagner, W.L. and D.R. Herbst. 1999. *Supplement to the Manual of the Flowering Plants of Hawai'i*, pp. 1855-1918. *In:* Wagner, W.L., D.R. Herbst, and S.H. Sohmer, Manual of

the flowering plants of Hawai'i. Revised edition. 2 vols. University of Hawaii Press and Bishop Museum Press, Honolulu.

Wood, K.R., and M. Kirkpatrick. 2012. Botanical Survey Kapa'a Highlands Phase II TMK (4) 4-3-003:001 Kaua'i, Hawai'i April-May 2012. Prepared for Greg Allen.

Appendix A

Wood, K.R., and M. Kirkpatrick. 2012.
Botanical Survey Kapa'a Highlands Phase II
TMK (4) 4-3-003:001
Kaua'i, Hawai'i April-May 2012.

Exhibit L

An Archaeological Assessment for the Proposed Kapa`a Highlands Phase II Project Kapa'a Ahupua'a, Kawaihau, Kaua'i

An Archaeological Assessment With Subsurface Testing for the Proposed Kapa`a Highlands Phase II Project, Kapa`a Ahupua`a, Kawaihau, Kaua`i TMK (4) 4-3-3: 1

By

Nancy McMahon, M.A. and Wendy Tolleson, M.A.

Prepared for:
Three Stooges LLC

Exploration Associates, Ltd

Revised September 2013

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Project Background

At the request of Three Stooges LLC., Exploration Associates Ltd. (EAL) conducted an archaeological assessment of a parcel of land (referred to hereafter as Kapa`a Highlands Phase II) in Kapa`a (in TMK 4-3-3:1) (Figures 1 & 2). The survey was performed to address any historic preservation or cultural impact issues that might affect the proposed development.

The proposed development, Kapa`a Highlands Phase II, project involves the development of a residential subdivision on a 97 acre parcel. Approximately 69 acres will be subdivided into residential lots both single family and multi-family units. In addition the breakdown of Phase II will include: roads - 9.4 acres; church - 0.8 acres; general commercial - 0.4 acres; parks - 3.1 acres and open space - 14.3 acres.

Scope of Work

The purpose of this archaeological investigation is to address any archaeological and/or historical concerns. The proposed work includes a surface survey, subsurface testing, and a report detailing methods and any finds. This archaeological work meets the requirements of an inventory-level survey per the rules and regulations of (State Historic Preservation Division/Department of Land and Natural Resources) SHPD/DLNR. The level of work is sufficient to address site types, locations, and allow for future mitigation recommendations if appropriate. Any property over 50 years of age must be evaluated for historic Significance on the National Register of Historic places, and include remnant pr-contact and historic period site.

The scope of work includes:

- Historical research includes study of archival sources, historic maps, Land Commission Awards and previous archaeological reports to construct a history of land use and to determine if archaeological sites have been recorded on or near this property.
- Pedestrian survey of 100% of the subject parcel to identify any surface archaeological features and investigate and assess the potential for impact to such sites, and limited subsurface testing to identify any subsurface sensitive areas that may require further investigation or mitigation before the project proceeds.
- Preparation of a report which will include the results of the historical research and the fieldwork with an assessment of archaeological potential based on that research with recommendations for further archaeological work, if appropriate. It also will provide mitigation recommendations if there are archaeologically sensitive areas that require further consideration.

Figure 1. USGS Map Showing Project Area

EXPLORATION ASSOCIATES LTD

Figure 2. Project location and surveyed area outlined in purple.

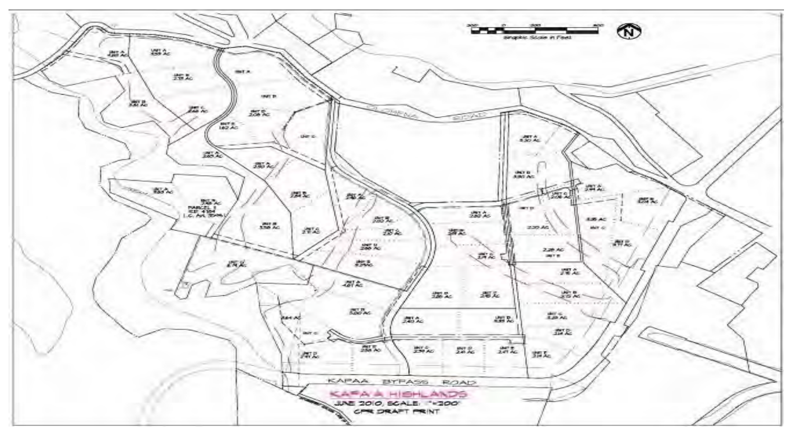


Figure 3. Project development map.

Figure 4 Aerial View of the Kapa`a *Highlands Phase II Looking West.*

Figure 5. Aerial View of Kapa`a *Highlands Phase II Looking Mauka.*

Methods

On January 3, 2012 and April 25, 2012 and November 11, 2012 a survey of the Kapa`a Highlands Phase II project area was conducted by Exploration Associates Ltd. by archaeologist Nancy McMahon, M.A. Survey transects oriented north-south were spaced 10 m. apart where possible through thick guinea grass. Field observations were recorded and photographs were taken of the project area, the surrounding area, and the backhoe trenches. Three test trenches were machine excavated to examine the soils and determine if any stratigraphy or buried cultural deposits was present. Soils were classified using a Munsell color chart, then photographed.

Historical research includes a review of previous archaeological studies on file at the State Historic Preservation Division of the Department of Land and Natural Resources; studies of documents at Hamilton Library UH Manoa, the Kapa`a and Lihue Public Libraries, the Kaua'i Museum, the Kaua`i Historical Society and from the study of maps at the Survey Office of the Department of Land and Natural Resources. Nineteenth-century Land Commission Award claim records were accessed via the Internet from the *Mahele* Database prepared by Waihona `Aina Corp.

Natural Setting/Project Area

The subject parcel is located north of Kapa`a town on former cane lands situated on a bluff adjacent to the coastal plain. It is bordered by Olohena Road to the north and the Kapa`a Bypass Road on the south and east. Kapaa Intermediate School is located on state land near the middle of the northern portion of the property. A Phase I parcel has an existing solar farm and equipment building.

The southern border of the project area is adjacent to the by-pass road within an elevation of approximately 55 feet above msl. The topography or the project area rises in elevation to the northern border approximately 130 feet above msl or an average increase of less than 5%. There are particular areas of the property with 20% slopes. The project area is currently fallow and is vegetated with Guinea Grass (*Panicum maximum*), Koa Haole (*Leucaena leucocephala*), and Java Plum (*Syzygium cumini*). The last cultivation of sugar cane on the project area was 15 years ago, but due to the poor soil, strong trade winds and the salt spray from the ocean, the viability of agricultural crops is limited. Solar farming, goat and cattle grazing are the current utilization of the property

Foote et al (1972) described the soil in this area as Lihue-Puhi association, deep, nearly level to steep, well drained soils with fine texture and moderately fine texture subsoil. Permeability is moderately rapid, run-off is slow and erosion hazard is slight. The mean annual rainfall throughout the study area is about 22 inches per year. Average temperatures in the region range from the 60s to the low 90s, Fahrenheit. Temperature differences between day and night are about 15 degrees. The consistent direction of the tradewinds is from the northeast at between 10 and 15 miles per hour.

HISTORICAL BACKGROUND

From Puna District to Kawaihau District

The *ahupua`a* of Kapa`a belongs in the ancient district of Puna, one of five ancient districts on Kaua`i (King 1935: 228). Puna was the second largest district on Kaua`i, behind Kona, and extended from Kipu, south of Lihue to Kama`oma`o`o, just north of Kealia. For taxation, educational and judicial reasons, new districts were created in the 1840s. The Puna District, with the same boundaries became the Lihu`e District, named for an important town in that district. In 1878, King Kalakau'a in securing a future name for the new *Hu`i* Kawaihau, created the new district of Kawaihau. This new district encompassed the *ahupua`a* ranging from Olohena on the south to Kilauea on the north. Subsequent alterations to district boundaries in the 1920s left Kawaihau with Olohena as its southernmost boundary and Moloa'a as its northernmost boundary (King 1935:222).

Traditional and Legendary Accounts of Kapa`a

A more in depth study of the legends and mythology of Kapa`a can be found in the Cultural Impact Assessment for the Proposed Kapa`a Highlands Phase II [EAL 2012]. Just a few of some of the legends of the area are included in this report.

Palila and Ka`ea

High in the *mauka* region of Kapa`a in the Makaleha mountains at a place called Ka`ea, is reported to be the supernatural banana grove of the Kaua`i kupua or demigod Palila, grandson of Hina (Handy and Handy 1972:424). In a 1913 edition of the newspaper Ka`oko`a Joseph Akina describes Pahla's banana grove:

> The stalk could hardly be surrounded by two men, and was about 35 feet high from the soil to the lowest petiole. The length of the cluster from stem to lowest end of the bunch of bananas was about 1 3/4 fathoms long (one anana and one muku). There were only two bananas on each about 4 inches around the middle. There were just two bananas, one on the east side and one on the west, each about a foot or more in length. The one on the east side was tartish, like a *waiawi* (Spanish guava) in taste and the one on the west was practically tasteless. The diameter of the end of the fruit stem of this banana seemed to be about 10 feet. This kind of banana plant and its fruit seemed almost supernatural... (Akina, 1913:5).

Ka Lulu o Mo`ikeha

Kapa`a was the home of the legendary Mo`ikeha. Born at Waipi`o on the island of Hawai`i, Mo`ikeha sailed to Kahiki (Tahiti), the home of his grandfather Maweke, after a disastrous flood. On his return to Hawai`i, he settled at Kapa`a, Kaua`i. Kila, Mo`ikeha's favorite of three sons by the Kaua`i chiefess Ho`oipoikamalani, was born at Kapa'a and was said

to be the handsomest man on the island. It was Kila who was sent by his father back to Kahiki to slay his old enemies and retrieve a foster son, the high chief La`amaikahiki (Handy and Handy 1972:424; Beckwith 1970:352-358; Kalakaua 1888:130-135; Fornander 1916, vol.4 pt.1:160). Mo`ikeha's love for Kapa`a is related in the *`olelo no`eau*: Ka lulu o Mo`ikeha i ka laula o Kapa`a. "The calm of Moikeha in the breadth of Kapa`a" (Pukui, 1983: 157).

"Lulu-o-Mo`ikeha" is described as being situated "near the landing and the school of Waimahanalua" (Akina, 1913: 5). The landing in Kapa`a was known as the Makee Landing and was probably constructed in the late 1870s, along with the Makee sugar mill. Today, in place of the old Makee Landing is part of a breakwater located on the north side of Mo`ikeha Canal near the present day Coral Reef Hotel, and approximately half-a-mile north of Waikaea Bridge.

Akina (1913) tells the story of how Mo`ikeha's son, Kila stocks the islands with the fish *akule*, *kawakawa* and *`opelu*. When Kila travels to Kahiki, he seeks out his grandfather Maweke and explains that he is the child of Mo`ikeha. When Maweke asks Kila if Mo`ikeha is enjoying himself, Kila answers with the following chant:

> My father enjoys the billowing clouds over Pohaku-pili,
>
> The sticky and delicious poi,
>
> With the fish brought from Puna,
>
> The broad-backed shrimp of Kapalua,
>
> The dark-backed shrimp of Pohakuhapai,
>
> The potent awa root of Maiaki`i,
>
> The breadfruit laid in the embers at Makialo,
>
> The large heavy taros of Keahapana
>
> The crooked surf of Makalwa too
>
> The bending hither and thither of the reed and rush blossoms,
>
> The swaying of the kalukalu grasses of Puna The large, plump, private parts of my mothers,
>
> Of Ho`oipoikamalanai and Hinau`u, The sun that rises and sets,
>
> He enjoys himself on Kaua`i,
>
> All of Kaua`i is Mo`ikeha's. (Akina, 1913: 6)

Maweke was delighted and when the boy is questioned as to his purpose, Kila tells his grandfather he is seeking fish for his family. Maweke tells Kila to lead the fish back to his homeland. This is how Kila led the *akule, kawakawa* and *opelu* to Hawai`i.

Paka`a and the wind gourd of La`amaomao (Keahiahi)

Kapa`a also figures prominently in the famous story of Paka`a, and the wind gourd of La`amaomao. Paka`a was the son of Kuanu`uanu, a high-ranking retainer of the Big Island ruling chief Keawenuie`umi (the son and heir to the legendary

Chief, Umi), and La`amaomao, the most beautiful girl of Kapa`a and member of a family of high status *kahuna.* Kuanu`uanu left the island of Hawai`i, traveled throughout the other islands and finally settled on Kaua`i, at Kapa`a. It was there that he met and married La`amaomao, although he never revealed his background or high rank to her until the day a messenger arrived, calling Kuanu`uanu back to the court of Keawenuia` umi.

Intent on seeking out his real father and making himself known to him, Paka`a prepared for the journey to the Big Island. His mother presented to him a tightly covered gourd containing the bones of her grandmother, also named La`amaomao, the goddess of the winds. With the gourd and chants taught to him by his mother, Paka`a could command the forces of all the winds in Hawai`i. While this story continues on at length about Paka`a and his exploits on the Big Island and later on Moloka`i, it will not be dwelt upon further here. It is important to note that several versions of this story do include the chants which give the traditional names of all of the winds at all the districts on all the islands, preserving them for this and future generations (Nakuina 1990; Rice 1923:69-89; Beckwith 1970:86-87; Thrum 1923:53-67; Fomander 1918-19 vol. 5 pt.1:78- 128).

Frederick Wichman (1998:84) writes that Paka`a grew up on a headland named Keahiahi. Here, Paka`a learned to catch *malolo*, his favorite fish. After studying the ocean and devising his plan to fabricate a sail, Paka`a wove a sail in the shape of a crab claw and tried it out on his uncle's canoe. One day, after going out to catch *malolo*, he challenged the other fishermen to race to shore. He convinced them to fill his canoe with fish suggesting it was the only way he could truly claim the prize if he won:

> The fishermen began paddling toward shore. They watched as Paka`a paddled farther out to sea and began to fumble with a pole that had a mat tied to it. It looked so funny that they began to laugh, and soon they lost the rhythm of their own paddling. Suddenly Paka`a's mast was up and the sail filled with wind. Paka`a turned toward shore and shot past the astonished fishermen, landing on the beach far ahead of them. That night, Paka`a, his mother, and his uncle had all the *ma`o`o* they could eat (Wichman 1998:85).

Kaweloleimakua

Kapa`a is also mentioned in traditions concerning Kawelo (Kaweloleimakua), Ka`ililauokekoa (Mo`ikeha's daughter, or granddaughter, dependent on differing versions of the tale), the mo 'o Kalamainu'u and the origins of the *hina`i hinalea* or the fish trap used to catch the hinalea fish, and the story of Lonoikamakahiki (Fornander 1917, vol.4 pt.2:318, vol.4 pt. 3:704- 705; Rice 1923:106-108; Thrum 1923:123-135; Kamakau 1976:80).

Kalukalu grass of Kapa`a

"Kiimoena kalukalu Kapa`a" or "Kapa`a is like the *kalukalu* mats" is a line from a chant recited by Lonoikamakahiki. Kalukalu is a sedge grass, apparently used for weaving mats (Fornander 1917, Vol. IV, Pt. 2, pp. 318-19). Pukui (1983: 187) associates the kalukalu with lovers in "ke kalukalu moe ipo o Kapa`a; the *kalukalu* of Kapa`a that sleeps with the lover". According to Wichman (1998:84), "a kalukalu mat was laid on the ground under a tree, covered with a thick pile of grass, and a second mat was thrown over that for a comfortable bed", thus the association with lovers. Kaua`i was famous for this peculiar grass, and it probably grew around the marshlands of Kapa`a. It is thought to be extinct now, but an old-time resident of the area recalled that it had edible roots, "somewhat like peanuts." Perhaps it was a famine food source (Kapa`a Elementary School 1933:VI).

Heiau of Kapa`a

During their expeditions around Hawai`i in the 1880's, collecting stories from *ka po`e kahiko*, Lahainaluna students stopped in Kapa`a and Kealia and gathered information regarding *heiau* of the region. Altogether, fourteen *heiau* were named in Kapa`a and Kealia, suggesting the two *ahupua`a* were probably more politically significant in ancient times. Table 1 lists the names of the ten *heiau* identified in the *ahupua`a* of Kapa`a, their location if known, their type, and associated chief and priest.

Table 1. *Heiau* of Kapa'a

Name	Location	Type	Associated
Mailehuna	Kapa'a (Mailehuna is the area of the present day Kapa`a School)	Unknown	Kiha, Kaumuali'i/ Lukahakona
Pueo	Kapa'a	Unknown	Kiha, Kaumuali'i/
Pahua	Kapa'a/Kealia	Unknown	Kiha/ Lukahakona
Kumalae	Kapa'a/Kealia	Unknown	Kiha/ Lukahakona
Waiehumalama	Kapa'a/Keilia	Unknown	Kiha/ Lukahakona
Napu'upa'akai	Kapa'a/Kealia	Unknown	Kiha/ Lukahakona
Noeamakali`i	Kapa'a/Kedlia	Heiau for birth of Kaua`ii Chiefs, like Holoholoku	Unknown
Pu'ukoa	Kapa'a/Kealia	Unu type heiau	Unknown
Piouka	Kapa'a/Kealia	Unu type heiau	Unknown
Una	Kapa'a/Kealia	Unknown	Kiha/ Lukahakona
Mano	Kapa'a/Kealia	Unknown	Kiha/ Lukahakona
Kuahiahi	Kapa'a (govmt) school stands on site now)	Unknown	Kaumuali'i/ Lukahakona
Makanalimu	Upland of Kawaihau	Unknown	Kaumuali'i
Kaluluomoikeha	Kapa'a	Unknown	Moikeha

The exact locations of these *heiau* are unknown. The locations of two of the *heiau* correlate with the locations of *wahi pana* which are known to be close to Kuahiahi and Kaluluomo'ikceha. Kuahiahi (also spelled Kaahiahi and Keahiahi) is the rocky headland at the north end of Kapa'a where the first Kapa`a School was once located. Kaluluomo`ikeha is thought to be the general area near the Mo`ikeha Canal and the present day Coral Reef Hotel.

The Mahele: Kapa'a Land Commission Awards

The Organic Acts of 1845 and 1846 initiated the process of the *Mahele*, the division of Hawaiian lands, which introduced private property into Hawaiian society. In 1848 the crown and the *ali`i* received their lands. The common people received their *kuleana* in 1850. It is through records for Land Commission Awards (LCAs) generated during the Mahele that specific documentation of traditional life in Kapa`a Ahupua`a comes to light. During the *Mahele*, Kapa'a was taken as Crown Lands (Office of the Commissioner of Public Lands of the Territory of Hawaii, 1929). The i1i of *Paikahawai* and *Ulakiu* in Kapa`a *Ahupua`a* were retained as Government Lands.

Table 2. Mahele Land Claims in Kapa`a Ahupua`a

LCA Number	Ahupuaʻa	Claimant	´Ili of the Ahupuaʻa	Village/Farm	Land Use	Number of Āpana
3971	Kapa`a	Honolii,	Kapana	Kupanihi Village	6 *loʻi* (uncult), house lot	2 (2 acres, 1 rood, 1 rod)
3554	Kapa`a	Keo	Kahanui	Puhi Village	15 *loʻi*, house lot	2 (7 acres, 1 rood, 17 rods)
3638	Kapa`a	Huluili	Maeleele	Kaloko Village	12-15 *loʻi*, house lot	2 (5 acres, 1 rood, 19 rods)
8247	Kapa`a	Ehu	Moalepe/Noalepe		20 *loʻi*,	1 (3 rods)
8837	Kapa`a	Kamapaa	Ulukiu lalo Awawaloa Ulukiu		3 *loʻi*, 2 *loʻi*, house lot	1 (2 acres, 2 rods, 27 rods)
8843	Kapa`a	Kiau	Apopo	Kalolo Village	6 (5) *loʻi* and *kula*, house lot	2 (2.75 acres 3 rods)
10564	Kapa`a	Oleloa Daniel		Hikinui Farm	Fishpond, 10 *loʻi*	

The land claims during this period show that only five individuals were awarded land parcels in the relatively large *ahupua`a* of Kapa`a. The five awardees were Kiau (#08843), Kamapaa (#08837), Mane Honolii (#03971) Hulili (#03638) and Ehu (#08247). All four had lo`i or irrigated *kalo* fields on the *mauka* side of the lowland swampy area, sometimes extending a short distance up into small, shallow gulches and valleys. Many of these *lo`i* parcels name *pali* or hills/cliffs as boundaries. Each LCA also had a separate house lot located on the *makai* side of the swamp, near the beach. Three of the land claims name ponds on their lands, including Puhi Pond (LCA #03554), and fishponds in Kupanihi 'Ili (LCA #03971) and Hahanui 'Ili (LCA #10564). *Loko* Kihapai may be the same as the fishpond in the same land claim. The other two *loko* are associated with house lots, situated on the *makai* edge of the Kapa'a swamplands suggesting modification of the natural swamplands.

Other natural and cultural resources mentioned in the LCAs include freshwater springs, pig pens, *hau* bushes, *hala* clumps, streams, `*auwai*, and *kula* or pasturelands.

Interestingly, the residential "village" of Kapa'a did not exist as a single entity, but was likely a series of small settlements or compounds, perhaps even individual house lots which stretched along the shoreline of the *ahupua`a* and included (south to north) Kupanihi (Makahaikupanihi), Kalolo (Kaulolo), Puhi, and Uluki.

The fifth individual, Ehu (LCA #08247), was the only person to be awarded a single parcel in the upland area of Kapa`a, Moalepe Valley, approximately five miles one mile southwest of the project area. In 1848, when Ehu made his claim, he was the only one living there. A few years later, according to Honolii's testimony to support Ehu's claim, "There are no houses and no people now living on the land. Ehu found himself lonely there, all his neighbors having either died or left the land. Ehu now lives in Wailua." Evidently Ehu may have been the last person to live at and cultivate in the traditional way, the far *mauka* region of Kapa`a (Van Ryzin and Hammat 2004).

Early Historic Accounts of Kapaa (1830s-1900s)

Although most of the historic record documents for Kaua`i in this period revolve around missionary activities and the missions themselves, there was indication that the Kapaa area was being considered for new sugar cane experiments, similar to those occurring in Kōloa In 1835 Ladd and Company received a 50 year lease on land in Kōloa from Kamehameha III and Kaua`i Governor Kaikio`ewa of Kaua`i. The terms of the lease allowed the new sugar company "the right of someone other than a chief to control land" and had profound effects on "traditional notions of land tenure dominated by the chiefly hierarchy" (Donohugh, 2001: 88). In 1837, a very similar lease with similar terms was granted to Wilama Ferani, a merchant and U.S. citizen based in Honolulu (Hawai`i State Archives, Interior Dept., Letters, Aug. 1837). The lease was granted by Kauikeaouli for the lands of Kapaa, Kealia and Waipouli for twenty years for the following purpose:

> ...for the cultivation of sugar cane and anything else that may grow on said land, with all of the right for some place to graze animals, and the forest land above to the top of the mountains and the people who are living on said lands, it is to them whether they stay or not, and if they stay, it shall be as follows: They may cultivate the land according to the instructions of Wilama Ferani and his heirs and those he may designate under him... (Hawai`i State Archives, Interior Dept. Letters, Aug. 1837).

Unlike Ladd & Company which eventually became the Kōloa Sugar Company, there is no further reference to Wilama Ferani and his lease for lands in Kapaa, Kealia and Waipouli. In a brief search for information on Honolulu merchant, Wilama Ferani, nothing was found. It is thought that perhaps Wilama Ferani may be another name for William French, a well-known Honolulu merchant who is documented as having experimented with grinding sugar cane in Waimea, Kaua`i at about the same time the 1837 lease for lands in Kapaa, Kealia and Waipouli was signed (Joesting 1984: 152).

In 1849, son of Wai`oli missionary, William P. Alexander, recorded a trip he took around Kaua`i. Although, he focuses on the larger mission settlements like Kōloa and Hanalei, he does mention Kapa`a.

> A few miles from Wailua, near Kapaa we passed the wreck of a schooner on the beach, which once belonged to Capt. Bernard. It was driven in a gale over the reef, and up on the beach, where it now lies. A few miles further we arrived at Kealia. We had some difficulty crossing the river at this place, owing to the restiveness of our horses. The country here near the shore was rather uninviting, except the valley which always contained streams of water (Alexander 1991: 123).

In later years, the notorious Kapaa reef was to become the location of many shipwrecks once a landing was built there in the 1880s.

The first large scale agricultural enterprise was begun in Kapaa in 1877 by the Makee Sugar Plantation and the *Hui* Kawaihau (Dole 1916: 8). Originally a choral society begun in Honolulu its membership consisted of many prominent names, both Hawaiian and *haole*. It was Kalakau'a's thought that the *Hui* members could join forces with Makee, who had previous sugar plantation experience on Maui, to establish a successful sugar corporation on the east side of Kaua`i. Captain Makee was given land in Kapaa to build a mill and he agreed to grind cane grown by *Hui* members. Kalakau'a declared the land between Wailua and Moloaa, the Kawaihau District, a fifth district and for four years the *Hui* attempted to grow sugar cane at Kapahi, on the plateau lands above Kapaa town. After a fire destroyed almost half of the *Hui*'s second crop and after the untimely death of one of their principal advocates, Captain James Makee, the *Hui* began to disperse and property and leasehold rights passed on to Makee's son-in-law and new Makee Plantation owner, Colonel Z.S. Spalding (Dole 1916: 14).

As part of the infrastructure of the new plantation, a sugar mill was erected and the Makee Landing was built in Kapaa during the early years of operation of the Makee Sugar Plantation. Following Captain Makee's death, Colonel Spalding took control of the plantation and in 1885 moved the mill to Kealia (Cook 1999: 51). The deteriorating stone smokestack and landing were still there well into the 1900s (Damon 1931:359). Conde´ and Best (1973:180) suggest that railroad construction for the Makee Plantation began just prior to the mid-1890s. There is one reference to a railroad line leading from the Kapaa landing to Kealia in 1891. During Queen Lili`uokalani's visit to Kaua`i in the summer of 1891, the royal party was treated to music by a band, probably shipped in from O`ahu. "The band came by ship to Kapaa and then by train to Kealia" (Joesting 1984:252). This railroad line is depicted on a 1910 USGS map which shows the line heading south from Kealia Mill and splitting near the present Coral Reef Hotel, another line going to the old Kapaa Landing (Makee Landing) and another line heading *mauka*, crossing the present Moikeha Canal, traveling southwest up Lehua Street and through what is now goat pasture, along a plateau and into the *mauka* area behind Kapaa swamplands. This railroad line was part of a twenty mile network of plantation railroad with some portable track and included a portion of Kealia Valley and in the *mauka* regions of the plateau lands north of Kealia (Conde´ and Best 1973:180).

By the late 1800s hundreds of Portuguese and Japanese immigrants found work on Makee Plantation and the new influx of immigrants required more infrastructure (Cook 1999:51). In 1883, a lease for a school lot was signed between Makee Sugar Company and the Board of Education (Kapaa School 1983: 9). Stipulations in the Portuguese immigrant contracts with Makee Sugar Company stated that "children shall be properly instructed in the public schools" (Garden Island April 1, 1983). The original Kapaa School was constructed in 1883 on a rocky point adjacent to the Makee Sugar Company railroad. Traditionally, this point was known as Kaahiahi (Kapaa School 1983: 10). In 1908, Kapaa School was moved to its present site directly *mauka* and up the hill at Mailehune.

Narrow wagon roads gave way to macadamized roads in the early part of the 20th century. One of these new roads was called the Kaua`i Belt Road and parts of it are thought to have followed along the "Old Government Road" (Cook, 1999). In Kapaa, the present day Kuhio Highway likely follows the same route as the original Government Road and subsequent Kaua`i Belt Road. In fact, the locations of the *kuleana* awards in Kapaa indicate that the majority of the house lots were situated along the Government Road. LCA 3243 names a "road" as one of its boundaries.

In the latter half of the 1800s, following Makee's death, Chinese rice farmers began cultivating the lowlands of Kapaa with increasing success. Several Hawaiian *kuleana* owners leased or sold their parcels *mauka* of the swamp land to Chinese rice cultivators. Other Chinese rice cultivators appealed to the government for swamplands, first leasing and later buying the land. The economic activity displaced the house lot *kuleana* on the *maka*i side of the marsh for increasing commercial and residential development (Lai 1985:148-161).

20th Century History of Kapa`a (1900 - Present)

In the early 1900s, to help with the burgeoning plantation population, government lands were auctioned off as town lots in Kapaa. One *kama`aina* mentioned that in the 1930s and 1940s, the area north of Moikeha Canal in Kapaa was mostly settled by Portuguese families (Bushnell et al 2002). The Japanese were also very prominent in the 1920s and 1930s largely replacing the Chinese merchants in the Kapaa business sector (Bushnell et al. 2002). Starting in 1926, the territorial Board of Health ran a dispensary in Kapaa, which was located at the *makai* edge of Niu Street, near the extant Kapaa Beach Park parking lot and bike path. The location of the former dispensary currently is a vacant lot. Elsewhere in the vicinity, a fire station occupies the location of the former Coral Reef Hotel, and a courthouse and a jail once stood where the present Kapaa Neighborhood Center is located. It is not known when these structures were abandoned or removed.

In 1913, Hawaiian Canneries opened in Kapaa at the site now occupied by Pono Kai Resort (Cook, 1999: 56). Through the Hawaiian Organic Act, Hawaiian Canneries Company, Ltd. purchased land they were leasing, approximately 8.75 acres, in 1923 (Bureau of Land Conveyances, Grant 8248). A 1923 sketch of the cannery shows only four structures, one very large structure assumed to be the actual cannery and three small structures *makai* of the cannery. By 1956, the cannery was producing 1.5 million cases of pineapple. By 1960, 3400 acres were in pineapple and there were 250 full time employees and 1000 seasonal employees (Honolulu Advertiser, March 20, 1960). In 1962, Hawaiian Canneries went out of business due to competition from third world countries.

The Ahukini Terminal & Railway Company was formed in 1920 to establish a railroad to connect Anahola, Kealia, Kapaa to Ahukini Landing and "provide relatively cheap freight rates for the carriage of plantation sugar to a terminal outlet" (Conde´ and Best, 1973: 185). This company was responsible for extending the railroad line from the Makee Landing, which was no longer in use, to Ahukini Landing, and for constructing the original Waikaea Railroad Bridge and the Moikeha Makai Railroad Bridge.

In 1934, the Lihue Plantation Company absorbed the Ahukini Terminal & Railway Company and Makee Sugar Company (Conde´ and Best, 1973: 167). The railway and rolling stock owned by Makee Sugar Company became the Makee Division of the Lihue Plantation. At this time, besides hauling sugar cane, the railroad was used to haul plantation freight including "fertilizer, etc... canned pineapple from Hawaiian Canneries to Ahukini and Nawiliwili, pineapple refuse from Hawaiian Canneries to a dump near Anahola and fuel oil from Ahukini to Hawaiian Canneries Co., Ltd." (Hawaiian Territorial Planning Board, 1940: 11). Former plantation workers and *kama`aina* growing up in Kapaa remember when the cannery would send their waste to the pineapple dump, a concrete pier just north of Kumukumu Stream (State Site No. 50- 30-08-789) by railroad. The structure is built over the water where the rail cars would dump the pineapple waste. The current would carry the waste to Kapaa which would attract fish and sharks (Bushnell et al. 2002).

Lihue Plantation was the last plantation in Hawaii to convert from railroad transport to trucking (Conde´ and Best, 1973: 167). "By 1957 the company salvaged a part of their plantation railroad, which was being supplanted by roads laid out for on or close to the old rail bed" (Ibid: 167). By 1959, the plantation had completely converted over to trucking. The Cane Haul Road which begins near the intersection of Haua`ala Road and Kuhio Highway is thought to date to the late 1950s and follows the alignment of the old railroad until just before or near `Alibi Point.

Severe floods in Kapaa in 1940 led to the dredging and construction of the Waikaea and Mokeha Canals sometime during that decade. (Hawaii Territorial Planning Board, 1940: 7). Although the Waikaea Canal, bordering the Kapaa Pineapple Cannery, had been proposed as early as 1923, nothing was constructed until after the floods (Bureau of Land Conveyances, Grant 8248). A Master Plan for Kapaa, published in 1940, asks the Territorial Legislature for funds to be set aside for the completion of a drainage canal and for filling *makai* and *mauka* of the canal (Hawaii Territorial Planning Board, 1940:7). In 1955, the local newspaper reported the dredging of coral from the reef fronting Kapaa Beach Park for the building of plantation roads (Garden Island Newspaper, September 21, 1955). This dredging was later blamed for accelerated erosion along Kapaa Beach (Garden Island Newspaper, October 30, 1963). Today, there are several sea walls along the Kapaa Beach Park to check erosion. Old time residents claim the sandy beach in Kapaa was once much more extensive than it is now (Bushnell et al. 2002).

In the 1930s after the incorporation of Makee Sugar Company into Lihue Plantation, Kealia Town was slowly abandoned. Many of the plantation workers bought property of their own and moved out of the plantation camps. The camps which bordered Kuhio Highway were disbanded in the 1980s. In the last part of the 20th century the Lihue Plantation began to phase out and Kapaa Town suffered after the closing of the Kapaa Cannery; however the growing tourist industry helped to ease the economic effects of the Cannery's closing.

PREVIOUS ARCHAEOLOGICAL RESEARCH

Archaeological Studies and Sites in Kapa`a *Ahupua`a*

The following table outlines the archaeological research (Table 3) and historic properties (Table 4) identified in Kapa`a *Ahupua`a*. These tables are followed by discussion of the research and historic properties. Table 3 provides a list of archaeological research conducted within Kapa`a *Ahupua`a*, including columns for source, location, nature of study, and findings. The locations of these archaeological studies are shown in Figure 4. Table 4 is a list of known historic properties within the *ahupua`a* and includes columns for state site numbers, site type, location and reference. The locations of identified sites within Kapa`a *Ahupua`a* are shown in Figure 5. All site numbers are numbered 50-30-08-SHIP site number. Here only the SHIP sit number designation will be used

Table 3. Previous Archaeological Studies in coastal Kapa`a.

EXPLORATION ASSOCIATES LTD

Source	Location	Nature of Study	Findings
Bennett 1931	Island wide: identifies 2 sites: Site 110 Taro terraces and bowl and Site 111 A large simple dirt Hawaiian ditch	Archaeological Reconnaissance	Identifies 2 sites: Site 110 Taro terraces and bowl and Site 111 A large simple dirt Hawaiian ditch
Handy and Handy 1972	Archipelago-wide	Native Planter study	Discusses "highly developed irrigation system"
Ching 1976	Just south of the Waikaea Drainage Canal	Archaeological Reconnaissance	No significant findings
Hammatt 1981	Upland Kapaa	Archaeological Reconnaissance	No significant findings
Hammatt 1986	Upper reaches of the Makaleha stream valley.	Archaeological Reconnaissance	No significant findings
Hammatt 1991	Along Kuhio Highway	Subsurface Testing	Identifies two sub-surface cultural layer sites
Kikuchi and Remoaldo 1992	Around Kapaa Town	Cemeteries of Kauai	Identifies six cemeteries
Spear 1992	South side Waikaea Canal, *mauka* of Kuhio Highway. (TMK: 4-5-05:04, 09)	Monitoring Report	Designated subsurface Site 547

Source	Location	Nature of Study	Findings
Chaffee, Burgett & Spear 1994a	A house lot near the corner of Kukui and Ulu Streets in *mauka* Kapaa Town. [TMK: 4-5-09:10]	Archaeological Inventory Survey	No significant findings
Chaffee, Burgett & Spear 1994b	Mamane Street Kapaa Town. [TMK: 4-5-09:51]	Archaeological Inventory Survey	No significant findings
Hammatt, Ida & Chiogioji 1994	Proposed bypass routes *mauka* of Kapaa Town	Archaeological Assessment	No new field work, literature review only
Hammatt, Ida & Folk 1994	South side Waikaea Canal, *mauka* of Kuhio Highway [TMK: 4-5-05:06]	Archaeological Inventory Survey	Weak cultural layer designated Site 748
Kawachi 1994	Inia Street (Jasper) [TMK 4-5-08:33]	Burial Report	Designated Site 871
McMahon 1994	"behind the armory in Kapa`a near the god stones" The location is uncertain, and at "Buzz's near the Coconut Marketplace"	Documents a report of two burials	16 sets of human remains. Site numbers unknown
Creed, Hammatt, Ida, Masterson & Winieski 1995	Kapa`a Sewer line project, Kuhio Highway, south and central Kapaa Town	Archaeological Monitoring Report	Documents cultural layer of Site -1848 and (an enlarged) Site -1849 & recovery of thirty burials at Sites —867, -868, -871, and -1894
Jourdane 1995	1382-A Inia Street, *makai* of Kuhio Highway, central Kapaa Town	Burial Report	Site 626
McMahon 1996	South side Waikaea Canal, *mauka* of Kuhio Highway [TMK: 4-5-05:08]	Archaeological Inventory Survey	No significant cultural material
Hammatt, Chiogioji, Ida & Creed 1997	Test excavations focused inland of Kapaa Town	Archaeological Inventory Survey	Four test trenches were excavated inland of Kapaa Town
Borthwick and Hammatt 1999	Kapaa Seventh-Day Adventist Church at 1132 Kuhio Highway	Archaeological Monitoring and Burial Treatment Plan	Monitoring was indicated as this parcel lay within designated Site 1848.

Figure 6. Map showing previous archaeological studies in Kapa'a.

Table 4. Historic Properties in Kapa`a **Ahupuaʻa**

Site #	Ahupuaʻa	Site Type/ Name (if any)	Location	Site Constraints	Reference
B001	Kapaʻa	Historic Cemetery	South of bend of Kapa`a Stream, a kilometer *mauka* from Kuhio Hwy	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B002	Kapaʻa	Historic Cemetery	Just *mauka* from Kuhio Highway, south of Kapa`a Stream	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B003	Kapaʻa	Kapaʻa Public Cemetery	South of Kanaele Road, one kilometer inland of Kuhio Highway	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B004	Kapaʻa	Historic Cemetery	North of Apopo Road, one kilometer inland of Kuhio Highway	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B013	Kapaʻa	Historic Cemetery	Just *mauka* from Kuhio Highway, north of the Waikaea Canal	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B014	Kapaʻa	All Saints Episcopal Church Cemetery	Just *mauka* from Kuhio Highway, south of the Waikaea Canal	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo. 1992:62-65
547	Kapaʻa	Sub-surface features including a firepit and a possible house foundation	South of bend of Waikaea Canal, *mauka* of Kuhio Highway	Archaeological monitoring in the vicinity recommended	Spear 1992:3
626	Kapaʻa	Burial	Inia Street, *makai* of Kuhio Highway,	Consultation and monitoring in vicinity indicated	Jourdane 1995
748	Kapaʻa	Minimal findings, a weak cultural layer (buried A-horizon)	South of the bend of the Waikaea Canal, *mauka* of Kuhio Highway	Considered no longer significant within project area	Hammatt et al. 1994
789	Kapaʻa/Kealia	Historic Road	Coastal Cane Haul Road near Kawaihau Road turn off	Unknown	Perzinski et. al. 2000

Site # 50-30-08-	Ahupuaʻa	Site Type/ Name (if any)	Location	Site Constraints	Reference
867	Kapa`a	1 set of human remains	Kukui Street, just *mauka* of Kuhio Highway, Kapa`a Town	Consultation and monitoring in vicinity indicated	Creed et al. 1995:50
868	Kapa`a	1 set of human remains	Lehua Street *mauka* of Kuhio Highway, Kapa`a Town	Consultation and monitoring in vicinity indicated	Creed et al. 1995:50
871	Kapa`a	13 sets of human remains (Creed et al. 1995:50)	Inia Street, *makai* of hio Highway	Consultation and monitoring in vicinity indicated	Kawachi 1994; Creed et al. 1995:50
1848	Kapa`a	Cultural layer and sub-surface features	Along Kuhio Highway between Wana Road and the Waikaea Drainage Canal	Archaeological monitoring in the vicinity recommended	Hammatt 1991; Creed et al. 1995
1849	Kapa`a	Cultural layer and sub-surface features; Creed et al. 1995:53 expands boundaries to incl. burial sites 626, -867, -868 -871, and -1894	Along Kuhio Highway between Inia Street and Kauwila Street extending to the coast	Consultation and monitoring in vicinity indicated	Hammatt 1991; Creed et al. 1995
1894	Kapa`a	11 sets of human remains	Ulu Street, just north of Kuhiö Highway, Kapaa Town	Consultation and monitoring in vicinity indicated	Creed et al. 1995:50
2075	Kapa`a/Kealia	Highway Bridge Foundation (old Kauaʻi Belt Road)	Kuhio Highway at Kapa`a/ Kealia River	Unknown	Bushnell et al. 2002:55
2076	Kapa`a	Petroglyph	Rocky coast below former cane haul road (Site -789)	Preservation	Bushnell et al. 2002:55
2077	Kapa`a	Concrete steps (related to historic beach pavilion)	Near present Kapaa Beach Park Pavilion	Unknown	Bushnell et al. 2002:55

Site #	Ahupua'a	Site Type/ Name (if any)	Location	Site Constraints	Reference
2078	Kapa'a	Historic Railway Alignment (2 Railroad Bridges, & RR Culvert Foundation)	Both railroad bridges span the Moikeha Canal; the RR culvert foundation is located north of the Kapaa Swimming Pool.	Unknown	Bushnell et al. 2002:55

Figure 7. Map showing previously documented archaeological sites in Kapa`a

The majority of study areas are located within urban Kapa'a along the shoreline and away from the mountain areas.

Pattern of Archaeological Sites in Kapa`a

The pattern of archaeological studies in Kapa`a *Ahupua`a* is somewhat skewed with a dozen projects in urban Kapaa Town and very little work along the coast (Figure 4). Major archaeological sites have been found in area include extensive cultural layers with burials and other cultural features underlying Kuhio Highway near All Saints Gym, and near the older part of Kapaa Town between Waikaea Canal and Kapaa Beach Park, *makai* of Kuhio Highway (Hammatt 1991; Kawachi 1994; Creed et al. 1995; Jourdane 1995; Callis 2000). The *mauka-makai* extent of these cultural layers has not been clearly defined. The five *kuleana* awarded during the *Mahele* are located adjacent to the present coastal highway. The areas directly *mauka* of Kapaa Town are marshy though much of it has been filled in recent decades for the ByPass Road and shopping centers and housing. These cultural deposits associated with pre-historic and early historic habitation are known to exist in a relatively narrow sand berm that makes up the physiogeography of Kapa`a. The more *mauka* studies but still lower coastal areas, suggest they are located towards the *mauka* fringe of the sand berm, approaching more marshy conditions and have generally reported no significant or minimal findings (Spear 1992; Chaffee et al. 1994a & 1994b; Hammatt et al. 1994, 1997; McMahon 1996). Less than 1.5 km to the south of Waikaea Canal at the southern boundary of Waipouli adjacent to Uhalekawa`a Stream (Waipouli Stream) and the ocean is another extensive subsurface cultural deposit which is associated with a pre-contact fishing encampment located (Hammatt et al. 2000).

Anticipated sites based on historic and archaeological studies in *mauka* Kapa`a are the remains of cane cultivation infrastructure such as ditches and pre-contact too historic period Native Hawaiian terracing for *lo`i* cultivation with nearby habitation sites in the gulches, however the gulches lay outside the current project area.

RESULTS OF FIELD WORK

Pedestrian Survey

On January 3 and April 25, 2012 Exploration Associates Ltd. archaeologist Nancy McMahon, M.A. made field inspections on proposed Kapa`a Highlands project area. Access was made via Olohena Road (two gates). North-south oriented transects were utilized to 100% survey the project area. Because of known historic cane cultivation in this area of Kapa`a, predicted sites might be historic plantation related infrastructure such as ditches, flumes, roads, temporary cane-haul railroad berms and reservoirs. None were observed during the survey. The shallow ravine the project area were surveyed and tested, however no pre-Contact or historic era terraces or habitation sites were revealed. The parcel contains no surface archaeological sites. The access road is related to access for construction of the buildings already present on the Phase I parcel.

Subsurface Testing

On November 11, 2012, three trenches were excavated with a backhoe with a 24 in. width bucket (Figure). Trench 1 was excavated to a depth of 183 cm with a length of 10 meters. Trench 2 was excavated to a depth of 160 cm and a length of 3 m. Trench 3 was excavated to a depth of 260 cm and a length of 2.5 m. Each evinced the same soil composition. A description of the soils representing all three trenches is presented here.

A representative profile description evinced the same stratigraphy consisting in all three trenches, consisting of three soil layers with only a single clear boundary delineating the topsoil from the underlying soils. Soil differences could only be determined utilizing the Munsell Color Chart. The topsoil in each trench 5 YR 4/3 *reddish brown organic.* The other two layers are classified as 5 YR 5/6 *yellowish red* [20 cmbs] and 5 YR 4/6 *yellowish red* [20cmbs to base of excavation]. Characteristics are dry to very dry, crumbly, medium firm, clayey silt. It is pretty much cultivated soils. A local informant, Mr. Vasquez, who worked for the Lihue plantation most of his life Informant stated the plantation chain and ball dragged this land several time over.

A geologic survey was undertaken on the adjacent Phase I parcel prior to the construction of a solar farm. Soils extracted and examined in test trenches revealed only agricultural soils. No buried cultural layers or plantation infrastructure was present.

Figure 8. Trench locations, facing northeast.

Figure 9. Profile Test Trench 2 on the left and Trench 3 right.

Figure 10. Entrance off Olohena Road looking makai in the distance the Solar Farm part of Phase I

Figure 11. Access Road to Solar Farm with Cattle Grazing in the Distance.


Figure 12. Lower Elevation Outside Project Area from the access road.


Figure 13. View Across the Project Area, Facing Makai and Northeast.

Figure 14. The Roof of Kapaa Middle School on State land

RECOMMENDATIONS

As no archaeological sites are present, there are no historic preservation concerns for this project. We recommend no further historic preservation work. Though highly unlikely, if any human remains or other significant subsurface deposits are encountered during the course of development activities all work in the immediate area should stop and the State Historic Preservation Division promptly notified.

REFERENCES

Akina, Joseph

1913 *"I Ke hou i Ka Lulu-o-Moikeha i ka laula o Kapa `a", Kuokoa.* May 2-9, 1913. Bishop Museum Archives HEN Place Names, Kaua`i.

Alexander, William Patterson

1991 "A Tour of Kaua`i in 1849: Private Journal of William DeWitt Alexander," *The Kaua`i Papers,* Kauai Historical Society, A Kauai Historical Society Publication, Lihue, Kaua`i, HI.

Beckwith, Martha

1970 Hawaiian Mythology, University Press of Hawai`i, Honolulu.

Bennett, Wendell C.

1931 The Archaeology of Kaua' i, Bishop Museum Bulletin 80, Honolulu, HI. Bishop Museum Archives HEN I: 214 "Heiaus of Kealia and Kapa`a" and "Well Known Things [or Places]".
HEN I: 215 "Famous Things mentioned by Two Men".
HEN I: 216 "Heiaus from Kapa`a to Kealia" and "Things for which Kapa'a was Known".

Bushnell, K.W., Melanie Mann, Douglas Borthwick, Tony Bush, Todd Tulchin, David Shideler and Hallett H. Hammatt

2002 Archaeological Inventory Survey for the Proposed Kapa`a/Kealia Bike and Pedestrian Path, Kapa`a and Kealia, Kawaihau Districts, Kaua`i Island, Hawaii (TMK 4-5, 4-6-14, 4-7-03 & 04). Cultural Surveys Hawai`i, Inc. Kailua, HI.

Calis, Irene

2000 *End of Field Work Report: Human Burial Removal and Archaeological Monitoring, Kapa`a Beach Park Public Bathroom Installation, Kapa`a, Kaua`i* Scientific Consultant Services

Chafee, David B., Berdena Burgett and Robert L. Spear

1994a An Inventory Survey of a Kukui Street Houselot, Kapa`a Ahupua'a, Kawaihau District, Puna, Island of Kaua`i (TMK: 4-5-09:10), SCS Inc., Kaneohe, HI.

1994b An Inventory Survey of a Mamane Street Houselot, Kapa`a Ahupua'a, Kawaihau District, Puna, Island of Kaua`'i (TMK: 4-5-09:51), SCS Inc., Kaneohe, HI.

Ching, Francis K. W.

1968 Archaeological Surface Survey; Wailua State Park, Kaua`i, State of Hawaii, Dept. of Land and Natural Resources, Honolulu, HI.

1976 Letter Report: Archaeological Reconnaissance Report, Kapa`a "Wastewater Treatment and Disposal System, ARCH 14-96, Letter to R. M Towill Corporation, ARCH, Lawai, Kaua`i, HI.

Conde, Jesse C. and Gerald M. Best

1973 Sugar Trains, Narrow Gauge Rails of Hawaii, Glenwood Publishers, Felton, CA.

Cook, Chris

1999 "Kaua`i, the Garden Island: A Pictorial History of the Commerce and Work of the People", Donning Co., Virginia Beach, VA.

Creed, Victoria, Hallett H. Hammatt, Gerald K. Ida, Ian Masterson and John Winieski

1995 A Summary of the Archaeological Monitoring for the Kapa`a Sewerline Project Waipouli and Kapa`a Ahupua`a, Puna District, Kaua`i (TMK: (4)-3-09 and 4-5-03 to 11), Cultural Surveys Hawai`i, Kailua, HI.

Damon, Ethel M.

1934 The Heiau at Wailua, The Kauai Historical Society by the Garden Island Press, Lihue, Kaua`i, HI.

1931 Koamalu, two vols. privately printed by the Honolulu Star-Bulletin Press, Honolulu, HI.

Dega, Michael F. and James Powell

2003 Archaeological Monitoring During Phase I of the Kaua`i Rural Fiber Optic Duct Lines Project, Kaua`i Island, Hawaii. Scientific Consultant Services.

Dole, Charles S.

1916 "The Hui Kawaihau" pp.8-15. A Paper read at the November meeting of the Kauai Historical Society on November 16, 1916. In Lihue, Kaua`i.

Donohugh, Donald

2001 The Story of Kōloa, A Kaua`i Plantation Town, Mutual Publishing, Honolulu, HI.

Foote, Donald E. E. L. Hill, S. Nakamura and F. Stevens

1972 Soil Survey of the Islands of Kauai, 0ahu, Maui, Molokai and Lanai, State of Hawaii U.S. Department of Agriculture. U.S. Government Printing Office, Washington D.C.

Fomander, Abraham

1916-19 Fomander Collection of Hawaiian Antiquities and Folk-Lore, with translations edited and illustrated with notes by Thomas G. Thrum, Volume 4, First series, 1916 - 1917 notes by Thomas G. Thrum, Memoirs of the Bernice P. Bishop Museum, Vols. 4, 5, 6, Honolulu, HI.

Garden Island Newspaper

1955 "Geologists Says Kapa'a Coral Removal No Threat to Town". September 21, 1955.

1963 "Kapa'a Blames Federal Role As Erosion Continues. Says Barrier on Reef is Required". October 30, 1963.

1983 "Centennial Year, Kapa'a School Wants Pix of its 100 Years". April 1, 1983.

Giambelluca, Thomas W., Michael A. Nullet and Thomas A. Schroeder
1986 Rainfall Atlas of Hawai`i, Department of Land and Natural Resources, Honolulu, HI.

Hammatt, Hallett H.

1981 Archaeological Reconnaissance of 52.56 Acres for a Proposed subdivision, TMK: (4)-6-13-1, Kapa`a, Puna, Kaua`i Island, ARCH Report 14-236, Prepared for Waialeale Partners.

1986 Archaeological Reconnaissance of the Makaleha Springs Water Source Development, Kapa`a, Kaua`i TMK: (4)-6-01:1, Cultural Surveys Hawai`i, Kailua, HI.

1991 Archaeological Subsurface Testing for the Proposed Kapa'a Sewer line, Wailua, Olohena, Waipouli and Kapa`a, Kaua`i, Cultural Surveys Hawai`i, Kailua, HI.

Hammatt, Hallett H., Rodney Chiogioji, Gerald K. Ida and Victoria S. Creed
1996 An Archaeological Inventory Survey for the Kuhio Highway Widening and Bypass Options Within the Ahupua`a of Wailua, South Olohena, North Olohena, Waipouli & Kapa`a, Island of Kaua`i, Cultural Surveys Hawai`i, Inc., Kailua, HI.

Hammatt, Hallett H., Gerald K. Ida and William H. Folk
1994 Archaeological Inventory of a 1.87-Acre Parcel, Kapa`a, Kaua`I (TMK (4)-5-05:6), Rev. August 1994, Cultural Surveys Hawai`i, Kailua, HI.

Handy, E.S. Craighill and Elizabeth G. Handy
1972 Native Planters in Old Hawaii: Their Life, Lore, and Environment, B.P. Bishop Museum Bulletin 233, B.P. Bishop Museum, Honolulu, HI.

Hawaii State Archives
1837 Interior Department, Land, Incoming Letter. August 1837.

1882 Interior Department, Letter book, Vol. 20, p. 426, Letter from Spalding to the Honorable Jacob Hardy, Circuit Judge—Fourth Circuit Kaua`i.

Hawaiian Territorial Planning Board
1940 Master Plan of the Town of Kapa`a, In collaboration with the Kaua`i County Board of Supervisors, Publication No. 8. Advertiser Publishing Co., Honolulu, HI.

Honolulu Advertiser
1997 "Amfac to put more land up for sale: Tracts on Kaua`i, Big Island" by Mike Gordon. July 7, 1997. Section Bl.

1960 "Kaua`i Tries to See into Future. March 20, 1960.

Joesting, Edward
1984 Kaua`i, The Separate Kingdom, University of Hawaii Press and Kaua`i Museum Association, Ltd., Honolulu.

Jourdane, Elaine
1995 Inadvertent Discovery of Human Remains at 1382-A Inia Street, Kapa`a, Kaua`i (Kapa`a Sewerline Project Laterals) Site 626, SHPD, Honolulu, HI.

Kalakau'a, David
1888 The Legends and Myths of Hawaii, Edited by R.M. Dagget, Charles L. Webster and Co., New York.

Kamakau, Samuel Manaiakalani
1976 The Works of the People of Old, Na Ham a ka Po' e Kahiko, Bishop Museum Special Publication, No. 61, Honolulu, HI.

Kapa`a Elementary School
1982 Kapaa School 1883-1983: A "Century of Knowledge". Kapa`a Elementary, Kapa'a, Kaua`i

Kawachi, Carol T.
1994 Inadvertent Burial at 1316 Inia Street (Jasper) TMK 4-5-08:33, Kapa`a, Kawaihau, Kaua`i 50-30-08-871, State Historic Preservation Division, Honolulu, HI.

Kikuchi, William K. and Susan Remoaldo
1992 Cemeteries of Kaua'i, Volume 1, Kaua'i Community College and University of Hawaii, Puhi, Kaua`i, HI.

King, Robert D.
1935 "Districts in the Hawaiian Islands" In Coulter, John Wesley (compiler) A Gazetteer of the Territory of Hawaii, University of Hawaii Research Publications, No. 11, University of Hawaii, Honolulu, Hi.

Lai, Violet L. assisted by Kum Pui Lai
1985 He Was a Ram, Wong Aloiau of Hawaii, Published for the Hawaii Chinese History Cemetery and the Wong Aloiau Association by University of Hawaii Press, Honolulu.

McMahon, Nancy A.
1994 Inadvertent Burial Find, Kapa` a, Kawaihau, Kaua`i, SHPD, Honolulu, HI.

1996 Archaeological Inventory Survey for 5 Unit Apartment, (TMK:(4)-5-05:8), Kapa`a, Kawaihau, Kaua`i, Exploration Associates, LTD., Kōloa, Kaua`i, HI.

Nakuina, Moses K.
1990 The Wind Gourd of La' amaoma, Translated by Esther T. Mookini and Sarah Nakoa, Kalamaku Press, Honolulu.

Office of the Commissioner of Public Lands
1929 Indices of Awards, Made by the Board of Commissioners to Quiet Land Title in the Hawaiian Islands.

Pukui, Mary Kawena
1983 (Melo No'eau: Hawaiian Proverbs and Poetical Sayings, Bishop Museum Special Publication No.71, Bishop Museum Press, Honolulu, HI.

1986 Hawaiian Dictionary, 2nd Edition, University of Hawaii Press, Honolulu, HI.

1974 Place Names of Hawaii, University of Hawaii Press, Honolulu, HI.

Rice, William Hyde
1974 Hawaiian Legends, Bernice P. Bishop Museum Bulletin 3, Honolulu, HI; originally published 1923, Kraus Reprint, Millwood, New York, N.Y.
1923 Hawaiian Legends, Bernice P. Bishop Museum Bulletin 3, Honolulu.

Spear, Robert L.
1992 Letter Report Concerning Monitoring for the Cost-U-Less Project Kapa'a, Kaua`i, HI (TMK: (4)-5-5:4&9), Scientific Consultant Services Inc., Honolulu, HI.

Thrum, Thomas G.
1906 "Heiaus and Heiau Sites Throughout the Hawaiian Islands, Kaua`i, in: Hawaiian Almanac and Annual 1907, pp. 36-48, Honolulu, HI.
1923 More Hawaiian Folk Tales, A.C. McClurg & Co., Chicago, IL.

Van Ryzin, Karl and Hallett H. Hammatt
2004 An Archaeological Assessment for The Proposed Water Reservoir, Kapa `a Ahupua `a, Kaua`i (TMK (4)-6-03:10 Cultural Surveys Hawai`i, Kailua, HI.

Wickman, Frederick B.
1998 Kaua`i Ancient Place Names and Their Stories. University of Hawaii Press: Honolulu

APPENDIX A

Photos of the Area Surveyed

Figure 1. View of Project Area from the gate at the top of Olohena Road.

Figure 2. Solar Farm on Phase I Property view to north

Figure 3. Cattle Grazing in the Project Area.

Figure 4. Fence in the left side of photo indicating property boundary.

Figure 5. Goats Grazing in the Project Area.

APPENDIX B

State Historic Preservation Letter (June 2010) Requesting Survey

State Historic Preservation Letter (December 1999) Subdivision "No Effect"

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

June 28, 2010

LOG NO: 2010.2441
DOC NO: 1006MV50

Greg Allen, Kapaa Highlands Inc.
161 Wailua Road
Kapaa, HI 96746

SUBJECT: Historic Preservation Review-
Consultation Letter on TMK [4]-4-3-003:001, Kapa'a Kauai

Thank you for the opportunity to provide a current determination letter on the property with TMK# [4]-4-3-003:001. According to our records, there has not been an *Archaeological Inventory Survey* (AIS) of this property. In addition, *Archaeological Inventory Surveys* of nearby properties (TMK [4]-4-3-003:004 and TMK [4]-4-3-003:005) recorded multiple historic properties (SHPD Log No. 2008.1916). However, aerial photos indicate that this property was previously cultivated with sugar cane, which may have destructive implications for pre and post-contact Native Hawaiian sites within the project area. However, current aerial photos indicate the presence of potentially historic irrigation features as well as terrain that may not have been subject to intensive cultivation.

The historic preservation requirements for any proposed action within this project area would vary depending on the extent of the action's impact on the parcel. If the action were to take place on previously cultivated land the only historic preservation requirement would be to document the irrigation features. However, if the action takes place in a part of the property that was not cultivated an Archaeological Inventory of that area may be required. It would be highly beneficial for all proposed actions to have an Archeological Inventory Survey for the entire property in order to document the presence or absence of historic sites in this parcel.

Please call Mike Vitousek at (808) 692-8024 if you have any questions or concerns regarding this letter.

Aloha,

Nancy A. McMahon

Nancy McMahon, Deputy SHPO/State Archaeologist
and Historic Preservation Manager

2-16-2010 8:54AM FROM BUSSHARD/BRUNSTEIN 808 245 8929 P. 2

Dec-19-99 12:40P GREG KAMM 1 808 7421751 P.02

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

TIMOTHY E. JOHNS, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DEPUTIES
JANET E. KAWELO
LINNEL NISHIOKA

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS
WATER RESOURCE MANAGEMENT

December 14, 1999

Mr. Greg Kamm
P.O. Box 1200
Koloa, HI 96756

LOG NO: 24572 ✓
DOC NO: 9912NM02

Dear Mr. Kamm:

SUBJECT: **Chapter 6E-42, Historic Preservation Review --**
Subdivision Permit Application S-99-45 (Silagi Family Trust and Hillside Corp. Center L.L.C.)
TMK: 4-3-03: 01 por
Kapaa, Kawaihau, Kaua'i

Thank you for submitting the 1975 air photo of the above subject parcels. We agree that the land has been extensively altered by cane cultivation and filling. Therefore, we now believe that this project will have "no effect" on significant historic sites.

If you have any questions, please call Nancy McMahon at 742-7033.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

NM:im

c: D. Crowell, Planning Department County of Kauai

APPENDIX C

Report of Geotechnical Evaluation Kapaa Solar Field

d. a. evans inc.

REPORT OF
GEOTECHNICAL EVALUATION-
KAPAA SOLAR FIELD
KAPAA, KAUAI

PREPARED FOR
WAGNER ENGINEERING SERVICES, INC.

PREPARED BY:

D.A.Evans, Inc.
P.O. Box 745
Kilauea, HI., 96754

d. a. evans inc.

REPORT OF
GEOTECHNICAL EVALUATION-
KAPAA SOLAR FIELD
KAPAA, KAUAI

PREPARED FOR
WAGNER ENGINEERING SERVICES, INC.

PREPARED BY:

D.A.Evans, Inc.
P.O. Box 745
Kilauea, HI., 96754

d. a. evans inc.

TABLE OF CONTENTS

d. a. evans inc.

INTRODUCTION

This report summarizes the results of our evaluation of the geotechnical feasibility of construction of a solar farm west of the town of Kapaa, Kauai. We understand the installation will be used to supply electric power to the Kauai Island Utility Cooperative.

PURPOSE

This report is for the exclusive use of our client, Wagner Engineering Services, Inc. Its purpose is to satisfy the terms of the contract between our two firms. The report summarizes the findings, conclusions and recommendations which were generated by the evaluation. The intent of the report has been to present conclusions and recommendations of a geotechnical nature in such a way as to assist the owner and their design team in preparing plans and specifications for construction.

SCOPE

As outlined in our contract dated August 22, 2010, the following work elements were performed.

- Review of available geologic data and stereographic aerial photographs.
- Subsurface exploration using a rubber-tired "Extendahoe" backhoe.
- Laboratory testing of selected samples of soil collected during subsurface exploration.
- Preparation of a formal report summarizing our findings, conclusions and recommendations.

LOCATION

The site is located slightly less than three miles west of the town of Kapaa. It is accessed by an unpaved road exiting from Olohena Road. The site is shown on Plate 1- Location Map.

REFERENCES

The following references were used in preparing our proposal, conducting our evaluation and preparing this report.

d. a. evans inc.

Our Job No. 2010-08-01 Page 2

- "Roadside Geology of Hawaii", Richard W. Hazlett and Donald W. Hyndman, Mountain Press Publishing Company, 1966.
- "Volcanoes in the Sea The Geology of Hawaii", Second Edition, Gordon A. MacDonald, Agatin T. Abbott and Frank L. Peterson, University of Hawaii Press, 1983.
- "Tsunami!", Second Edition, Walter C. Dudley and Min Lee, University of Hawaii Press, 1998.
- "Atlas of Natural Hazards in the Hawaiian Coastal Zone", USGS, Geologic Investigations, Series I-2761, 2002.
- "Reconnaissance Following the October 15th, 2006 Earthquakes on the Island of Hawaii, University Of Hawaii, College Of Engineering, Research Report UHM/CEE/06-07, October 26, 2006.

SITE CONDITIONS AND PROPOSED DEVELOPMENT

The site, as evidenced by preliminary topography and USGS mapping, is located on an elevated stream terrace on the south side of Olohena Road, 2.8 miles west of old Kapaa town and about 4000 feet northeast of the Nonou Forest Reserve. At the time of our exploration, vegetation was sparse due to the ongoing drought. Topography slopes toward the ancestral channel with the steepest portion immediately below Olohena Road.

Detailed plans of the proposed development were not available at the time of our exploration although, because of the nature of the development, the knowledge that it is a solar field is sufficient for our purposes. Drawings which have been provided by your office indicate that the project will consist of six solar panel arrays of varying size mounted on a shallow foundation system.

GEOLOGIC CONDITIONS

The Lihue Depression is the dominant geologic feature which has influenced thesite. The Lihue Depression is apparently the remains of the caldera of the ancestral Wai'ali'ali shield volcano. The caldera was displaced during the massive landsliding which caused the collapse of the portion of the island now occupied by Kapaa and Waipouli. The site is on the northern edge of the depression

Although there is evidence to suggest that the island is still undergoing some settlement associated with the collapse of the volcano, the amount of movement is apparently so small as to be undetectable without instrumentation and there is no longer volcanic activity on the island.

d. a. evans inc.

Our Job No. 2010-08-01 Page 3

Our subsurface exploration indicates that the site is an erosion terrace formed by previous stream action. Subsequent erosion has produced a residual soil profile which grades from a fully developed, moderately firm, surface soil to very stiff weathered rock at a depth of about six feet. In this area, as is the case on the majority of the eastern side of the island, the underlying rock is part of the Koloa series of volcanic flow material.

TSUNAMIS

The island of Kauai is susceptible to damage from tsunamis. Although there is a comparatively sophisticated early warning system in place world-wide, the ability of the system to predict the size of any particular event is limited. The general consensus is that tsunamis are certain to occur but their frequency is uncertain. Published data suggest that the site is not vulnerable to damage from tsunami run-up of the magnitude experienced in the Hawaiian Islands historically.

SURFACE AND SUBSURFACE WATER

Drainage on the property occurs as southwesterly sheet flow from the slope below Olohena Road toward the established stream. At the time of our exploration, drought conditions existed on the island and surface was non-existent.

We found no subsurface water to the depth of exploration. Because of the existing drought conditions, the near-surface soil was dry and brittle.

CONCLUSIONS

Based on the results of our geotechnical evaluation, we can offer the following conclusions.

FEASIBILITY

In our opinion, it is geotechnically feasible to develop the site essentially as proposed provided the improvements are properly designed and constructed.

SITE PREPARATION

We have assumed that little or no grading, other than that required for the creation of an access road and support facilities will be needed. Moreover, it is our understanding that the arrays will be supported by some form of pipe piles. As a result, it is likely that site preparation will be minimal.

d. a. evans inc.

Our Job No. 2010-089-01 Page 4

EARTHQUAKES

The island of Kauai is in Uniform Building Code seismic zone 1, a designation indicative of a low level of seismic activity. Published data indicate that, during the period 1962 to 1980, for example, there were no recorded earthquakes with a Richter Magnitude greater than 3.0 with an epicenter on or near Kauai. Within the last two years, however, earthquakes in the Richter Magnitude 3 to 4 range have occurred offshore of Maui and Oahu as well as the Loihi seamount east of the Big Island and magma production from Kilauea has altered perceptibly. Of particular importance was the October 15, 2006, M=6.7 and the November 23, 2006, M=5.0 events off the Kona Coast .This may be indicative of shifts in the Pacific tectonic plate which could generate an increase in seismic activity for the near future ,As part of our evaluation, we have provided below the numeric parameters necessary to perform the site characterization analysis required by the 1997 Uniform Building Code.

Soil Profile- S_b
$z = 0.075$
$c_a = 0.12$
$c_v = 0.18$
$N_a = 1.0$
$N_v = 1.0$

In our opinion, it is likely that the site will experience low-level ground shaking due to volcanic activity on or near the Big Island, but the magnitude and number of these events will not be larger than those in the historic record.

TSUNAMI

Tsunami run-up of historic proportions has been in the 10 to 40 foot range and, historically, has been concentrated on the north shore of the island. Although the pre-historic "monster" tsunami is still a theoretical possibility, the design practice in coastal areas of the island has apparently been to consider the run-up of historic proportion. The site of the proposed solar field is well above the elevation of historic run-up.

FOUNDATION DESIGN

The upper two feet of the surface soil in the area of the arrays is poorly consolidated and should not relied for either foundation support or uplift resistance. Below two feet, the soil is stiff and capable of generating more than 2500 pounds per square foot for bearing. Uplift resistance can be determined using the relationship (1100)d + Wl where "d" is outside shaft diameter, "W" is unit weight of the shaft and "l" is shaft length below two feet. This assumes that the shaft consists of a

d. a. evans inc.

Our Job No. 2010-08-01 Page 5

protected metal shaft encased in concrete. A passive pressure of 300 pounds per cubic foot (equivalent fluid) is reasonable for the soil below a depth of two feet.

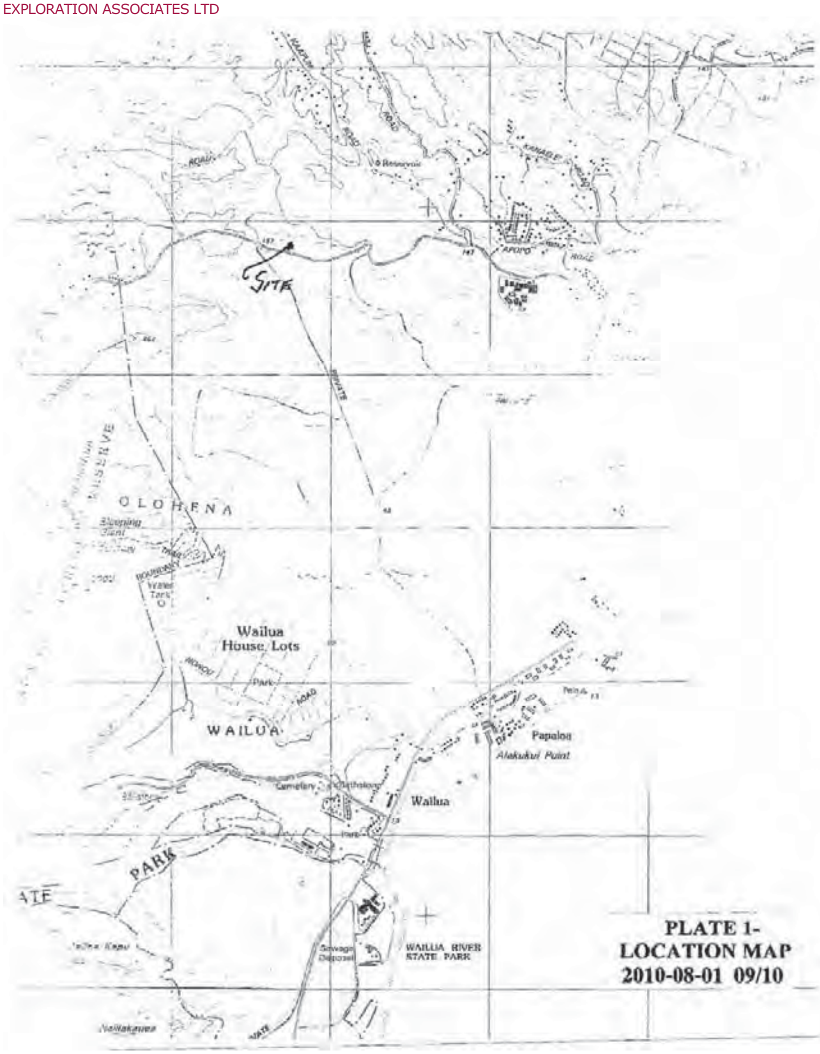
Laboratory tests to determine the relative corrosivity of the soil are currently being performed and the results will be reported under separate cover. However, our work on the island has shown, as the result of a number of tests, that the soil derived from the Koloa volcanic material is highly to severally corrosive to both concrete and metal. The results of the on-site tests will be submitted under separate cover.

SURFACE DRAINAGE

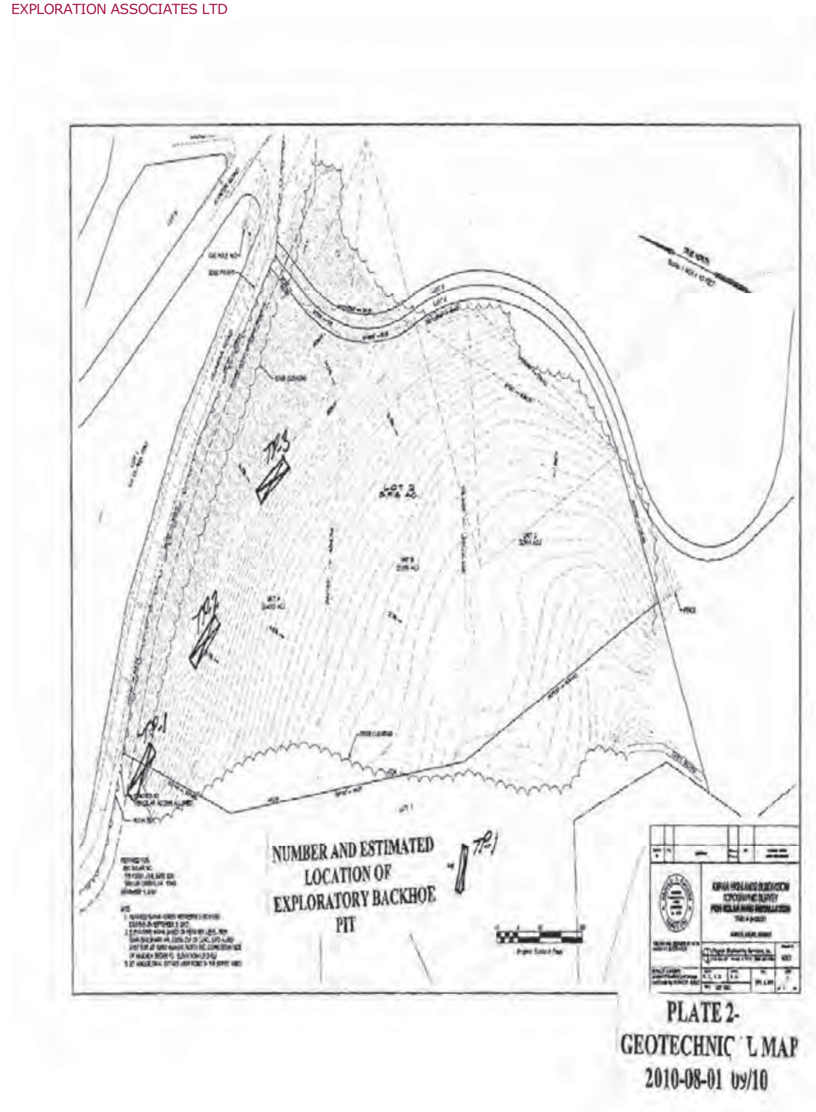
Runoff from rainfall and irrigation should be directed away from the proposed structures to an approved drainage device.

The Plates which are attached and complete this report are listed in the Table of Contents.

oOo



EXPLORATION ASSOCIATES LTD



d. a. evans inc.

APPENDIX
SUPPORTING DATA AND PROCEDURES

SURFACE GEOLOGIC MAPPING

A limited amount of surface geologic mapping was performed as part of our evaluation. This mapping was performed both physically and with the aid of topographic maps before and during the subsurface exploration. The results of this work were assimilated with the subsurface exploration.

SUBSURFACE EXPLORATION

Subsurface exploration at the site consisted of the excavation of three trenches using a rubber-tired backhoe with a three-foot-wide bucket. The trenches were located to (a) aid in establishing a "picture" of probable subsurface conditions at the site, and (b) provide access to the subsurface for possible sampling of soil and/or rock. To that extent, both the geomorphology of the site and the type and location of proposed improvements have a bearing on the location of subsurface exploration points. Our estimate of the location of each backhoe trench is shown on Plate-2 Geotechnical Map. Graphic logs, using standard United States Geological Survey, United States Corps of Engineers and United States Bureau of Reclamation nomenclature are included as Plates A-1.1 through A-1.3- Log of Test Pit. Upon completion, all pits were backfilled, tamped and wheel-rolled. The location of each test pits was also marked with a stake and flagging.

LABORATORY TESTING

Moisture/Density. Field moisture content and in-place dry density were determined for each "undisturbed" sleeve sample obtained during exploration. The field moisture content was determined according to ASTM Test Method D2216-66 by obtaining one-half of the moisture sample from each end of the sleeve. The in-place wet and dry density was determined by using the wet weight of the entire sleeve.

At the same time the field moisture content and in-place dry density were determined, the soil material at each end of the sleeve was classified according to the Unified Soil Classification System and pocket penetrometer readings were taken in the cohesive samples. The results of the field moisture content and in-place dry density tests are presented on Plates- A.1 and A-1.2-Log of Test Pit.

Index Tests. For purposes of this report, we have grouped grain-size distribution and Atterberg Limits under "index tests". The bulk sample taken from test pit TP-1 at a depth of two to

EXPLORATION ASSOCIATES LTD

d. a. evans inc.

three feet was also subjected to an analysis of its distribution of grain size and its Liquid Limit, Plastic Limit, and Plasticity Index were determined. The distribution of grain size was determined according to ASTM Test Method D422-63. Relative plasticity was determined according to ASTM Test Methods D423-66 and D424-59. Using these data, the soil can, among other things, be provided a positive Unified Soil Classification System group name. The tests indicate that the soil has no gravel-sized particles, 18 percent sand-sized particles, 80 percent silt-sized particles, two percent clay-sized particles, a Liquid Limit of 59, a Plastic Limit of 46 and a Plasticity Index of 13. The soil has been given a Unified Soil Classification System group name and symbol of Sandy Silt (MH). The results are summarized on Plate A-2- Relative Plasticity Data and Plate A-3- Grain Size Distribution Data.

Direct Shear Tests. Undisturbed samples taken from test pits TP-1 and Test Pit TP-2 at two feet were subjected to consolidated, drained direct shear tests to determine the shearing resistance of the soil. In each case, samples were allowed to stabilize in a suitable loading frame under the normal stress for the test (in this case, 500, 750 and 1000 pounds per square foot). The samples were then flooded, allowed to stabilize and then sheared at a constant rate of 0.008 inches per minute to failure. The applied normal and induced shear stresses were monitored with electronic load cells and the displacement in the normal and shear directions monitored with linear variable displacement transducers (LVDT's). The force and displacement in the direction of shear were plotted electronically. The results of the tests are summarized graphically on Plates A-4 - Shear Strength Data

Corrosion Tests. Tests to determine the relative corrosivity of the on-site soil are currently being completed and will be submitted under separate cover.

With the exception of the corrosion tests, all laboratory testing was performed for us by Evans, Colbaugh & Associates, Inc .in San Marcos, California

Log of Test Pit No. TP- 1

Date: 09/11/10 Elevation: +60 (Map Datum)

Logged By: DAE Hole Size/ Type: 2'x 6'x 6' Backhoe

Depth (feet)	Sample Type	Blow ount	Dry Density	Moisture Content	Other Tests	USCS	Graphic Log	Description
								SOIL (Residual), Clayey Silt (ML), medium-brown, moderately firm, dry, to very dry
1								
2	D,SS		72	30	DS,AL GS	MH		stiff at two feet
3								
4								very stiff, at 4 feet, mottled light brown and yellow grading to highly weathered Koloa volcanic rock at six feet.
5								
6								
7								
8								
9								
10								Bottom at 6 feet. No water. No caving. Hole backfilled, tamped and wheel-rolled
11								

Water level shown is at time of measurement and may be different at different times.
Blow counts are per foot; dry density is in pounds per square foot; moisture content is percent of dry weight.

d. a. evans inc.

Date: 09/12/10 Project No.: 2010-08-01

SOLAR PANEL FIELD
LOG OF TEST PIT TP-1

PLATE A-1.1

Log of Test Pit No. TP- 2

Date: 09/11/10 Elevation: +60 (Map Datum)

Logged By: DAE Hole Size/ Type: 2'x 6'x 6' Backhoe

Depth (feet)	Sample Type	Blow ount	Dry Density	Moisture Content	Other Tests	USCS	Graphic Log	Description
								SOIL (Residual), Clayey Silt (ML), medium-brown, moderately firm, dry, to very dry
1								
2	D		70	28	DS	MH		stiff at two feet
3								
4								very stiff, at 4 feet, mottled light brown and yellow grading to highly weathered Koloa volcanic rock at six feet.
5								
6								
7								
8								
9								
10								Bottom at 6 feet. No water. No caving. Hole backfilled, tamped and wheel-rolled
11								

Water level shown is at time of measurement and may be different at different times.
Blow counts are per foot; dry density is in pounds per square foot; moisture content is percent of dry weight.

d. a. evans inc.

Date: 09/12/10 Project No.: 2010-08-01

SOLAR PANEL FIELD
LOG OF TEST PIT TP-2

PLATE A-1.2

Log of Test Pit No. TP- 3

Date: 09/11/10 Elevation: +60 (Map Datum)

Logged By: DAE Hole Size/ Type: 2'x 6'x 6' Backhoe

Depth (feet)	Sample Type	Blow count	Dry Density	Moisture Content	Other Tests	USCS	Graphic Log	Description
								SOIL (Residual), Clayey Silt (ML), medium-brown, moderately firm, dry, to very dry.
1								
2								four inch dia. "bomb" at three feet.
3								
4								
5								
								stiff at six feet.
6								
7								
8								
9								
10								Bottom at 6 feet. No water. No caving Hole backfilled, tamped and wheel-rolled
11								

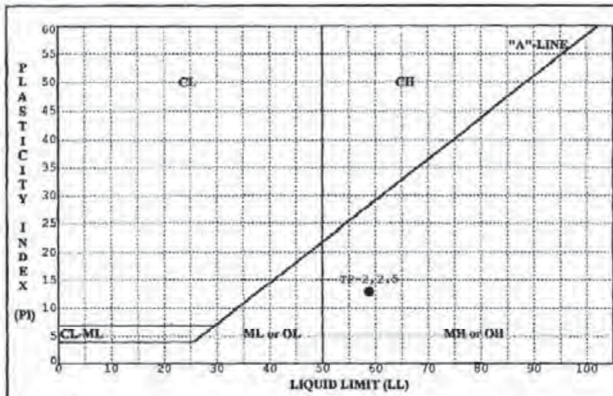
Water level shown is at time of measurement and may be different at different times.
Blow counts are per foot; dry density is in pounds per square foot; moisture content is percent of dry weight.

d. a. evans inc.

Date: 09/12/10 Project No.: 2010-08-01

SOLAR PANEL FIELD
LOG OF TEST PIT TP-3

PLATE A-1.3



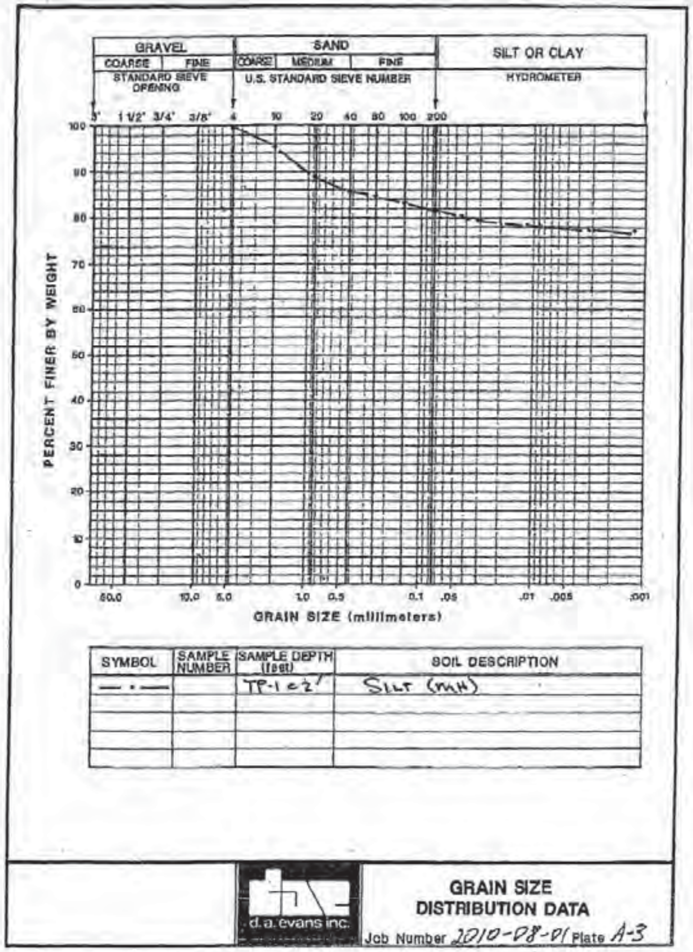
Symbol Type	Sample Location	Sample Depth (ft)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Group Symbol and Name
●	TP-2	2.5	59	46	13	MH

evans, colbaugh & assoc. inc.

2010-08-01

Relative Plasticity
D A Evans

A-2
1 of 1


GRAVEL
COARSE
FINE
STANDARD SIEVE OPENING
SAND
COARSE
MEDIUM
FINE
U.S. STANDARD SIEVE NUMBER
SILT OR CLAY
HYDROMETER
PERCENT FINER BY WEIGHT
GRAIN SIZE (millimeters)
SYMBOL
SAMPLE NUMBER
SAMPLE DEPTH (feet)
SOIL DESCRIPTION
TP-1 @ 2'
SILT (MH)
d.a. evans inc.
GRAIN SIZE DISTRIBUTION DATA
Job Number 2010-08-01 Plate A-3

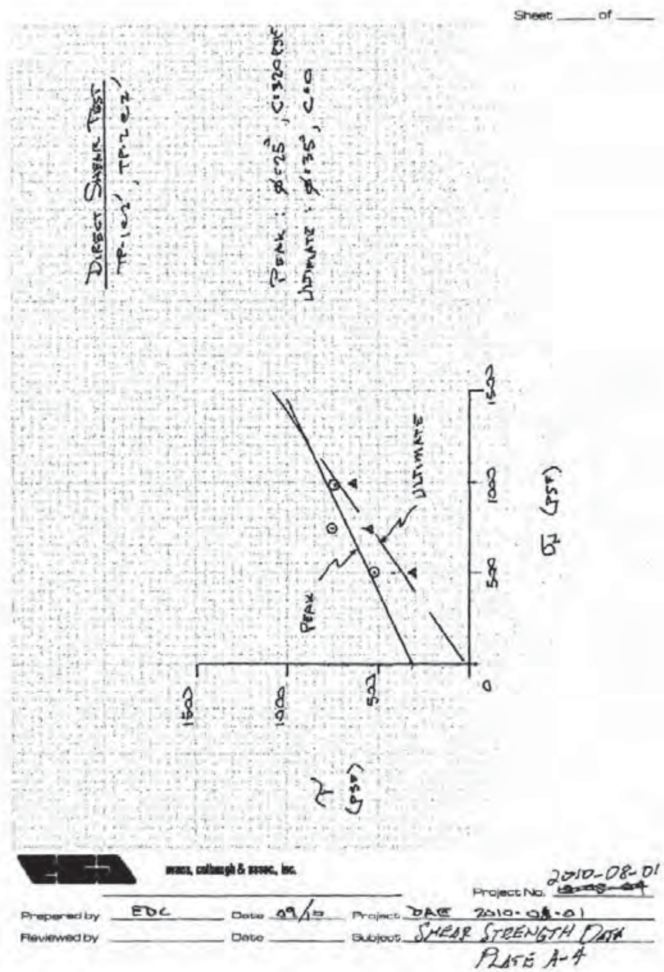

Sheet ___ of ___
DIRECT SHEAR TEST
TP-1 @ 2', TP-2 @ 2'
PEAK
ULTIMATE
evans, colbaugh & assoc, inc.
Project No. 2010-08-01
Prepared by EDC
Date 09/10
Project DAE 2010-08-01
Reviewed by
Date
Subject SHEAR STRENGTH DATA
PLATE A-4

Exhibit M

A Cultural Impact Assessment for the Proposed Kapa'a Highlands Phase II
Kapa'a Ahupua'a, Kawaihau District, Kaua'i

Exploration Associates Ltd.

A Cultural Impact Assessment for the Proposed Kapa`a High-lands Phase II, Kapa`a Ahupua`a, Kawaihau District, Kaua`i

TMK (4) 4-3-03:01

by

Nancy McMahon, M.A.

Prepared for
Three Stooges LLC

By
Exploration Associates, Ltd.
May 2012

EAL 3-2600 Kaumualii Hwy 1300-306 **T** 808 639 6695 poipunan@me.com

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Scope of Work

The following scope of work was agreed upon to fulfill the requirements of a cultural impact assessment, as outlined by the Office of Environmental Quality Control guidelines:

1) Further background research with the goal 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) Examination of historical documents, Land Commission Awards, and historic maps, with 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 to develop a Cultural landscape background study,
3) A review of the existing archaeological information pertaining to the sites in the study area as they may allow us to reconstruct traditional land use activities and identify and describe the cultural resources, practices and beliefs associated with the parcel and identify present uses, if appropriate.
4) Conduct oral interviews with persons and agencies knowledgeable about the historic and traditional practices in the project area and region. This includes eight formal interviews and more informal interviews plus coordination with relevant community groups.
5) Preparation of a report on items 1-3 summarizing the information gathered related to traditional practices and land use. The report will assess the impact of the proposed action on the cultural practices and features identified.

Methods

1. Historic Research

Research was conducted to find historic maps at the Hawai'i State Survey Office, the State Historic Preservation Division library and the Kaua'i Historical Society. Historical research was conducted at the State Historic Preservation Division Library, the Hawai'i State Archives and the Bishop Museum where information on historic land use and past cultural traditions was sought. The Bishop Museum also provided historic photographs for

the report. In an attempt to obtain more regional or local sources, historic documents were sought at the Kaua'i Historical Society, Kaua'i Museum and the Kapa'a Public Library.

2. Archaeological Review

The library at the Department of Land and Natural Resources, State Historic Preservation Division were used to obtain information regarding previous archaeological and cultural studies in the Kapa'a area. Previously identified archaeological sites are presented for each section separately and are discussed in the context of associated cultural traditions. A complete review of archaeological sites, including descriptions, *ahupua'a*, settlement patterns and archaeological constraints is available in a separate archaeological assessment document (McMahon 2012).

3. Identification of Knowledgeable Informants

Hawaiian organizations, community members and cultural and lineal descendants with lineal ties to the greater Kapa'a area were contacted to: (1) identify potential knowledgeable individuals with cultural expertise and knowledge of the project area and surrounding vicinity, and (2) identify cultural concerns and potential impacts relative to the project. An effort was made to locate informants who either grew up in the project area or who, in the past, used the area for cultural purposes. These included lifetime residents of Kapa'a Town, families with ties to the historic rice industries of Kapa'a and former employees of Lihue Plantation who may have lived in one of the residential camps near the study area. Other potential user groups were residents in the Kapa'a who have their roots in Kapa'a, and continue to utilize the *makai* areas for cultural reasons. In addition, informal talk-story with community members familiar with the study area is ongoing. The organizations consulted were the State Historic Preservation Division (SHPD), The Office of Hawaiian Affairs (OHA), the Kaua'i/Ni'ihau Islands Burial Council, the Royal Order of Kamehameha, Kaumuali'i Chapter, Kaua'i County Council, Kaua'i County Mayor, Kaua'i Health Heritage Coastal Corridor Committee, Kaua'i Historical Society, Kaua'i Historic Preservation Commission.

4. Interviews

Interviews were conducted for this assessment. Once the participant was identified, she/he was contacted and interviewed. Excerpts from the interview are used throughout this report, wherever applicable.

5. Report

This study documents relevant information on traditions and practices from the historic record as well as from contemporary oral sources. The report includes cultural and historic documentation of Kapa'a, a summary of archaeological studies, the results of community consultation, and an assessment of traditional resources/traditional practices. The report is organized in such a way that reflects the effort of data and information gathering. This is the information used in the final assessment of Traditional Resources/ Cultural Practices reported in the Conclusions Section IV and V.

KAPAʻA

The Kapaʻa Highlands Phase II is located in Kapaʻa, above the Kapaʻa Bypass Road and adjacent to Kapaʻa Middle School. The property is further identified by Kauaʻi Tax Map Key No. (4) 4-3-03:01. The total acreage of the area is 163.125. (Figure 1 and 2).

The project area lies in the traditional *ahupuaʻa* of Kapaʻa belongs' to the ancient district of Puna (now the district is more commonly called "Kawaihau"), one of five ancient districts on Kauaʻi (King 1935: 228). Puna was the second largest district on Kauaʻi, behind Kona, and extended from Kipu south of Lihuʻe to Kamalomaloʻo, just north of Kealia. For taxation, educational and judicial reasons, new districts were created in the 1840's. The Puna District, with the same boundaries became the Lihuʻe District, named for an important town in that district. In 1878, by the act of King Kalakaua in securing a future name for the new Hui Kawaihau, created the new district of Kawaihau. This new district encompassed the *ahupuaʻa* ranging from Olohena on the south to Kilauea on the north. Subsequent alterations to district boundaries in the 1920's left Kawaihau with Olohena as its southernmost boundary and Moloaʻa as its northernmost boundary (King 1935:222).

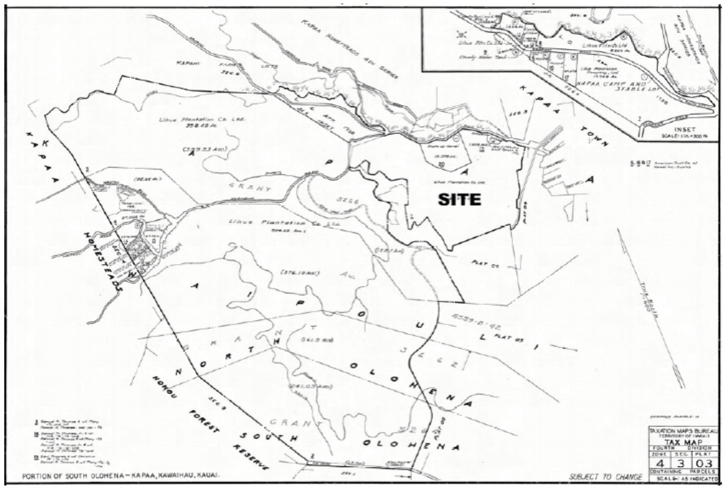


Figure 1. Tax Map Showing the Project Area for Kapaa Highlands Phase II.

Figure 2. Aerial View of Project Area Looking North

Natural Setting

The *ahupuaʻa* of Kapaʻa, is located on the eastern side of the island of Kauaʻi, in the old district or *moku* of Puna. Adjacent and to the north is the *ahupuaʻa of* Keālia, and to the south, Waipouli. Like other *ahupuaʻa* in Puna, Kapaʻa is exposed to the northeast tradewinds and receives 40 to 50 inches of rain a year at the shore and considerably more precipitation inland. The area of the *ahupuaʻa* of Kapaʻa, is approximately 6,394 acres (Gay 1872 R.M. 159, Commission of Boundaries Record, Kauaʻi, vol.1, 1873:23; Commission of Boundaries Record, Kauai, vol. 1, 1872:109). Wichman (1998:84) notes the paradox that Kapaʻa "is one of the largest *ahupuaʻa* of the Puna District [of Kauaʻi] and the most bereft of legends."

Alluvium, colluvium and terrigenous sediments resulting from the erosion of the primary island building events in Kauaʻi history, the Waimea Canyon Volcanic Series and the Koloa Volcanic Series, are the major sources of sediment for the formation of Kauaʻi's non-mountainous region, including Kapaʻa (MacDonald and Abbott 1970:382-384). Kapaʻa is located within the physiographic division known as the Līhuʻe Plain (Armstrong 1973:30). During higher sea levels, terrigenous sediment accumulated further inland as streams released their sediment loads further inland from where the shoreline had encroached. Also, reefs grew with the rising sea level, and, as the sea receded, marine sediments were created and deposited on shore by the erosion of these reefs. Both of these processes were part of the formation of the Līhuʻe Plain.

The soils of the project area reflect the original geologic sediments deposited and the erosional processes induced by climatic agents. Backshore of the sand berm in Kapaʻa, are found sandy loams associated with the Mokuleia soil series (Foote et al. 1972:95). These soils consist of mostly recent alluvium deposited over coral sand and are typical of the eastern and northern coastal plains of Kauaʻi. Behind Kapaʻa Town and north of Moikeha Canal is found mixed fill. South of Moikeha Canal are Mokuleia clay loams, similar to the sandy loams fronting them. The soils found in the sand berm in Waipouli and Olohena are of the Lihue Series, which are characterized as well-drained soils derived from igneous material originating in Kapaʻa's uplands (Foote et al. 1972:82).

Historically, these *ahupuaʻa* contained two prominent landscape features, a coastal plain with sand dunes and a large marsh. An 1872 map (Figure 2) by James Gay delineating the boundaries of Kapaʻa and adjacent lands shows that much of the *makai* region was a "swamp" that extended from Waipouli into Kapaʻa. This "swamp" appears to be the most prominent natural feature of the seaward end of Waipouli and Kapaʻa. The *makai* areas of the *ahupuaʻa* can be characterized as fairly flat. Kapaʻa has an irregularly-

shaped gulches and small valleys in the uplands, through which small tributary streams run, including the Kapahi, Makaleha, Moalepe and Konohiki Streams. While some of these streams combine with other tributaries in neighboring Keālia to form Kapaʻa Stream, which empties into the ocean at the northern border of the *ahupuaʻa*, others flow directly into the marsh areas of Kapaʻa and Waipouli (Handy and Handy 1972:394,423; Territorial Planning Board 1940:9).

Kapaʻa Town areas is built on a sand berm with ocean on the *makai* side and marsh on the *mauka* side. The sand berm was probably slightly wider here than in other localities, but dry land was probably always at a premium.

Moʻolelo of Kapaʻa

A brief overview of some of the better documented mythological and traditional accounts of Kapaʻa is presented below and is followed by a brief summation of their import.

The Puna district of Kauaʻi is well known for two legendary chiefs, Kawelo and Mōʻīkeha. Kawelo is more closely associated with Wailua and Hanamāʻulu and Mōʻīkeha is linked to Kapaʻa. Mōʻīkeha is understood to be the grandchild of Maweke, one of the principal genealogical lines from which Hawaiians today trace their ancestry (Beckwith 1970:352). Sometime between the eleventh and twelfth centuries marks the arrival of Maweke to the Hawaiian Islands. Mōʻīkeha succeeds his older brother Kumuhonua as ruling chief during the time of Mailikūkahi. Kapaʻa is mentioned in traditions concerning Kawelo (Kaweloleimākua), the *moʻo* Kalamainuʻu and the origins of the *hinaʻi hinālea* fish, and the story of Lonoikamakahiki (Fornander 1917:IV:318, 704-705; Rice 1923: 106-108; Thrum 1923: 123-135; Kamakau 1976:80).

1. Mōʻīkeha

Kapaʻa was the final home of the legendary chief Mōʻīkeha. Born at Waipiʻo on the island of Hawaiʻi, Mōʻīkeha sailed to Kahiki (Tahiti), the home of his grandfather, Maweke, after a disastrous flood. On his return to Hawaiʻi, he settled at Kapaʻa, Kauaʻi. Kila, Mōʻīkeha's favorite of three sons by the Kauaʻi chiefess Hoʻoipoikamalani, was born at Kapaʻa and was considered the most handsome man on the island. It was Kila who was sent by his father back to Kahiki to slay his old enemies and retrieve a foster son, the high chief Laʻamaikahiki (Handy and Handy 1972:424; Beckwith 1970:352-358; Kalākaua 1888:130-135; Fornander 1917:IV:160). Mōʻīkeha's love for Kapaʻa is recalled in the *ʻōlelo noʻeau*: *Ka lulu o Moʻīkeha i ka laulā o Kapaʻa* "The calm of Mōʻīkeha in the breadth of Kapaʻa " (Pukui 1983: 157).

The place “Lulu-o-Mōʻīkeha” is described as being situated “near the landing and the school of Waimahanalua” (Akina 1913: 5). The landing in Kapaʻa was known as the Makee Landing and was probably constructed in the late 1870s, along with the Makee sugar mill. Today, in place of the old Makee Landing is part of a

breakwater located on the north side of Moikeha Canal, near the present day Coral Reef Hotel (Bushnell et al. 2002:7).

In the Hawaiian newspaper *Kuʻokoʻa* published at the turn of the century, Akina (1913: 6) also tells the story of how Mōʻīkeha's son, Kila stocks the Hawaiian Islands with the *akule*, *kawakawa* and *ʻopelu* fish. When Kila travels to Kahiki, he seeks out his grandfather Maweke and explains that he is the child of Mōʻīkeha. When Maweke asks Kila if Mōʻīkeha is enjoying himself, Kila answers with the following chant of Puna, Kauaʻi:

My father enjoys the billowing clouds	*I walea no kuʻu makuakāne i ke ao*
over Pöhaku-pili,	*hoʻokanunu, iluna o Pöhakupili*
The sticky and delicious poi,	*I ka poi uouo ono ae no a,*
With the fish brought from Puna,	*Me ka iʻa i na mai o ka Puna,*
The broad-backed shrimp of Kapalua,	*Ka opae hoainahanaha o Kapalua;*
The dark-backed shrimp of Pohakuhapai,	*Na opae kua hauli o Pohakuhapai,*
The potent awa root of Maiakii,	*Na puawa ona mai no o Maiakii,*
The breadfruit laid in the embers at Makialo	*Me ka ulu moelehu mai no o Makialo,*
The large heavy taros of Keahapana	*Me na kalo pehi hua o Keahapana,*
The crooked surf of Makaiwa too	*A i kekee nalu ae no hoi o Makaiwa,*
The bending hither and thither of the reed and rush blossoms,	*A i ke kahuli aku kahuli mai o ka pua uku me ka pua neki,*
The swaying of the kalukalu Puna,	*A i ka nuʻa ae no o ke kalukalu o Puna,* grasses of
The large, plump, private of my mothers,	*A i na mea nui nepunepu no a kuʻu mau* parts *makuahine*
Of Hoʻoipoikamalanai and Hinau-u,	*O Hoʻoipoikamalanai me Hinau-u,*
The sun that rises and sets,	*A i ka la hiki ae no a napoo aku,*
He enjoys himself on Kauaʻi,	*Walea ai no ka nohona ia Kauaʻi,*
All of Kauaʻi is Möʻikeha's	*Ua puni a puni Kauaʻi ia Möʻikeha*

Maweke was delighted and when the boy is questioned as to his purpose, Kila tells his great grandfather he is seeking fish for his family. Maweke tells Kila to lead the fish back to his homeland. This is how Kila led the *akule*, *kawakawa* and *ʻöpelu* to Hawaiʻi (Fornander 1917:IV:162-163).

In another legend of Kila, Möʻikeha sends his son to Tahiti to slay his enemies. Upon reaching Tahiti, Kila meets his father's aunt, Kanepohihi, in the form of a blind, supernatural rat. He introduces himself, sending his father Möʻikeha's greetings. Kanepohihi asks of Möʻikeha, and Kila responds:

He is indulging in ease in Kauaʻi	*I walea ia Kauaʻi*
Where the sun rises and sets again,	*I ka lā hiki ae a pö iho*
Where the surf of Makaiwa curves and	*I ke kee a ka nalu o Makaiwa* bends,
Where the sun comes up over	*I ka hiki mai a ka la maluna*
The kalukalu of Kewa;	*O ke kalukalu o Kewa*
The stretched out waters of Wailua,	*O ka wai halau o Wailua*
And the entrancing favors of my mother	*O ka lealea o ka mai o kuu makuahine*
Hoʻoipoikamalanai	*O Hoʻoipoikamalanai*
He will live and die in Kauaʻi	*O kahi noho no o Kauaʻi a make*
(Fornander 1916:IV:162-163)	

2. Kaʻililauokekoa the Chiefess of Kapa'a and the Lute Kanikawi

Waipouli and Kapaʻa are mentioned in the legend of Kaʻililauokekoa, a chiefess of Kapaʻa and granddaughter or daughter of Möʻikeha. Thomas Thrum (1907: 83-84) relates that:

> [Kaililauokekoa's] greatest desire was to play konane, a game somewhat resembling checkers, and to ride the curving surf of Makaiwa (*keʻekeʻe nalu o Makaiwa*), a surf which breaks directly outside of Waipouli, Kapaʻa. She passed the larger part of her time in this matter every day, and because of the continual kissing of her cheeks by the fine spray of the sea of Makaiwa, the bloom of her youth became attractive ʻas a torch on high,' so unsurpassed was her personal charm.

In the Thrum (1923:123-135) version, Kaʻililauokekoa is seduced by the nose flute of Kauakahialiʻi who is at the time residing in Wailua uka at a place called Pihanakalani. She travels up to Pihanakalani with her companion where she joins Kauakahialiʻi as his wife. They are found by Möʻikeha's people and taken down to Kapaʻa where Kauakahialiʻi is imprisoned. A boy named Kalukaluokewa takes pity on Kauakahialiʻi and sneaks through the *kalukalu* grass and the *ahuawa* rushes to bring the prisoner food and water. Meanwhile, Ka´ililauokekoa tells her parents of her calling by Kanikawi to the home of Kahalelehua at Pihanakalani and her encounter with Kauakahiali'i.

3. Kalukalu grass of Kapa'a

"*Kūmoena kalukalu Kapa'a*" or "Kapa'a is like the *kalukalu* mats" is a line from a chant recited by Lonoikamakahiki. *Kalukalu* is a sedge grass, apparently used for weaving mats (Fornander 1917:IV:318-319). Pukui (1983:187) associates the *kalukalu* with lovers in "*ke kalukalu moe ipo o Kapa'a*"; "the *kalukalu* of Kapa'a that sleeps with the lover." According to Wichman (1998:84), "a *kalukalu* mat was laid on the ground under a tree, covered with a thick pile of grass, and a second mat was thrown over that for a comfortable bed," thus the association with lovers. Kaua'i was famous for this peculiar grass, and it probably grew around the marshlands of Kapa'a. It is thought to be extinct now, but an old-time resident of the area recalled that it had edible roots, "somewhat like peanuts." Perhaps it was a famine food source (Kapa'a Elementary School 1933: VI).

4. Pāka'a and the wind gourd of La'amaomao (Keahiahi)

Kapa'a also figures prominently in the famous story of Pāka'a and the wind gourd of La'amaomao. Pāka'a was the son of Kuanu'uanu, a high-ranking retainer of the Big Island ruling chief Keawenuia'umi (the son and heir to the legendary chief 'Umi), and La'amaomao, the most beautiful woman of Kapa'a and member of a family of high status *kahuna*. Kuanu'uanu left the island of Hawai'i, traveled throughout the other islands and finally settled on Kaua'i, at Kapa'a. It was there that he met and married La'amaomao, although he never revealed his background or high rank to her until the day a messenger arrived, calling Kuanu'uanu back to the court of Keawenuia'umi. By that time, La'amaomao was with child but Kuanu'uanu could not take her with him. He instructed her to name the child, if it turned out to be a boy, Pāka'a. Pāka'a was raised on the beach at Kapa'a by La'amaomao and her brother Ma'ilou, a bird snarer. He grew to be an intelligent young man and it is said he was the first to adapt the use of a sail to small fishing canoes. Although Pāka'a was told by his mother from a very young age that his father was Ma'ilou, he suspected otherwise. After constant questioning by Paka'a, La'amaomao told her son the truth about Kuanu'uanu.

Intent on seeking out his real father, Pāka'a prepared for the journey to Hawai'i Island. His mother presented him with a tightly covered gourd containing the bones of her grandmother, also named La'amaomao, the goddess of the winds. With the gourd and chants taught to him by his mother, Pāka'a could command the forces of all the winds in Hawai'i. While this story continues on at length about Pāka'a and his exploits on Hawai'i and later

on Moloka'i, it will not be dwelt upon further here. It is important to note that several versions of this story do include the chants which give the traditional names of all the winds at all the districts on all the islands, preserving them for this and future generations (Nakuina 1990; Rice 1923:69-89; Beckwith 1970:86-87; Thrum 1923:53-67; Fornander 1918:V:78-128).

Frederick Wichman (1998:84) writes that Pāka'a grew up on a headland named Keahiahi just south of Kapa'a River. Here, Pāka`a learned to catch *mālolo*, his favorite fish. After studying the ocean and devising his plan to fabricate a sail, Pāka'a wove a sail in the shape of a crab claw and tried it out on his uncle's canoe. One day, after going out to catch *mālolo*, he challenged the other fishermen to race to shore. He convinced them to fill his canoe with fish suggesting it was the only way he could truly claim the prize if he won:

> The fishermen began paddling toward shore. They watched as Pāka'a paddled farther out to sea and began to fumble with a pole that had a mat tied to it. It looked so funny that they began to laugh, and soon they lost the rhythm of their own paddling. Suddenly Pāka'a's mast was up and the sail filled with wind. Pāka'a turned toward shore and shot past the astonished fishermen, landing on the beach far ahead of them. That night, Pāka'a, his mother, and his uncle had all the mālolo they could eat [Wichman 1998:85].

5. Kaweloleimakua

Kapa'a is also mentioned in traditions concerning Kawelo (Kaweloleimakua), Keililauokekoa (Moikeha's daughter, or granddaughter, dependent on differing versions of the tale), the *mo'o* or reptile Kalamainu'u and the origins of the *hina'i hinalea* or the fish trap used to catch the *hinalea* fish, and the story of Lonoikamakahiki (Fornander 1917, vol.4 pt.2:318, vol.4 pt.3:704-705; Rice 1923:106-108; Thrum 1923:123-135; Kamakau 1976:80).

6. Kanaka-Nunui-Moe-The Sleeping Giant

Frederick B. Wichman relates an account of Kaua'i's Sleeping Giant:

> A long time ago, there was a giant living in Kawaihau among the low hills behind Kapa'a town. He was so tall he could see above the coconut trees. If he sat very still, it was easy to mistake him for one of the hills. Anyone who did not know him was afraid of his great size, fearing

the damage he might cause. However the people of Kawaihau loved him, for he was very friendly and went out of his way to be useful.

This giant was always careful where he stepped so that he would not injure anyone and he never destroyed taro patches or houses with a careless foot. When he wished to rest, he sat on one of the small hills above Kapa'a. The villagers were glad when this happened for his weight flattened the hilltop, making another plot of ground fit for cultivation.

"He is very helpful," the Kapa'a people said to astonished stranger who came to their land. "He does many things for us quickly that otherwise we could not do in many months."Wherever this giant stepped he left keep footprints and in these deep holes the people planted banana trees. The villagers threw leaves, taro peelings, and other vegetable rubbish into these holes. When compost had been formed, they planted banana sprouts. In this way, the people of Kapa'a always had ripe bananas to give to the giant, for banana was his favorite food.

The giant yawned very often, for he was always sleepy. The gust of wind from his mouth often knocked down houses and blew the grass thatch into the sea. The giant was always very apologetic whenever this happened and he quickly brought logs from the uplands to rebuild the fallen houses and gathered *pili* for the thatching.

He found it difficult to stay awake more than a hundred years at a time. When he could no longer fight against the drowsiness overpowering him, he would sleep using a small hill for a pillow. Because of this, the people called him Kanakanunui-moe, the sleeping giant.

When he slept, Nunui slept for hundreds of years while the winds blew dirt over him and seeds were dropped there by the birds. The gently showers sent by *Kahale-lehua*, goddess of the gentle rains, fed these seeds and forest grew up over the giant. When Nunui awoke and stretched, the people of Kapa'a fled in great fear, for what they had thought to be a hill had come alive.

One time, while Nunui was still awake, the high chief of Kawaihau wanted to build a large *heiau* to honor one of his gods. This was to be no ordinary temple. The chief wanted water-polished rocks for the walls and hard *koa* wood from Kokee for the framework of the god's house.

So the chief told the Kawaihau people what he wanted them to do. They must gather rocks from the golden brown waters of the Koke`e streams and

cut *koa* trees on the edges of Waimea canyon, and gather *pili* grass that grew at Mana. "All this must be done in the turn of one moon," he ordered.

The unhappy people left their chief and silently returned to their village. The giant Nunui, stepping carefully among them, saw the long faces of the people.

"What is wrong?" he asked.

The Kapa'a villagers told him what they must do within the impossibly short time. "This cannot be done," the people said in low, sad voices. "How can we go to Kokee and bring back stones enough to build the walls in that time? And cut down the *koa* trees and bring the logs here and build the sacred house? And even if we do these things, who will cultivate our fields?"

Nunui smiled gently. "Tend to your fields," he said. "This work is nothing for me, and I'll gladly help you. Besides, it will give me something to do."

The giant went to Kokee and scooped up smooth, round boulders from the golden brown waters and brought them to Kapa'a. "Chief," he called to the astonished ruler, "show me where you wish to build this *heiau.*"

The amazed chief pointed out the place set aside for the temple. Nunui placed the rocks to form a wall, fitting them so closely together that not even a mouse could squeeze between the cracks. Within a week, he had built a strong, thick, handsome wall around the sacred place.

Nunui returned to the edge of Waimea Canyon and cut down *koa* trees and trimmed them into the shaped he needed. He carried these back and made the framework of the house. He gathered *pili* grass form Wild and wrapped the stems into bundles, tied these bundles to the framework, and within half the time the chief had set, the *heiau* was finished.

Everyone was happy. The farmers had been able to keep up with their chores, the chief had his *heiau,* and Nunui had something to do. There was even time enough a celebration. The chief ordered all his people to gather bananas and to pound sweet potatoes and taro into poi. Some people hurried to slaughter pigs and dogs to be cooked in the *imu,* while other paddled out to sea to fill their canoes with fish and sent their wives to gather seaweed and *opihi* from the reef. At last, enough food for everyone was ready, and the chief, the villagers, and Nunui sat down before the overflowing bowls and platters.

"Eat," said the chief to Nunui. "After the work you have done, you must be hungry."

The giant ate all the food that had been put before him. When he was through, his stomach bulged and he was very sleepy. He chose a comfortable hill just a short distance above Kapa'a town. Nunui stretched a last time, lay down along the top of the hill, and soon was sound asleep.

As he slept through the years, the winds blew dirt over him and the birds brought seeds. Ka-hale-lehua, goddess of the gentle rains, sent showers to water the plants that now covered the giant.

So Kanaka-nunui-moe sleeps and sleeps and has come to resemble a long hill with a lump at one end where his nose is and lumps at the other ends where his feet are. He no long looks like a living being, but one day, perhaps soon, his eyes will open, he'll yawn and stretch his arms, and sit up. [Wichman 1985:13-16]

7. Lepeamoa

In the Legend of "Lepeamoa (The Chicken Girl of Palama)"(Thrum 1923:177) is a reference to a fantastic battle at Kapa'a between Lepeamoa's brother, the hero Kauilani and a supernatural kupua called Akuapehuale ("god of swollen billows"):

Kauilani struck him a heavy blow and the spear leaped again and again upon him, till he rolled into a mountain stream at a place called Kapa‘a, out of which he crawled, almost drowned. Then he was driven along even to the image houses, where a fierce battle took place, in which the wooden images took part, many of them being torn to pieces by the teeth of Akuapehuale.

8. Palila and Ka`ea

High in the *mauka* region of Kapa‘a in the Makaleha mountains at a place called Ka`ea, is reported to be the supernatural banana grove of the Kaua`i *kupua* or demigod Palila, grandson of Hina (Handy and Handy 1972:424). Joseph Akina for *Kieoko 'a* Newspaper in 1913 describes Palila's banana grove:

The stalk could hardly be surrounded by two men, and was about 35 feet high from the soil to the lowest petiole. The length of the cluster from stem to lowest end of the bunch of bananas was about 1 $^3/4$ fathoms long (one *anana* and one *muku).* There were only two bananas on each about 4 '/2 inches around the middle. There were just two bananas, one on the east side and one on the west, each about a foot or more in length. The one on the east side was tartish, like a *waiawi* (Spanish guava) in taste and the one on the west was practically tasteless. The diameter of the end of the fruit stem of this banana seemed to be about 11/2 feet. This kind of banana plant and its fruit seemed almost supernatural... (Akina, 1913:5).

Exploration Associates Ltd.

9. Winds

The winds of Kapa‘a and Waipouli are named in the *mo‘olelo* of Kuapaka‘a and these include the *kehau* for Kapa‘a, the *ho‘olua* for Makaiwa and the *inuwai* for Waipouli (Fornander 1917:IV:96). A *kama‘āina* interviewed for the 50th anniversary book of Kapa‘a School in 1933 (p. 28) identified the winds of Kapa‘a:

...Some persons call the wind MAKANI LIHUE: That is, those who live here in Kapa‘a, because the wind comes from Lihue. The wind we had on Jan. 30 was really, MAKANI LIHUE. The wind that comes from Hanalei is called MAKANI KIU which means, a very cold wind. The wind that comes from the northeast—(tradewind) is called MAKANI HOOLUA. This is the plant destroying wind...

Place Names and Wahi Pana of Kapa‘a

Place names and *wahi pana* (“legendary place”) (Pukui and Elbert 1986:377) are an integral part of Hawaiian culture. “In Hawaiian culture, if a particular spot is given a name, it is because an event occurred there which has meaning for the people of that time” (McGuire 2000:17). The *wahi pana* were then passed on through language and the oral tradition, thus preserving the unique significance of the place. Hawaiians named all sorts of objects and places, points of interest that may have gone unnoticed by persons of other cultural backgrounds.

Hawaiians named taro patches, rocks and trees that represented deities and ancestors, sites of houses and *heiau* (places of worship), canoe landings, fishing stations in the sea, resting places in the forests, and the tiniest spots where miraculous or interesting events are believed to have taken place. (Pukui et al. 1974:x)

The following is a list of place names for Kapa‘a, mentioned in this report. This list should by no means be considered complete. Place names were gathered from traditional literature (*mo‘olelo*, chants), historical sources, maps and the Māhele records. Almost all of the *‘ili* names were taken from Land Commision Award records. Sadly, none of these *‘ili* names were documented on historic maps researched for this project, and their meanings and cultural associations appear to be lost and forgotten.

Place Names of Hawai´i (Pukui et al. 1974) was used as the primary source for all place name translations. Where there were no known translations, a literal translation of the place name was sometimes made using the *Hawaiian Dictionary* (Pukui and Elbert 1986). The intent of the author is merely to present the available information and let the reader come to his/her own conclusions.

An attempt was made to include the proper diacritical marks for all known and generally accepted translations of place names. Making incorrect assumptions about the pronunciation and where to place the diacritical marks in a name can entirely change the meaning of a name, (e.g. *pū'ā'ā*: "scattered; to flee in disorder and fright"; *pua'a*: "pig, pork"). Therefore, in cases where the pronunciation of a name was uncertain, diacritical marks were not used and no attempt was made to translate the name. In some cases, cultural relationships were made based on the literal translation of the root word.

One of the beauties of the Hawaiian language is the dualism in names and the double meanings—the literal meaning and the *kaona* or hidden meaning. It should be remembered that the true significance of a place name lies only with the people who use them and know their history.

The following abbreviations are used throughout the Place Names section for ease and efficiency. (Refer to the References section for complete citations.)

LCA=Land Commission Award

PE=Hawaiian Dictionary by Pukui and Elbert, 1986

PEM=Place Names of Hawai´i by Pukui, Elbert and Mookini, 1974

Table 1 Place Names of Kapa'a.

Name	Meaning	Reference
Apopo	Land division, possibly ʻili in Kapaʻa, pali, Literally "tomorrow"?	(LCA #10907/#8343) Soehren (2002:265)
Awawaloa	The name of a land division, possibly an ʻili in Kapaʻa in which lo'i were cultivated meaning - long valley, gulch, ravine.	(LCA #8843/#8837), (Soehren, 2002:265)
Hahanui /Kahanui	The name of an ʻili in Kapaʻa where loʻi were claimed pali, stream, Lobelia plant?	(LCA #10564/#3554/#3599), (Soehren, 2002:265)
Hoa	Pali, Literally "Friend"?	(LCA#3638:1) (Soehren, 2002:265)
Hoʻopiʻi	Wailele, Literally "To cause to rise?"	(Soehren, 2002:265)
Humuʻula	Puʻu, Literally "Jasper stone?"	(LCA #8247) (Soehren, 2002:265)
Kahana	The name of a land, possibly an ʻili in Kapaʻa where uncultivated loʻi were claimed Literally, "cutting"	(LCA 3971). (PEM: 63), (Soehren, 2002:265)

Name	Meaning	Reference
Kaiakea/Kaikea	Name of area encompassing Kuahiahi Point. "Kaikea: White sea foam, especially as washed up on a beach: kaʻikeʻa: Station of the cross (Catholic); procession of the cross"	(PE:116).
Kalolo/Kaloko	The name of a village or houselot in Kapaʻa Ahupuaʻa Kauhale, kula, Literally, "the pond", " liquor"	(LCA#3638, #8843), (Soehren, 2002:265)
Kaloloku	Name of swamp in back of Kapaʻa and Waipouli	
Kamahuna	Puʻu	(Soehren, 2002:265)
Kamaliʻi	Ridge, Literally "Children"	(Soehren, 2002:265)
Kapaʻa	Ahupuaʻa name, Literally "solid" or "the closing"	(Wichman, 1988:84 and Soehren, 2002:265)
Kapahi	Village, stream, Literally "the Knife"	(Soehren, 2002:265)
Kapeku	Loʻi, Literally "the Kick"	LCA# 8837, (Soehren, 2002:265)
Kaulolo	Kauhale	LCA# 3638, (Soehren, 2002:265)
Kehau	Name of wind of Kapaʻa	(Fornander, 1918:V:96, 97)
Keiwa	Ridge, boundary point, Literally "The ninth"	(Soehren, 2002:265)
Koalua	Surf, Literally "Two coral heads",	Finney 1959, (Soehren, 2002:265)
Kolehaka	Pali,	LCA#3971/#3243 (Soehren, 2002:265)
Kolokolo	Name of deep fresh water pond, Literally "Soap Plant"	Wichman (1988:84)
Kolouna	Pali,	LCA# 8247, (Soehren, 2002:265)
Kuahiahi/Kaahiahi	Name of rocky headland at north end of Kapaʻa Ahupuaʻa;	
Kuahiahi/Keahiahi	Location of first Kapaʻa School (1883-1908); location of former heiau called Kuahiahi, place where the legendary figure Pakaʻa, keeper of the wind gourd of Laʻamaomao, grew up and fished Literally "twilight"	(PEM 211 :216) ; (Wichman 1998 : 85)
Kupaliʻi	Name of a pond in Puna district famed in chant for the rustling of the manienie grass	(PEM: 211-216)

Name	Meaning	Reference
Kupanihi	The name of a pond in the Puna district associated with Kaeo, Kaumuali'i's older brother, ili, kauhale, Name of fishpond and land in Kapa'a claimed	(PEM:216); in LCA #3971/#3243, (Soehren, 2002:265)
Maeleele	The name of a land division, possibly an 'ili in Kapa'a in which lo'i Literally "Numb" were cultivated,	(LCA #3638), (Soehren, 2002:265)
Makaleha	Pu'u, boundary point, Eyes looking about as in wonder and admiration,	Boundary Commission, (Soehren, 2002:265)
Makanalimu	Place, heiau, Literally "Gift of seaweed"	PEM:141
Makea	'Auwai, Literally "fallow land"	LCA# 3599/#3554 (Soehren, 2002:265)
Moalepe/Moalepi	Hill in the mauka region of Keālia (HAS, Interior Dept., Land, June 23, 1862); land division, stream possibly an 'ili in mauka region of Kapa'a	LCA #8247 (Soehren, 2002:265)
Moikeha Canal	Canal which is traversed by two plantation era railroads near the present day Kapa'a Public Library and the Coral Reef Hotel	
Naele	Pali, Literally "swamp, big"	LCA #8837, (Soehren, 2002:265)
Paikahawai	'ili,	(Soehren, 2002:265)
Pohakiikii	Pu'u, Tilted stone,	(Soehren, 2002:265)
Pohakupili	Pu'u, boundary point, Literally " joined stone",	(Soehren, 2002:265)
Poo	Surf, Literally "Head"	Finney 1959, (Soehren, 2002:265)
Pueo	Pali, Literally "owl",	LCA# 8843, (Soehren, 2002:265)
Puhi	The name of a village or household in Kapa'a Ahupua'a, Kauhale, pond, Literally "eel",	LCA #3554/#3599, (Soehren, 2002:265)
Puohomaka	Pali,	LCA# 8837, (Soehren, 2002:265)
Pupukai	Pali,	LCA# 3638, (Soehren, 2002:265)
Puu Ekeeke	Pali,	LCA# 8837, (Soehren, 2002:265)
Puu Lauii	Pu'u, boundary point, Laui'i fern hill,	Boundary Commission,(Soehren, 2002:265)
Ulakiu	Ku,	LCA# 8837, (Soehren, 2002:265)
Ulukiu	Name of a houselot or village in Kapa'a	(LCA #8837

Name	Meaning	Reference
Waika'ea	Canal and boat ramp in Kapa'a adjacent to the present day Pono Kai Resort, ditch,	(Clark 2002:374), (Soehren, 2002:265)
Waikaeee	A place described as being located in the uplands near Nounou	(PEM Placenames, Ku'oko'a, May 2, 1913)
Waileia	Rock, boundary point, Literally "Abundant Water"	Boundary Commission, (Soehren, 2002:265)
Waimahanalua	Name of a stream and school located near the old Makee The name mahanalua suggests the stream was forked and fed by multiple streams which could well be the case since the backlands of Kapa'a were swamplands fed by many streams. near the present day Moikeha Canal.	(PEM Placenames, Ku'oko'a May 9, 1913).
Waitala	"local" name used to refer to Waika ´ea Canal	(T. Sokei, July 28, 2003 in Bushnell et.al. 2004)

Summary of the Mythological and Traditional accounts of Kapa'a

A survey of traditional mythological literature shows Kapa'a prominently associated with some of the most famous legendary and historical figures including Maui, Kawelo, Mo'ikeha, Maweke, Palila, Paka'a and Kanaka Nunui Moe. What few specific references there are suggest that high status habitation was focused near the coast with less intensive utilization of the uplands which were regarded as wild places. The most notable feature of the traditional accounts are the references to grasses and sedges *(Kalukalu* grass and *Ahuawa* rushes) which undoubtedly reflects in part the natural marsh lands near the coast but may also reflect transformation of the landscape through a denudation of trees by the activities of a relatively dense population harvesting slow growing trees for firewood and construction materials over many centuries.

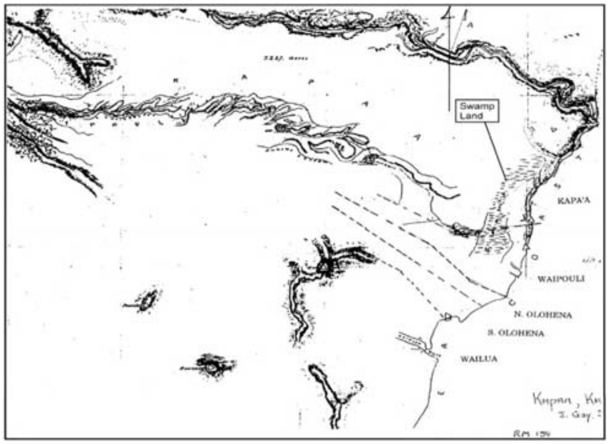


Figure 3. Portion of 1872 Survey Map by James Gay, Showing Swamp Land in Puna.

Early Post-Contact Period

Very few recorded observations exist for this period in Kapa'a's history. George Vancouver (1798:2:221-223) examined the east coast of the island from his ship in 1793 and stated that it was the "most fertile and pleasant district of the island..." However, he did not anchor nor go ashore there due to inhospitable ocean conditions.

Kiaimakani stands out as a particularly interesting Hawaiian chief in the early post-contact history of Waipouli. In 1824, the brig, "Pride of Hawaii," owned by Liholiho (Kamehameha II), ran aground in Hanalei Bay. Hiram Bingham (1847:221-222) recorded the efforts of a great crowd of Hawaiians to pull the vessel to shore for salvage:

> Kiaimakani passed up and down through the different ranks, and from place to place, repeatedly sung out with prolonged notes, and trumpet tongue... 'be quiet - shut up the voice.' To which the people responded...'say nothing,' as a continuance of the prohibition to which they were ready to assent when they should come to the tug. Between the trumpet notes, the old chieftain, with

> the natural tones and inflections, instructed them to grasp the ropes firmly, rise together at the signal, and leaning inland, to look and draw straight forward, without looking backwards toward the vessel. They being thus marshalled and instructed, remained quiet for some minutes, upon their hams.

The salvage efforts ultimately failed and the brig was lost. Bingham's account vividly suggests the force of personality of the chief and further betokens an authority and stature that may have been founded upon the traditional prestige of his domain, Waipouli.

Kiaimakani appears in Samuel Kamakau's account (1961:267) of the 1824 rebellion of the chiefs of Kaua'i upon the death of Kaumuali'i. Kalanimoku, representative of Kamehameha II, had called a council of the Kaua'i chiefs at Waimea during which he announced

> "The lands shall continue as they now stand. Our son, Kahala-i'a, shall be ruler over you." A blind chief of Waipouli in Puna, named Ki'ai-makani, said, "That is not right; the land should be put together and re-divided because we have a new rule," but Ka-lani-moku would not consent to this.

After some Kaua'i chiefs, including Kiaimakani, rebelled against the imposed decrees:

> On August 8 [1824] the battle of Wahiawa was fought close to Hanapepe. The Hawaii men were at Hanapepe, the Kauai forces at Wahiawa, where a fort had been hastily erected and a single cannon (named Humehume) mounted as a feeble attempt to hold back the enemy...Large numbers of Kauai soldiers had gathered on the battleground, but they were unarmed save with wooden spears, digging sticks, and javelins...No one was killed on the field, but as they took to flight they were pursued and slain. So Kia'imakani, Na-ke'u, and their followers met death [Kamakau 1961: 268].

Kamakau´s singling out of Kiaimakani for special mention reinforces the impression that the chief and his *ahupua'a* may have shared a traditional prestige.

In 1840, Peale and Rich, with Charles Wilkes' United States Exploring Expedition, traversed the coastline there on horseback heading north from Wailua:

> The country on the way is of the same character as that already seen. They passed the small villages of Kuapau, Keālia, Anehola, Mowaa, and Kauharaki, situated at the mouths of the mountain streams, which were closed with similar sand-bars to those already described. These bars afforded places to cross at, though requiring great precaution when on horseback. The streams above the bars were in most cases deep, wide, and navigable a few miles for canoes. Besides the sugarcane, taro, &c., some good fields of rice were seen. The country may be called open; it is covered

> with grass forming excellent pasture-grounds, and abounds in plover and turnstones, scattered in small flocks [Wilkes 1845:69].

James Jarves (1844:157), who tracked much of the same route as Peale and Rich, noted "nothing of particular interest is met with on the road, until arriving at Anahola."

The Mahele Period

The Organic Acts of 1845 and 1846 initiated the process of the Mahele, which introduced private property into Hawaiian society. It is through information garnered from records for Land Commission Awards (LCAs) generated during the Mahele that specific documentation of traditional life in Kapa'a come to light.

Table 2. Mahele Land Claims and Land Use of Kapa'a.

LCA Number	Ahupua'a	Claimant	ʻIli of the Ahupua'a	Land Use	Number of ʻĀpana
3243 (See 3971)	Kapa'a	Honolii, Ioane	Kahana, Kupanihi Village	6 *lo'i* (uncult), house lot	2 (2 acres, 1 rood, 1 ord)
3554	Kapa'a	Keo	Kahanui Puhi Village	15 *lo'i*, house lot	2 (7 acres, 1 rood, 17 rods)
3638	Kapa'a	Huluili	Maeleele Kaloko Village	12-15 *lo'i*, house lot	2 (5 acres, 1 rood, 19 rods)
8247	Kapa'a	Ehu	Moalepe / Noalepe	20 *lo'i*,	1 (3 roods)
8837	Kapa'a	Kamapaa	Ulukiu lalo Awawaloa Ulukiu	3 *lo'i*, 2 *lo'i*, house lot	1 (2 acres, 2 roods, 27 rods)
8843	Kapa'a	Kiau	Apopo Kalolo Village	6 (5) *lo'i* and *kula*, house lot	2 (2.75 acres, 3 rods)
10564	Kapa'a	Oleloa, Daniel	Hikinui farm	fishpond, 10 *lo'i*	

Kapa'a Land Commission Awards

Documents relating to Land Commission Awards (*kuleana*) during this period show, surprisingly, that only six individuals were awarded *kuleana* parcels in the relatively large *ahupua'a* of Kapa'a. Five of the six received multiple parcels and show characteristic similarities. They are Keo (LCA #3554, 3599), Kiau (#8843), Kamapaa (#8837), Ioane Honolii (#3971), and Huluili (#3638) (See Table 1). All five had *lo'i* on the *mauka* side of the lowland swamp area, sometimes extending a short distance up into small, shallow gulches and valleys. Each also had a separate house lot located on the *makai* side of the swamp, adjacent to the beach.

Interestingly, the residential "village" of Kapa'a did not exist as a single entity, but was a series of small settlements or compounds that stretched along the shoreline of the *ahupua'a* and included (south to north) Kupanihi (Makahaikupanihi), Kalolo (Kaulolo), Puhi, and Ulukiu. The sixth individual, Ehu (#8247), was the only person to be awarded a single parcel in the upland area of Kapa'a at Moalepe valley, approximately five miles from the shore. In 1848, when Ehu made his claim, he was the only one living there. A few years later, according to Honoli'i's testimony to support Ehu's claim, "There are no houses and no people now living on the land. Ehu found himself lonely there, all his neighbors having either died or left the land. Ehu now lives in Wailua." Ehu may have been the last person to live at and cultivate in the traditional way the far *mauka* region of Kapa'a.

A check of the Foreign Testimony (F.T) for *Kuleana* Claims to Quiet Land Titles in the Hawaiian Islands (1848-50) reveals the names of three *'auwai* in Kapa'a. Cross-referencing this information with various maps gives a general indication of their location: Makahaikupanihi, along the southern border near the shore and the settlement in Waipouli; Makea, near the current Kapa'a Public Library on the *mauka* side of Kūhiō Highway; and Kapa'a, probably along the current Kanaele Road.

There were no *kuleana* claims found within the project area.

The Late 1800s

In 1849, a son of Wai'oli missionaries, William P. Alexander, recorded a trip he took around Kaua'i. Although, he focuses on the larger mission settlements like Koloa and Hanalei, he does mention Kapa'a:

> A few miles from Wailua, near Kapa'a, we passed the wreck of a schooner on the beach, which once belonged to Capt. Bernard. It was driven in a gale over

> the reef, and up on the beach, where it now lies. A few miles further we arrived at Kealia. We had some difficulty crossing the river at this place, owing to the restiveness of our horses. The country here near the shore was rather uninviting, except the valley which always contained streams of water (Alexander, 1991: 123).

In later years, the notorious Kapa'a reef was to become the location of many shipwrecks particularly once a landing was built there in the 1880s.

Although most of the historic record documents for Kaua'i in this period revolve around missionary activities and the missions themselves, there was indication that the Kapa'a area was being considered for new sugar cane experiments, similar to those occurring in Koloa. In a historic move, Ladd and Company received a 50 year lease on land in Koloa from Kamehameha III and Kaua'i Governor Kaikio'ewa of Kaua'i. The terms of the lease allowed the new sugar company "the right of someone other than a chief to control land" and had profound effects on "traditional notions of land tenure dominated by the chiefly hierarchy" (Donohugh, 2001: 88). In 1837, a very similar lease with similar terms was granted to Wilama Ferani, a merchant and U.S. citizen based in Honolulu (Hawai`i State Archives, Interior Dept., Letters, Aug. 1837). The lease was granted by Kauikeaouli or Kamehameha III for the lands of Kapa'a, Kealia and Waipouli for twenty years for the following purpose:

> ...for the cultivation of sugar cane and anything else that may grow on said land, with all of the right for some place to graze animals, and the forest land above to the top of the mountains and the people who are living on said lands, it is to them whether they stay or not, and if they stay, it shall be as follows: They may cultivate the land according to the instructions of Wilama Ferani and his heirs and those he may designate under him... (Hawai`i State Archives, Interior Dept., Letters, Aug. 1837).

Unlike Ladd & Company which eventually became the Koloa Sugar

Company, there is no further reference to Wilama Ferani and his lease for lands in Kapa'a, Kealia and Waipouli. In a brief search for information on Honolulu merchant, Wilama Ferani, nothing was found. It is thought that perhaps Wilama Ferani may be another name for William French, a well known Honolulu merchant who is documented as having experimented with grinding sugar cane in Waimea, Kaua'i at about the same time the 1837 lease for lands in Kapa'a, Kealia and Waipouli was signed (Joesting, 1984: 152).

The sugar industry came to the Kapa'a region in 1877 with the establishment of the Makee Sugar Company and subsequent construction of a mill near the north end of the present town. Cane was cultivated mainly in the upland areas on former *kula* lands. The first crop was planted by the *Hui* Kawaihau, a group composed of associates of King

David Kalākaua. The king threw much of his political and economic power behind the project to ensure its success (Dole 1929:8-15). The *Hui* Kawaihau was originally a choral society begun in Honolulu whose membership consisted of many prominent names, both Hawaiian and *haole*. It was Kalakaua's thought that the *Hui* members could join forces with Makee, who had previous sugar plantation experience on Maui, to establish a successful sugar corporation on the east side of Kaua'i. Captain Makee was given land in Kapa'a to build a mill and he agreed to grind cane grown by *Hui* members. Kalakaua declared the land between Wailua and Moloa'a, the Kawaihau District, a fifth district and for four years the *Hui* attempted to grow sugar cane at Kapahi, on the plateau lands above Kapa'a. After a fire destroyed almost one half of the *Hui's* second crop of cane and the untimely death of one of their principal advocates, Captain James Makee, the *Hui* began to disperse and property and leasehold rights passed on to Makee's son-in-law and new Makee Plantation owner, Colonel Z. S. Spalding (Dole, 1916: 14). As part of the infrastructure of the new plantation, a sugar mill was erected and the Makee Landing was built in Kapa'a during the early years of the Makee Sugar Plantation. Following Captain Makee's death, Colonel Spalding took control of the Plantation and in 1885 moved the mill to Kealia (Cook, 1999: 51). The deteriorating stone smokestack and landing were still there well into the 1900s (Damon, 1931:359).

A train line went inland from Kapa'a Town from the coast along the present Lehua Street alignment heading south behind Kapa'a Town. This railroad line skirts the rice lands behind Kapa'a Town. Another branch ran between Hauaala and Hundley Roads and the branch from behind Kapa'a Town joined the Hauaala/Hundley railroad alignment where the proposed corridors for this project join the present Kūhiō Highway. The train line continued north to the Keālia (Kapa'a) River. Chinese rice farmers had begun to cultivate the lowlands of Kapa'a with increasing success about this same time. Several Hawaiian *kuleana* owners leased or sold outright their parcels *mauka* of the swampland to rice cultivators. Concurrently, the economic activity as a result of the rice and sugar cultivation sparked interest in the house lot *kuleana* on the *makai* side of the marsh for increasing commercial and residential development (Lai 1985:148-161). This land was drained and used for cane in the early 20th century before more recent urbanization of the area.

Narrow wagon roads gave way to macadamized roads in the early part of the 20th century. This new road was called the Kaua'i Belt Road and parts of it are thought to have followed the "Old Government Road" (Cook, 1999). In Kapa'a, the present day Kuhio Highway probably follows the same route as the original Government Road and subsequent Kaua'i Belt Road. The location of the *kuleana* awards in Kapa'a indicates that the majority of the house lots were situated along the Government Road. LCA 3243 names a "road" as one of its boundaries.

20th Century History of Kapaʻa

In the early 1900s, government lands were auctioned off as town lots in Kapaʻa Town to help with the burgeoning plantation population. Many of these lots were purchased by Portuguese and Japanese laborers who had fulfilled their contract duties with Makee Plantation. One *kamaʻāina* interviewed for a previous project in Kapaʻa mentioned that in the 1930s and 1940s, the area north of Moʻikeha Canal in Kapaʻa was mostly settled by Portuguese families (W. Kaneakua in Bushnell et al. 2002:28). The Japanese were also very prominent in the 1920s and 1930s, largely replacing the Chinese merchants of the turn of the century in the Kapaʻa business sector.

Though most of the large plantation camps were located in neighboring Keālia, there were a few in Kapaʻa. Many people consulted had clear memories of the plantation camps in Kapaʻa: a fairly large camp located just behind Kapaʻa Town and three smaller camps located in the hills above Kapaʻa. The large camp, Pueo Camp (Figure 6), was located adjacent to the intersection where the current Kapaʻa Bypass Road turns off of Olohena Road (Interview w/ A. Paik, 5/14/03 in Bushnell et. al. 2004). One Kapaʻa resident who grew up in Pueo Camp remembers the camp being quite large with between 75 and 100 people, mostly single Filipino and Chinese men with some Japanese families and a few Hawaiian and Portuguese families Pueo Camp is thought to be a fairly early Makee Plantation Sugar Camp built strategically adjacent to the railroad tracks which accessed the sugar fields in the upland areas of Kapaʻa. Though no one consulted knew the date Pueo Camp was established, the oldest of our informants, Mrs. Alice Paik, born in 1912, knew the camp was there before she was born (Interview w/ A. Paik, 5/14/03 in Bushnell et. al. 2004). Pueo camp was destroyed sometime in the 1950s. The other three camps located in the hills adjacent to or just off of Olohena Road were considerably smaller than Pueo Camp. These consisted of Stable Camp, 35 Camp and 18 Camp (See Figure 6). Two other camps in the Kapaʻa/Waipouli area were also mentioned. Aguiar camp was a residential camp for employees of the pineapple industry, and Mundon Camp was thought to be a residential camp for Lihue Plantation workers (Interview w/ G. Hiyane, 5/14/03 in Bushnell et. al. 2004).

Pineapple became the next largest commercial enterprise in the region. In 1913, Hawaiian Canneries opened in Kapaʻa at the site now occupied by Pono Kai Resort (Cook 1999:56; Figure 6). The Kapaʻa Cannery provided employment for many Kapaʻa residents and many of the informants for this project mentioned having worked in the cannery during some time of their lives. By 1960, 3400 acres were in pineapple and there were 250 full time employees and 1000 seasonal employees for the Kapaʻa Cannery. However, in 1962, Hawaiian Canneries went out of business due to competition from third world countries.

The Ahukini Terminal & Railway Company was formed in 1920 to establish a railroad to connect Anahola, Keālia and Kapaʻa to Ahukini Landing at Hanamāʻulu and to "provide relatively cheap freight rates for the carriage of plantation sugar to a terminal outlet" (Condé and Best 1973:185). This company was responsible for extending the Makee Sugar Company railroad line from the Makee Landing [formerly located near the present day Coral Reef Hotel] to the Ahukini Landing at Hanamāʻulu Bay. This railroad line traversed near much of the study area (Figures 4 & 5) and was in use from 1921, through the take-over by Lihue Plantation Company in 1934 and until Lihue Plantation converted from railroad transport to trucking in the late 1950s.

Lihue Plantation was the last plantation in Hawaiʻi to convert from railroad transport to trucking (Condé and Best 1973: 167). In 1955, reports came out on the dredging for coral proposed for the reef fronting Kapaʻa Beach Park (*Garden Island Newspaper*, September 21, 1955). This coral was to be used for building plantation roads. The dredging was later blamed for accelerated erosion along Kapaʻa Beach (*Garden Island Newspaper*, October 30, 1963). Today, there are several sea walls along the Kapaʻa Beach Park to check erosion. Old time residents claim the sandy beach at Kapaʻa was once much more extensive than it is now. "By 1957 the company was salvaging a part of their plantation road, which was being supplanted by roads laid out for the most part on or close to the old rail bed" (Condé and Best 1973: 167). By 1959, the plantation had completely converted over to trucking.

Severe floods in Kapaʻa in 1940 led to the dredging and construction of the Waikaea and Moikeha Canals sometime in the 1940s (Territorial Planning Board 1940:7). Although the Waikaea Canal, bordering the Kapaʻa Pineapple Cannery, had been proposed as early as 1923, nothing was constructed until after the floods (Bureau of Land Conveyances, Grant 8248). A Master Plan for Kapaʻa, published in 1940, asks the Territorial Legislature for funds to be set aside for the completion of a drainage canal and for filling *makai* and *mauka* of the canal (Territorial Planning Board 1940:7). In 1955, reports came out on the dredging for coral proposed for the reef fronting Kapa'a Beach Park *(Garden Island Newspaper,* September 21, 1955). The coral was to be used for building plantation roads. This dredging was later blamed for accelerated erosion along Kapa'a Beach (Garden Island Newspaper, October 30, 1963).

Today, there are several sea walls along the Kapa'a Beach Park to check erosion. Old time residents claim the sandy beach in Kapa'a was once much more extensive than it is now (Bushnell et al. 2002).

Many of the plantation workers bought property of their own and moved out of plantation camps. The plantation camps which bordered Kahio Highway were disbanded in the 1980s. The Lihue Plantation began to phase out in the last part of the 20th century. Kapa'a Town suffered after the closing of the Kapa'a Cannery, however the growing tourist industry helped to ease the economic affects of the Cannery's closing.

Figure 4. Aerial View of Kapa'a, Kaua'i, looking west, circa 1933 (Bishop Museum Archives)

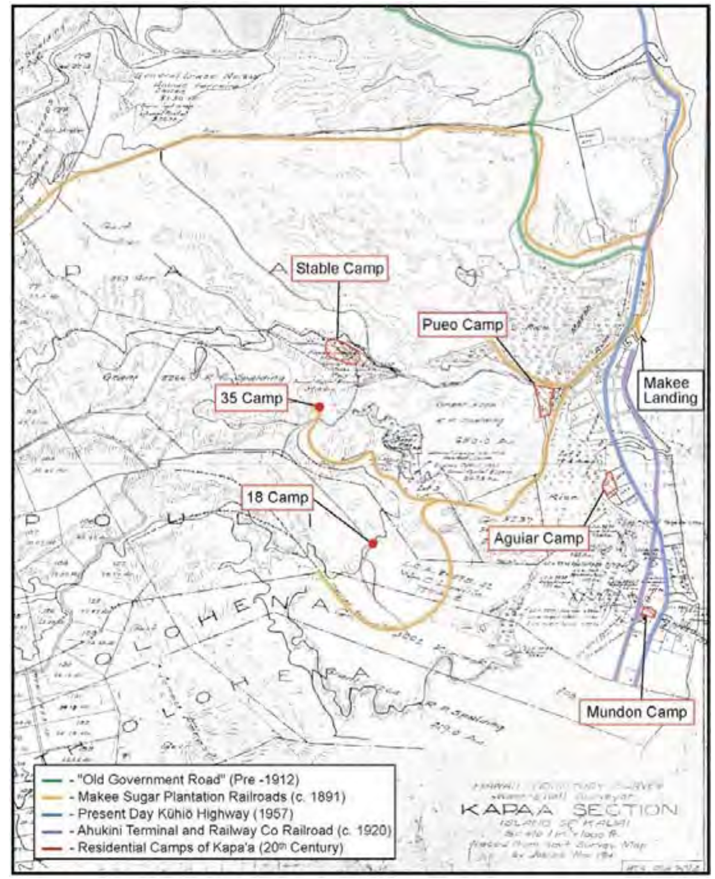


Figure 5. Hawai'i Territory Survey Map (Iao 1914) of Kapa'a Section Showing Roads, Railroads and Camps

Previous Archaeological and Cultural Studies of Kapaʻa

During their expeditions around Hawaiʻi in the 1880s collecting stories from *ka pōʻe kahiko*, Lahainaluna students stopped in Kapaʻa and Kealia and gathered information regarding *heiau* of the region (Bishop Musuem Archives (HEN I:214). Fourteen *heiau* were named, suggesting that these two *ahupuaʻa* were probably more socially/politically/religiously significant in ancient times and a testament to the substantial population of these *ahupua ʻa*.

Unfortunately, the locations for most *heiau* were given as Kapaʻa/Kealia, indicating that the exact location of the *heiau* was not identified. Of the fourteen *heiau*, five are definitely located in Kapaʻa. These include the locations of *wahi pana* or sacred places, Mailehuna (in the area of the present day Kapaʻa School), Pueo, Kuahiahi ((also spelled Kaahiahi and Keahiahi) the site of the first Government School in Kapaʻa—adjacent to the Kuhiö Highway near the northern boundary of Kapaʻa Ahupuaʻa), Makanalimu (in upland of Kawaihau) and Kaluluomoikeha. Kaluluomolkeha is thought to be the general area near the Mo`ikeha Canal and the present day Coral Reef Hotel.

There are no known remains of these *heiau* today. The exact locations of these *heiau* are unknown.

Table 3. Heiau of Kapaʻa

Name	Location	Type	Associated
Mailehuna	Kapaʻa (Mailehuna is the area of the present day Kapaʻa School)	unknown	Kiha, Kaumualiʻi/ Lukahakona
Pueo	Kapaʻa	unknown	Kiha, Kaumualiʻi/ Lukahakona
Pahua	Kapaʻa/Kealia	unknown	Kiha/ Lukahakona
Kumalae	Kapaʻa/Kealia	unknown	Kiha/ Lukahakona
Waiehumalama	Kapaʻa/Keilia	unknown	Kiha/ Lukahakona
Napuʻupaʻakai	Kapaʻa/Kealia	unknown	Kiha/ Lukahakona
Noeamakali`i	Kapaʻa/Kedlia	"heiau for birth of Kauaʻi Chiefs, like Holoholoku"	Unknown
Pu'ukoa	Kapaʻa/Kealia	"unu type heiau"	Unknown
Piouka	Kapaʻa/Kealia	"unu type heiau"	Unknown
Una	Kapaʻa/Kealia	Unknown	Kiha/ Lukahakona
Mano	Kapaʻa/Kealia	Unknown	Kiha/ Lukahakona

Name	Location	Type	Associated
Kuahiahi	Kapaʻa (govn't school stands on site now)	Unknown	Kaumualiʻi/ Lukahakona
Makanalimu	Upland of Kawaihau	Unknown	Kaumualiʻi
Kaluluomoikeha	Kapaʻa	Unknown	Moʻikeha

4. Historic Properties in Kapaʻa Ahupuaʻa (see Figure 6)

Site # 50-30-08-	Ahupuaʻa	Site Type/ Name (if any)	Location	Site Constraints	Reference
B001	Kapaʻa	Historic Cemetery	South of bend of Kapaʻa Stream, a kilometer mauka from Kuhiö Hwy	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B002	Kapaʻa	Historic Cemetery	Just mauka from Kuhiö Highway, south of Kapaʻa Stream	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B003	Kapaʻa	Kapaʻa Public Cemetery	South of Kanaele Road, one kilometer inland of Kuhiö Highway	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B004	Kapaʻa	Historic Cemetery	North of Apopo Road, one kilometer inland of Kuhiö Highway	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B013	Kapaʻa	Historic Cemetery	Just mauka from Kuhiö Highway, north of the Waikaea Canal	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B014	Kapaʻa	All Saints Episcopal Church Cemetery	Just mauka from Kuhiö Highway, south of the Waikaea Canal	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992:62-65
547	Kapaʻa	sub-surface features including a firepit and a possible house foundation	South of bend of Waikaea Canal, mauka of Kuhiö Highway	Archaeological monitoring in the vicinity is recommended	Spear 1992:3

Site # 50-30-08-	Ahupuaʻa	Site Type/ Name (if any)	Location	Site Constraints	Reference
626	Kapaʻa	Burial	ʻInia Street, makai of Kuhiö Highway, central Kapaʻa	Consultation and monitoring in vicinity indicated	Jourdane 1995
748	Kapaʻa	Minimal findings, a weak cultural layer (buried A-horizon)	South of the bend of the Waikaea Canal, mauka of Kuhiö Highway	Considered no longer significant within project area	Hammatt et al. 1994
789	Kapaʻa/ Kealia	Historic Road	Coastal Cane Haul Road near Kawaihau Road turn off		Perzinski et al. 2000
867	Kapaʻa	1 set of human remains	Kukui Street, just mauka of Kuhiö Highway, Kapaʻa Town	Consultation and monitoring in vicinity indicated	Creed et al. 1995:50
868	Kapaʻa	1 set of human remains	Lehua Street mauka of Kuhiö Highway, Kapaʻa Town	Consultation and monitoring in vicinity indicated	Creed et al. 1995:50
871	Kapaʻa	13 sets of human remains (Creed et al. 1995:50)	Inia Street, makai of Kuhiö Highway	Consultation and monitoring in vicinity indicated	Kawachi 1994; Creed et al. 1995:50
1848	Kapaʻa	Cultural layer and sub-surface features	Along Kuhiö Highway between Wana Road and the Waikaea Drainage Canal	Archaeological monitoring in the vicinity is recommended	Hammatt 1991; Creed et al. 1995
1849	Kapaʻa	Cultural layer and sub-surface features; Creed et al. 1995:53 expands boundaries to incl. burial sites, -626, -867, -868 -871, and -1894	Along Kuhiö Highway between Inia Street and Kauwila Street extending to the coast	Consultation and monitoring in vicinity indicated	Hammatt 1991; Creed et al. 1995
1894	Kapaʻa	11 sets of human remains	Ulu Street, just north of Kuhiö Highway, Kapaʻa Town	Consultation and monitoring in vicinity indicated	Creed et al. 1995:50

Site # 50-30-08-	Ahupuaʻa	Site Type/ Name (if any)	Location	Site Constraints	Reference
2075	Kapaʻa/Ke ālia	Highway Bridge Foundation (old Kauaʻi Belt Road)	Kuhiö Highway at Kapaʻa/ Keālia River		Bushnell et al. 2002:55
2076	Kapaʻa	Petroglyph	Rocky coast below former cane haul road (Site -789)	Preservation	Bushnell et al. 2002:55
2077	Kapaʻa	Concrete steps (related to historic beach pavilion)	Near present Kapaʻa Beach Park Pavilion		Bushnell et al. 2002:55
2078	Kapaʻa	Historic Railway Alignment (2 Railroad Bridges, & RR Culvert Foundation)	Both railroad bridges span the Moikeha Canal; the RR culvert foundation is located north of the Kapaʻa Swimming Pool.		Bushnell et al. 2002:55

Figure 6. Historic Properties in Kapa'a, Waipouli and Olohena Ahupua'a.

In summary, the archaeological research of the Kapa'a, area has been somewhat skewed to development which has mostly occurred along the coast. Early 20th century archaeological studies attested to the existence of upland terraces, however subsequent studies in the 1980s found no record of upland sites. Although there is little in the way of surface archaeology of Kapa'a that has been able to withstand the test of time (with the exception of Kukui Heiau), archaeological studies have illustrated the vast potential for intact subsurface cultural layers. These cultural deposits extend throughout modern day Kapa'a Town, on the shorelines between the Waipouli Town Center and the Coconut Plantation Resort and along the coast in Olohena *makai* of the old Coconut Plantation Cinema. These cultural deposits suggest a long occupation of the area over many centuries beginning by the late 15th or early 16th centuries.

RESULTS OF COMMUNITY CONSULTATION

As partial fulfillment of the Scope of Work, consultation with organizations and the community was conducted to identify knowledgeable *kūpuna* and participants to be interviewed, as well as others who could inform on the history of the subject area and previous land use. The organizations consulted were the State Historic Preservation Division, the Department of Land and Natural Resources (DLNR), the Office of Hawaiian Affairs, the Kaua'i/Ni'ihau Islands Burial Council, the Kaua'i Historical Society, and the Kaua'i Historic Preservation Review Committee (KHPRC).

A substantial effort was made to locate knowledgeable informants for the area of Kapa'a. An attempt was made to contact as many individuals as possible. These led us to the 5 knowledgeable parties that were interviewed for this project. A cultural impact assessment conducted for the Kapa'a-Kealia Bike and Pedestrian Path included a narrow corridor from the Waikaea Drainage Canal to Hömaikawa'a, a small inlet beyond Kealia (Bushnell et al. 2002). In addition cultural impact assessment was also conducted for the Kapa'a Relief Route (Bushnell et. al. 2004). Only one cultural impact assessment has been conducted for the uplands of Kapa'a for the proposed Water Reservoir *Mauka* Locale in Kapa'a, Kaua'i Island (Mitchell et. al. 2004). These CIA and historic research of the project area, community consultation and informant interviews were combined to provide an assessment of cultural traditions, both past and present.

Traditions were also collected in connection to the streams, canals and marsh areas where *'ōpae* and *'o'opu* were once found in abundance. Fishing for *'oama* in Kapa'a's canals continues to be a lively family tradition during the summers.

Consultation Process

Through the consultation process, five individuals were identified as potential informants. Three had written letters of their knowledge of the area (Stanley Vasques,

Willie Sanchez, and Albert Fukashima) [see Appendix]. Two others informants gave a verbal interviews. One of these the Martin family spoke about the use of the lands for pasture when the Plantation ceased using the land for cane. The other informant was from the East Kauai Soil and Water District (Les Milnes) and had no knowledge any plantation ditches that were still intact within the project area. The old maps he had, showed the ditch system around Twin Reservoir which is located directly across Olohena Road from this property but the maps stop before this project area. This indicates that there were no permanent plantation ditch lines on this parcel.

Mr. Fukashima drew a map of his recollection of the land uses of the project area, which matched some of the historic maps for Kapa'a.

Figure 7 and 8 Showing Cattle and Goats (in the Distance) Grazing.

No Native Hawaiian informants came forward to discuss any traditional gather associated with this project area. The Office of Hawaiian Affairs gave a list of possible indiviuals with extensive knowledge of traditional cultural practices and resources but none knew of any for this project area.

Figure 9. KIUC's Solar Farm and Equipment Buildings.

TRADITIONAL CULTURAL PRACTICES OF KAPA' A

Burials

The coastline in Kapa'a once contained extensive sand dunes that were documented in travels throughout the nineteenth century (Knudsen 1991; Alexander 1991). Most of the sand dunes were modified or destroyed at the onset of the twentieth century. This was due to the extensive use of the coastal areas for ranching, settlement, and new transportation routes like trains and roads. Archaeological studies in the Kapa'a area demonstrate the widespread prehistoric use of sand as a medium for burials. Burials have been idenfied along the coast and extending well *mauka* of the coastline into present day Kapa'a Town. Cultural deposits found associated with burials in the Kapa'a area shed light on the Hawaiian tradition of burying members of the *'ohana* in the *kulaiwi*, or birth land.

For Hawaiians, "man's immortality was manifest in his bones...Even the bones of the living became symbols of the link between man's progenitors and his own eventual immortality" (Pukui et al. 1972:106). Thus, the discovery of *iwi* (bones) is a very sensitive issue for the Hawaiian community requiring much mediation and protocol.

No burials are believed to be present within the project area and none are known in the vicinity.

Marshlands of Kapa'a

The areas inland of Kapa'a and Waipouli Towns were formerly the marshlands of Kapa'a. During the 20th century, portions of the marshlands of Kapa'a and Waipouli were filled, drained and designated as marginal agricultural lands. Traditionally, however, these marshlands were once much more significant. Westerners may call them "swamps," but Hawaiians who grew up in the Kapa'a and Waipouli area knew they were fishponds (Bushnell et. al. 2004). Many *kama'aina* recall fishing for freshwater shrimp and gobies, the *ʻopae* and *ʻoʻopu*. For the Kaneakua brothers, their childhood memories of *ʻopae* are tied to the old Chinese vendors who once traversed the neighborhood selling the shrimps.

> I can remember Chinese, they used to catch shrimp, fresh water shrimp in big five gallon can. They put it in there, both side and they have their stick across, walking through the little village that we were over there and used to come out and say, "ʻ*Opae, ʻOpae*" and families who want buy the *ʻOpae* and they used to dig it out in a big a scoop, bowl, and was so much you know. Yeah, those were the days. Our streams used to be loaded with shrimp (Interview with J. & W. Kaneakua 8/1/02 in Bushnell et al. 2002).

One informant said that his experience catching *ʻopae* centered on the irrigation ditches that drained the marshlands behind Kapaʻa. "My first lessons in swimming were in the drain ditches the sugar people created to dry out their cane lands. Also in the ditches were the ʻ*opae* or river shrimp. I caught ʻ*opae* and cooked them with soy sauce in recycled oil sardine cans." (Interview with G. Hiyane, 5/14/03 in Bushnell et. al. 2004). One individual who grew up in Pueo Camp adjacent to the marsh recalls frequenting the irrigation ditches in Waipouli for *ʻōpae*, *ʻoʻopu*, and *pantat* (catfish) that were then sold to the old Chinese men in the camp for 10¢ (Personal communication with G. Mukai, 8/5/03 in Bushnell et. al. 2004).

Mr. Sokei who grew up in a rice growing family in the back of what is known as All Saints Church in Kapaʻa shared some memories of his home in the 1930s that may reflect the landscape a hundred years prior. Mr. Sokei remembers the family home located on high ground above the marsh. "Back then, the land was natural, full of mounds. Rice was cultivated in fields all the way to the hills. The water level in the marsh would go up and down with the tide and when there was lots of water, one could find *ʻoʻopu*, *ʻōpae*, catfish, frogs and mud turtles for eating" (Personal communication with T. Sokei, 7/28/03 in Bushnell et. al. 2004). Likewise, the *kuleana* awards of the 1840s and 1850s present a picture of homes scattered on the edges of the marsh and on islands of high ground within the marsh. Numerous *ʻauwai* were constructed to irrigate *loʻi kalo*. *Hau* bush was shaped into fences to separate *kuleana* or physical features and fishponds were built to stock fish. For Hawaiians living the marsh was an extremely productive area constituting the basis of their existence.

The notion that the marshlands were quite significant traditionally is also evident in the Hawaiian place names, particularly the *wahi pana* (storied places) associated with the Kapaʻa/Waipouli marsh. Mākaha-o-Kupānihi was a pond, a "deep pool set aside for *aliʻi* to bathe in" located at the border of Kapaʻa and Waipouli Ahupuaʻa presumably within the marsh (Lahainaluna Students Compositions, No. 15). It was here that Kaumualiʻi's half-brother Keawe was shot to death forever defiling the waters of Kupānihi. Another *wahi pana* in this district was Këwā. The proverb ʻ*ke kalukalu o Kēwā*ʼ refers to a certain type

of grass, *kalukalu* (used in making a very soft gauze or *kapa*) found growing in the marshlands of Kapaʻa and Waipouli (Fornander 1916:IV:162).

Gathering for Plant Resources

Hawaiians utilized upland resources for a multitude of purposes. Forest resources were gathered, for not only the basic needs of food and clothing, but for tools, weapons, canoe building, house construction, dyes, adornments, hula, medicinal and religious purposes. The present project area is dominated by alien vegetation (albezia, ginger, California grass) although some traditional cultigens (banana, bamboo, *kid* and historically introduced food plants (papaya) are present as well. Within the project area itself no specific documentation was found regarding gathering of plants during traditional Hawaiian times. During this assessment there were no ongoing practices related to traditional gathering of plant resources identified in the present project area. None of the individuals contacted for this assessment identified any native plant gathering practices within the project area.

Historic Properties

No historic properties were identified within the project area or in the vicinity. The density of identified historic properties is far greater near the coast of Kapaʻa Ahupua'a. For a listing of the historic properties of Kapaʻa, Kauaʻi, see Table 4.

Trails

Based on nineteenth and twentieth century maps the primary transportation routes *mauka/makai* correlated closely to the existing major roadways. During this assessment there were no trail systems identified in the proposed project area.

Planation Ditch System or ʻAuwai

Based on the archaeological assessment (McMahon, 2012), field checks, documentation from land records, plantations records and maps, and informants information, no remnants of these historic properties exist. Several pieces presumed to be remnant of the metal flumes (transportable irrigation) were found. It is also thought that the existing roads on the property might be filled.

Figure 10. Remnant Road and Cattle Grazing in the Project Area.

SUMMARY AND CONCLUSIONS

A cultural impact assessment was conducted for the proposed Kapa'a Highlands Phase II. Historic research of the project area was carried out to identify any cultural resources or traditional cultural practices associated with the area encompassing the proposed Kapa'a Highlands Phase II. In addition, community consultation was conducted. An attempt was made to contact parties regarding cultural knowledge, land use history, cultural sites and traditional Hawaiian or other cultural practices in the vicinity of the project area. Five individuals came forward as knowledgeable informants. In addition to the informants, other community members shared valuable information regarding traditional land use, attitudes and practices associated with the project area.

The marshlands of Kapa'a were once a significant resource prior to Western contact. The fringes of the marsh were utilized for *lo'i kalo*, and other resources including the gathering of *kalukalu*, a type of grass utilized for *kapa*. Places in the marshes also served as fishponds. Vestiges of the cultural significance of the marshlands are retained in the *mo'olelo* and *'olelo no'eau* particular to this area. With the establishment of the sugar plantations in the late nineteenth century, the marshlands were significantly altered. Marsh areas were drained and filled to create more dryland for commercial agriculture and pasture land. Several individuals consulted and interviewed grew up fishing for *'ōpae* and *'o'opu* in the irrigation ditches which once drained the swamps. They expressed sadness at the changing of the landscape and the passing of their childhood traditions with the final draining and filling of the swamps. No further concerns regarding the marshlands were expressed other than the presumed low potential of possibly encountering habitation deposits and burials related to former LCA parcels.

This report documents the use of the *'auwai* or plantation ditches for irrigation and water use by the residents up until the 1960s. The *'auwai* were also utilized for a variety of activities beyond their primary irrigation purpose. The bulk of the *'auwai* have been lost through modern pasturage, disuse and adjacent road improvements.

In general the community emphasized the importance of communicating with the *'ohana* of Kapa'a regarding changes to the land. This includes asking permission of the *'ohana*, including *'uhane* (immortal spirits) for opening up the land to proposed new uses. It was stressed that this and other protocols are necessary to "open the path" for change, thus avoiding accidents and potential obstacles of a cultural nature.

In summary, there are no known traditional resources or cultural practices associated with the Kapaa Highlands Project Area.

BIBLIOGRAPHY

Akina, Joseph
1913 "I Ke hou I Ka Lulu-o-Moikeha I ka laula o kapaa", Ku'oko'a. May 2-9, 1913. Bishop Museum Archives HEN Place Names, Kauai.

Alexander, William Patterson
1991 "A Tour of Kauai in 1849: Private Journal of William DeWitt Alexander," *The Kauai Papers,* Kauai Historical Society, A Kauai Historical Society Publication, Lihue, Kauai, HI.

Armitage, George T.and H.P. Judd
1944 Ghost Dog and Other Hawaiian Legends; Advertiser Publishing Co., Ltd., Honolulu.

Armstrong, Warwick, Ed.
1973 Atlas of Hawai'i, University of Hawaii Press, Honolulu.

Barrère, Dorothy, compiler
1994 The King's Māhele: The Awardees and Their Lands, Honolulu, HI.

Beckwith, Martha W.
1970 Hawaiian Mythology, University of Hawaii Press, Honolulu, HI.

Bennett, Wendell C.
1931 The Archaeology of Kaua`i, Bishop Museum Bulletin 80, Honolulu.

Bingham, Hiram
1847 A Residence of Twenty-One Years in the Sandwich Islands, Huntington, Hartford.Conn., Convers, New York

Bishop Museum Archives
HEN I: 214 "Heiaus of Kealia and Kapa`a" and "Well Known Things [or Places]".

HEN I: 215 "Famous Things mentioned by Two Men".

HEN I: 216 "Heiaus from Kapa'a to Kealia" and "Things for which Kapa'a was Known".

Borthwick, Douglas F. and Hallett H. Hammatt

1999 Archaeological Monitoring and Burial Treatment Plans for the Proposed Improvements to the Kapa'a Seventh-day Adventist Church, Kapa`a Ahupua`a, Puna District, Kaua`i Island (TMK 4-5-03: 19), Cultural Surveys Hawai'i, Kailua, HI.

Boundary Commission see Commission of Boundaries

Buck, Peter H. (see also Te Rangi Hiroa)
1964 Arts and Crafts of Hawaii, Bishop Museum Special Publication 45, Vol. I, Honolulu.

Bureau of Land Conveyances
Grant 8248

Bushnell, K.W., D.W. Shideler, and H. H. Hammatt
2002 Cultural Impact Assessment for the Proposed Kapa'a -Kealia Bike and Pedestrian Path, Kapa'a and Kealia, Kawaihau District, Kaua'i Island, Hawai'i (TMK: 4-5, 4-6-14, 4-7-03 & 04), Vols. I & II; Cultural Surveys Hawai'i, Inc., Kailua, HI

2004 Cultural Impact Assessment for Kapa'aRelief Route: Kapa'a Waipouli, Olena and Hanamaulu, Kaua'i Island, Hawai'i Cultural Surveys Hawai'i, Kailua, HI

Bushnell, Kristina and Hallett H. Hammatt
2000 An Archaeological Monitoring Report for Improvements to the Kapa'a Seventh-Day Adventist Church, 1132 Kuhio Highway, Kapa'a Ahupua'a, District of Puna, Island of Kauai (TMK 4-5-03:19), Cultural Surveys Hawaii, Kailua, HI.

Bushnell, K.W., Melanie Mann, Douglas Borthwick, Tony Bush, Todd Tulchin, David Shideler and Hallett H. Hammatt
2003 *Archaeological Inventory Survey for the Proposed Kapa'a/Kealia Bike and Pedestrian Path, Kapa 'a and Kealia, Kawaihau District, Kaua `i Island, Hawai (TMK 4-5, 4-6-14, 4-7-03 & 04).* Cultural Surveys Hawaii, Inc. Kailua, HI.

Calis, Irene
2000 End of Field Work Report: Human Burial Removal and Archaeological Monitoring, Kapa'a Beach Park Public Bathroom Installation, Kapa'a, Kaua'i Scientific Consultant Services.

Chafee, David B., Berdena Burgett and Robert L. Spear
1994a An Inventory Survey of a Mamane Street Houselot, Kapa'a Ahupua'a, Kawaihau District, Puna, Island of Kaua'i (TMK: 4-5-09:51), SCS Inc., Kane'ohe, HI.

1994b An Inventory Survey of a Kukui Street Houselot, Kapa'a Ahupua'a, Kawaihau District, Puna, Island of Kaua'i (TMK: 4-5-09:10), SCS Inc., Kane'ohe, HI.

Chaffee, David B. and Robert L. Spear
1995 A Reconnaissance Survey Letter Report, Earl & Maggie Arruda Property, Kapa'a, Kaua'i, Hawai'i, TMK 4-4-02:100 Scientific Consultant Services, Inc. Kane'ohe, HI.

Ching, Francis K. W.
1976 *Letter Report: Archaeological Reconnaissance - Report, Kapa 'a "Wastewater Treatment and Disposal System,* ARCH 14-96, Letter to R. M Towill Corporation, ARCH, Lawa`i, Kaua`i, HI.

Clark, John R.K.
2002 Hawai'i Place Names, Shores, Beaches and Surf Sites, University of Hawaii Press, Honolulu, HI.

Commission of Boundaries
1864-1905 Record of Commission of Boundaries for the Island of Kaua'i, vol. 1, Honolulu, HI.

Condé, Jesse C. and Gerald M. Best
1973 Sugar Trains, Narrow Gauge Rails of Hawaii, Glenwood Publishers, Felton, CA.

Cook, Chris
1999 "Kaua'i, the Garden Island: A Pictorial History of the Commerce and Work of the People", Donning Co., Virginia Beach, VA.

Cooper, George and Gavan Daws
1990 Land and Power in Hawaii, The Democratic Years; University of Hawaii Press, Honolulu.

Coulter, John Wesley
1931 Population and Utilization of Land and Sea in Hawaii, 1853 Bernice P. Bishop Museum Bulletin 88, Honolulu, Hawaii.

Coulter, John Wesley and Chee Kwon Chun
1937 Chinese Rice Farmers in Hawaii, University of Hawai'i, Honolulu.

Creed, Victoria, Hallett H. Hammatt, Gerald K. Ida, Ian Masterson and John Winieski
1995 A Summary of the Archaeological Monitoring for the Kapa'a SewerlineProject Waipouli and Kapa'a Ahupua'a, Puna District, Kaua'i (TMK: 4-3-09 and 4-5-03 to 11), Cultural Surveys Hawaii, Kailua, HI.

Damon, Ethel M.
1931 Koamalu, Privately printed at the Honolulu Star-Bulletin Press, Honolulu, (2 Volumes).

Dega, Michael F. and James Powell
2003 Archaeological Monitoring During Phase I of the Kaua'i Rural Fiber Optic Duct Lines Project, Kaua'i Island, Hawai'i. Scientific Consultant Services

Dole, Charles S.
1929 The Hui Kawaihau" in Papers of the Hawaiian Historical Society, Number 16, Honolulu.

Donohugh, Donald
2001 *The Story of Koloa, A Kaua `i Plantation Town,* Mutual Publishing, Honolulu, HI.

Elmore, Michelle and Joseph Kennedy
2003 *An Archaeological Monitoring Report for the Proposed Kiihio Drainage Improvements Kapa'a and Anahola (Project # 56AC-01-01) Located in Kawaihau District, Island of Kaua* ACPI.

Foote, Donald E., Elmer L. Hill, Sakuichi Nakamura, and Floyd Stephens
1972 Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii. Soil Conservation Service, U.S. Department of Agriculture.

Fornander, Abraham
1878-85 An Account of the Polynesian Race, Its Origin and Migrations and the Ancient History of the Hawaiian People to the Time of Kamehameha I, 3 vols., Trubner & Co., London.

Fornander, Abraham
1917-1918 Collection of Hawaiian Antiquities and Folklore, T.G. Thrum edit., Memoirs of the Bernice Pauahi Bishop Museum (Vol. IV & V), Bishop Museum Press, Honolulu.

Fornander, Abraham
1996 Ancient History of the Hawaiian People to the Times of Kamehameha I, with an Introduction by Glen Grant, Mutual Publishing, Honolulu, HI.

Garden Island Newspaper
1955 "Geologists Says Kapaa Coral Removal No Threat to Town". September 21, 1955.

1963 "Kapaa Blames Feceral Role As Erosion Continues. Says Barrier on Reef is Required". October 30, 1963.

1983 "Centennial Year, Kapa'a School Wants Pix of its 100 Years". April 1, 1983.

Giambelluca, Thomas W., Michael A. Nullet and Thomas A. Schroeder
1986 *Rainfall Atlas of Hawaii,* Department of Land and Natural Resources, Honolulu, HI.

Glick, Clarence E.
1980 Sojourners and Settlers: Chinese Migrants in Hawaii. Hawaii Chinese History Center and The University Press of Hawaii, Honolulu.

Hammatt, Hallett H.
1981 Archaeological Reconnaissance of 52.56 Acres for a Proposed Subdivision, TMK:4-8(?)-13-1, Kapa'a, Puna, Kaua'i Island, ARCH Report 140298, Prepared for Waialeale Partners.

1986 Archaeological Reconnaissance of the Makaleha Springs Water Source Development, Kapa'a, Kaua'i TMK: 4-6-01:1, Cultural Surveys Hawaii, Kailua, HI.

1987 Letter Reports on Kapa'a Sewerline Project

1991a *Archaeological Subsurface Testing for the Proposed Kapa 'a Sewer line, Wailua, Olohena, Waipouli and Kapa 'a, Kaua `i,* Cultural Surveys Hawai`i, Kailua, HI.

1991b Archaeological Subsurface Testing for the Proposed Kapa'a Sewerline, Wailua, Olohena, Waipouli and Kapa'a, Kaua'i, Cultural Surveys Hawai'i, Kailua, O'ahu.

Hammatt, Hallett H., Rodney Chiogioji, Gerald K. Ida, and Victoria S. Creed
1997 An Archaeological Inventory Survey for the Kuhio Highway Widening and Bypass Options within the Ahupua'a of Wailua, South Olohena, North Olohena, Waipouli & Kapa'a, Island of Kaua'i , with Appendix on Palynology by Jerome Ward, Ph.D., Cultural Surveys Hawaii, Kailua, HI.

Hammatt, Hallett H., Gerald K. Ida, and Rodney Chiogioji
1994 Archaeological Document Review and Assessment of Three Alternative Widening and Bypass Options for the Kuhio Highway Within the Ahupua'a of Hanamaulu, Wailua, South Olohena, North Olohena, Waipouli & Kapa'a, Lihu'e and Kawaihau Districts, Island of Kaua'i, Revised 1994, Cultural Surveys Hawaii, Kailua, HI.

Hammatt, Hallett H., Gerald K. Ida and William H. Folk
1994 Archaeological Inventory of a 1.87-Acre Parcel, Kapa‘a, Kaua‘i (TMK 4-5-05:6), Rev. August 1994, Cultural Surveys Hawaii, Kailua, HI.

Hammatt, Hallett H. and David W. Shideler
2004 Archaeological Assessment of Alternative Routes Proposed for the Lydgate to Kapa‘a Bike and Pedestrian Pathway Project Within the Ahupua‘a of Wailua, South Olohena, North Olohena, Waipouli and Kapa‘a, Cultural Surveys Hawai`i, Kailua, HI.

Hammatt, Hallett H., David W. Shideler and William H. Folk
2002 Archaeological Study in Support of Proposed Kuhio Highway Improvements (Kapa‘a By-Pass) Hanama‘ulu to Kapa‘a Ahupua‘a, Kaua‘i, Cultural Surveys Hawai‘i, Kailua, HI.

Handy, E.S. Craighill
1940 The Hawaiian Planter, Volume 1, Bishop Museum, Bulletin No. 161., Honolulu, HI.

Handy, E.S. Craighill, and Elizabeth G. Handy
1972 Native Planters in Old Hawaii, Bishop Museum Press, Honolulu, HI.

Hawaii State Archives
1837 Interior Department, Land, Incoming Letter. August 1837.

1882 Interior Department, Letter book, Vol. 20, p. 426, Letter from Spalding to the Honorable Jacob Hardy, Circuit Judge—Fourth Circuit Kauai

Hawaii Territorial Planning Board
1940 Master Plan of the Town of Kapa‘a, In collaboration with the Kaua‘i County Board of Supervisors, Publication No. 8. Advertiser Publishing Co., Honolulu, HI.

Honolulu Advertiser
1997 "Amfac to put more land up for sale: Tracts on Kaua‘i, Big Island" by Mike Gordon. July 7, 1997. Section Bl.

1960 "Kaua‘i Tries to See into Future. March 20, 1960.

Jarves, James Jackson
1844 Scenes and Scenery in the Sandwich Islands and a Trip through Central America 1837-42, J. Munroe and Co., Boston.

Joesting, Edward
1984 Kaua‘i, The Separate Kingdom, University of Hawaii Press and Kaua‘i Museum Association, Ltd., Honolulu

Jourdane, Elaine
1995 Inadvertent Discovery of Human Remains at 1382-A Inia Street, Kapa‘a , Kaua‘i (Kapa‘a Sewerline Project Laterals) Site 626, SHPD, Honolulu, HI..

Kalākaua, David
1888 The Legends and Myths of Hawaii, Charles L. Webster, (Reprint of three volumes published in 1877-85), New York.

Kamakau, Samuel Manaiakalani
1961 Ruling Chiefs of Hawaii, The Kamehameha Schools Press, Honolulu, HI.

Kamakau, Samuel Manaiakalani
1976 The Works of the People of Old, Bishop Museum Special Publication, No. 61, Honolulu.

Kapa` a Elementary School
1933 Kapaa Elementary School, Kula O Kapa‘a, 1883-1933, Published by the school on its fiftieth anniversary, Kapa‘a , Kaua‘i .
1983 Kapa 'a School 1883 1983: A "Century of Knowledge". Kapa'a Elementary, Kapa`a, Kaua` i.

Kawachi, Carol T.
1994 Inadvertent Burial at 1316 Inia Street (Jasper) TMK 4-5-08:33, Kapa 'a, Kawaihau, Kauai 50-30-08-871, State Historic Preservation Division, Honolulu, HI.

Keaweamahi, D.
1876 “Huakai makaikai ia Kauai.” Ka Lahui Hawai‘i, 10 & 17 August 1876. “Tour of Kauai.” English Translation by M.K. Pukui. BMA: HEN Thrum #227.

Kikuchi, William K. and Susan Remoaldo
1992 Cemeteries of Kaua‘i, Vol. 1, Kaua‘i Community College and University of Hawai‘i, Puhi, Kaua‘i .

King, Robert D.
1935 "Districts in the Hawaiian Islands" In Coulter, John Wesley (compiler) *A Gazetteer of the Territory of Hawaii*, University of Hawaii Research Publications, No. 11, University of Hawaii, Honolulu, Hi.

King, Robert D., compiler
1942 Real Property, Appraisers Manual, Honolulu, HI.

Klass, Tim
1970 World War II on Kauai: Historical Research, Prepared for the Kauai Historical Society by The Westland Foundation, Portland, Oregon.

KRD (Kaua'i Renovation and Development - Kaipo Akana)
1994 Archaeological Monitoring of the Rock Wall Revetment for Burial Site - 746

Lai, Violet L. assisted by Kum Pui Lai
1985 He Was a Ram, Wong Aloiau of Hawaii, Published for the Hawaii Chinese History Center and the Wong Aloiau Association by University Press of Hawai'i, Honolulu.

Lydgate, J.M.
1917 Kaumuali'i, The Last King of Kaua'i, Hawaiian Historical Society, Annual Report No. 24, Honolulu.

Lydgate, John M.
1916 "The Pictured Rocks", The Garden Island, 22 February: 5.

MacDonald, G.A. and Abbott, A.T.
1970 Volcanoes in the Sea. University of Hawaii Press, Honolulu.

McMahon, Nancy A.
1996 Archaeological Inventory Survey for 5 Unit Apartment, TMK: 4-5-05:8, Kapa'a, Kawaihau, Kaua'i, Exploration Associates, Ltd., Koloa, Kauai, HI.
1994 Inadvertent Burial Find, Kapa 'a, Kawaihau, Kaua `i, SHPD, Honolulu, HI
1993a Inadvertent Burial Discovery and Disinterment, Site 50-30-09-6011, State Preservation Division, DLNR, Honolulu, HI.
1992a Field Inspection Report for Site 50-30-04-1880, on file at State Historic Preservation Division.
1992b Field Inspection Report for Site 50-30-04-1881, on file at State Historic Preservation Division.
2012 An Archaeological Assessment for the Kapaa Highlands Phase II, TMK: (4) 4-3-03:01, Exploration Associates Ltd, Lihue, Kauai

Mitchell, Auli'i and Hallett Hammatt
2004 A Cultural Impact Assessment For A Proposed Water Reservoir, Kapa'a Ahupua'a, Kawaihau District, Kaua'i, TMKS 4-6-11:, 4-6-8:24, 4-6-03: 30, Cultural Surveys Hawaii, Kailua HI

Malo, David
1951 Hawaiian Antiquities, Bishop Museum Press: Honolulu.

Nakuina, Moses K.
1990 The Wind Gourd of La'amaomao, Translated by Esther T. Mookini and Sarah Nakoa, Kalamaku Press, Honolulu.

Office of the Commissioner of Public Lands
1929 Indices of Awards, Made by the Board of Commissioners to Quiet Land Title in the Hawaiian Islands.

Pacific Planning & Engineering, Inc.
1992 Environmental Assessment and Environmental Impact Statement Preparation Notice Kuhio Highway, Hanamaulu to Kapaa Project Number 56A-07-90, Kapa'a, Kaua'i, Hawai'i, For U.S. Department of Transportation Federal Highways Administration and State of Hawai'i, Department of Transportation Highways Division.

Perzinski, Mary and Hallett H. Hammatt
2001 A Summary of Archaeological Monitoring for the Kuhio Highway, Waikaea Bridge Widening Project Kapa'a Ahupua'a, Kawaihau District, Kaua'i Island (TMK: 4-3-06 to 4-3-08), Cultural Surveys Hawaii, Kailua, HI.

Porteus, Stanley B.
1962 A Century of Social Thinking in Hawaii, Pacific Books Publication, Palo Alto, CA.

Pukui, Mary Kawena
1983 Olelo No'eau: Hawaiian Proverbs and Poetical Sayings, Bishop Museum Special Publication No.71, Bishop Museum Press, Honolulu.
1986 Hawaiian Dictionary, 2nd Edition, University of Hawaii Press, Honolulu, HI.

Pukui, Mary K., Samuel H. Elbert and Esther Mookini
1974 Place Names of Hawai'i, University of Hawai'i Press, Honolulu.

Rice, William Hyde
1923 Hawaiian Legends, Bernice P. Bishop Museum Bulletin 3, Honolulu..

Spear, Robert L.
1992c Letter Report Concerning Monitoring for the Cost-U-Less Project Kapa'a, Kaua'i , Hawai'i (TMK: 4-5-5:4&9), Scientific Consultant Services Inc.

Territorial Planning Board, Territory of Hawaii in collaboration with the County Board of Supervisors, County of Kaua'i
1940 Master Plan of the Town of Kapaa, County of Kauai, Hawaii, Publication No. 8, Advertiser Publishing Co., Ltd., Honolulu.

Thrum, Thomas G.
1906 "Heiaus and Heiau Sites Throughout the Hawaiian Islands, Kauai, in: Hawaiian Almanac and Annual 1907, pp. 36-48, Honolulu, HI.

1923 More Hawaiian Folk Tales, A.C. McClurg & Co., Chicago.

1998 Hawaiian Folk Tales: A Collection of Native Legends, Mutual Publishing, Honolulu.

Vancouver, George
1798 A Voyage of Discovery to the North Pacific Ocean and Round the World Performed in the Years 1790-95, 6 vols., John Stockdale, London.

Van Ryzin, Karl and Hallett H. Hammatt
2004 An Archaeological Assessment For The Proposed Water Reservoir, Kapa 'a Ahupua 'a, Kaua `i TMK 4-6-03:10 Cultural Surveys Hawai`i, Kailua, HI.

Wichman, Frederick B.
1998 Kaua‘i Ancient Place Names and Their Stories. University of Hawaii Press: Honolulu.

1985 Kauai Tales, Bamboo Ridge Press, Honolulu, HI

Wilkes, Charles
1845? Narrative of the United States Exploring Expedition, During the Years 1838, 1839, 1840, 1841, 1842, 5 Vols. Lea and Blanchard, Philadelphia, Pa.

APPENDIX

Letters from Informants

Jan. 4. 2012 4:37PM No. 4418 P. 1

I worked for Lihue Plantation
from 1965 - 1985 in various Jobs
I worked in Kapaa 20, approximately
80-100 acres, of which TMK (4) 4-3-03-1
is a portion of This field. my
father and uncles, else, worked in
These fields in The 1930s - 1970s I
worked in Kapaa 20 every other year
as a bulldozer driver pushing cane
as a crane operator and with The
Plow department plowing This field
AT no Time did we ever see or
heard of anyone finding any
human remains or gravesites in this
field If you have questions or
require additional information, please
call me at 651-8975

Stanley Vasquez
1737 Hulu Rd
Kapaa HI 96746

December 30, 2011

To Whom It May Concern,

I Willie Sanchez was the first person to work in the area of TMK (4) 4-3-03-1 after Amfac Sugar sold the property. I started mowing the property in about 1999. The agricultural water system was abandoned and the interior ditches have become almost flat from non-use. I have never seen any historical or cultural items on this property. I mowed the property for about 5 years. The property is now overgrown with guinea grass and hale koa.

Willie Sanchez

Greg Allen

The sugar Cane Land that you asked me about was First used by the Makee Sugar Company which was located in Kealia. After it Closed The Lihue Plantation Company Took over the Lands from Anahola to Lihue

I Dont know when these Land were used in sugar cane, I belive it was in the early 1800' the agriculture practice changed over the years to have better yeilds to produce sugar.

For my Part the Company that I worked for was Called Hawaiian Sugar Planters Assn, which we did the propagation of New Varieties over all the years that I worked and othe types of Expiriments.

Looking back For the 44 years that I worked For our Company there has been a Number of years We worked ~~#~~ in these Fields that covers the Waipouli Wailua areas where Sugar Cane was raised.

To my knowledge for the number of years that we worked in these Fields, we never did come across any Heiau or burial grounds in these areas that I know of. If it did exist it most likely is Far beyond my time —

Sincerely

Albert Fukashima

ALBERT FUKASHIMA

5-9-10

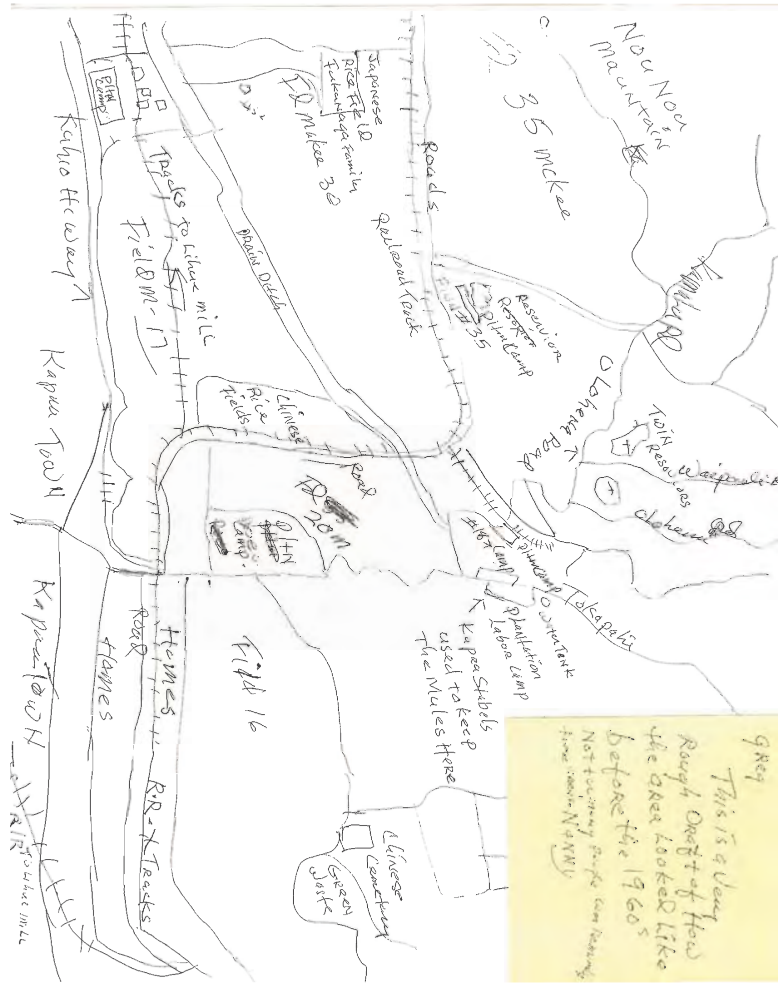


Exhibit N

Comment Letters, Scoping Letters and Letters of Support

Bernard P. Carvalho, Jr.
Mayor

Gary K. Heu
Managing Director

Larry Dill, P.E.
County Engineer

Lyle Tabata
Deputy County Engineer

DEPARTMENT OF PUBLIC WORKS
County of Kaua'i, State of Hawai'i
4444 Rice Street, Suite 275, Lihu'e, Hawai'i 96766
TEL (808) 241-4992 FAX (808) 241-6604

January 4, 2012

Vladmir P. Devens, Chairperson
Land Use Commission
Department of Business, Economic Development, and Tourism
State of Hawai'i
P.O. Box 2359
Honolulu, Hawai'i 96804-2359

Subject: Petition to amend the Land Use Boundary of certain lands situated at Kapa'a, Island of Kaua'i, State of Hawai'i, consisting of 97 acres from the Agriculture and Rural District, to the Urban District, Tax Map Key No. (4) 4-3-003:001, Kapa'a Highlands, Three Stooges, LLC

Dear Chairperson Devens:

This letter is to inform you of the County of Kaua'i, Department of Public Work's (County) general support of the Kapa'a Highlands petition to amend 97 acres in Kapa'a to the Urban District. The proposed amendment is for the development of 231 affordable housing units. The County is generally supportive of petitions that will provide affordable housing units in a manner consistent with the Kaua'i County General Plan.

We have met with the Petitioners, Three Stooges LLC, and we will work with them to ensure that any impacts from the project are analyzed and effectively mitigated.

Please call me at (808) 241-4996 if you have any questions.

Very truly yours,

Larry Dill, P.E.
County Engineer

bc: Greg Allen
Mayor Carvalho

An Equal Opportunity Employer

I worked for Lihue Plantation
from 1963 - 1986 in various Jobs
I worked in Kapaa 20, approximately
80-100 acres, of which TMK (4) 4-3-03-1
is a portion of This field. My
father and uncles, also, worked in
These fields in The 1930's - 1970's I
worked in Kapaa 20 every other year
as a bulldozer driver pushing cane
as a crane operator and with The
Plow department Plowing This field
AT no Time did we ever see or
heard of anyone finding any
human remains or gravesites in this
field If you have questions or
require additional information, please
call me at 651-8978

Stanley Vasquez
1737 Hulu Rd
Kapaa HI 96746

December30 ,2011

ToWhomItMayConcern,

IWillieSanchezwasthefirst persontoworkintheareaofTM K(4)43031afterAmfacSugar soldthe property.Istartedmowing thepropertyi nabout1999.Theagriculturalwatersystemwas abandonedandtheinterio rditcheshavebecomealmost flatfro mnonuse.I haveneverseenany historicalorculturalitemsonthisprope rty.Imowedtheproperty forabout 5years.The pro pertyis nowovergrownwithguinea grassandhalekoa.

WillieSanchez

NEIL ABERCROMBIE
GOVERNOR

KATHRYN S. MATAYOSHI
SUPERINTENDENT

STATE OF HAWAII
DEPARTMENT OF EDUCATION
OFFICE OF THE COMPLEX AREA SUPERINTENDENT
KAUAI SCHOOLS
3060 Eiwa Street, Room 305
Lihue, Hawaii 96766

October 28, 2011

Mr. Greg Allen
Kapaa Highlands Phase II Project
Harbor Mall

Dear Mr. Allen:

This is a letter of support for the relocation of the County of Kauai, Kapaa Swimming Pool to the subdivision area of the Kapaa Highlands Phase II Project.

The project will provide an opportunity to have a recreational facility in an area away from the tsunami inundation zone due to the current location. The relocation of the Kapaa Swimming Pool will provide accessibility to swimming and recreational activities for the general population in the Kapaa area.

The proposed new location of the pool will be in close proximity to Kapaa Middle School for students, teachers and staff usage for educational purposes such as physical education, sports events, and water safety training.

The Kauai Complex Area supports your effort to relocate the pool. It will serve as an added resource to reach our educational and healthy Hawaii initiatives for our students in the Kapaa complex school area.

We look forward to reviewing your environmental studies to better understand the full impact of your proposed Kapaa Highlands Phase II Project.

Please feel free to call me at 274-3502 should you have any questions.

Aloha,

William N. Arakaki

William N. Arakaki
Kauai Complex Area Superintendent

cc: Mayor Bernard P. Carvalho, Jr.

KAUAI PATH

P. O. Box 81 :: Lihue, HI 96766
phone 808.822.9447 :: fax 808.822.5075
www.KauaiPath.org
Pres@KauaiPath.org

registered 501(C)(3)

October 17, 2011

Commissioner Normand R. Lezy, Chairperson
Land Use Commission
Department of Business, Economic Development, and Tourism
State of Hawaii
PO Box 2359
Honolulu, HI. 96804-2359

RE: Petition to amend the Land Use Boundary of certain lands situated at Kapa'a, Island of Kaua'i, State of Hawaii, consisting of 97 acres from the Agriculture and Rural District to the Urban District, Tax Map Key No. (4)4-3-03:001.
Kapa'a Highlands, Three Stooges, LLC

Dear Commissioner Lezy,

Thank you for the opportunity for the Kauai Path, Inc. Board of Directors to offer our support for Kapa'a Highlands subdivision.

This proposed development as described to us by the developer appears to be consistent with smart, responsible growth. The planned development has the potential to serve the best interests of our communities. Preliminary plans we have been shown integrate community parks, green spaces, residential housing, and commercial areas. These elements promote a healthy and livable community.

Accordingly, it is our recommendation that if the Commission approves the applicants' request to change the property's zoning, such an approval should include conditions requiring the project to incorporate active transportation facilities. We recommend that these accommodations be designed with all users in mind. Such facilities should be described in a well-conceived circulation plan with provisions for safe bicycling and access to public transportation serving riders and pedestrians of all ages and abilities in compliance with Americans with Disabilities Act ("ADA") guidelines. The final plan should include appropriate traffic calming features like roundabouts, back-in diagonal parking, sidewalks, bike lanes and/or multi-use paths, public transportation stop(s), safe crossing opportunities, and median islands. These concepts encompass a Complete Streets approach to urban development.

As a feature conducive to smart growth and urban in-fill projects, we further recommend the inclusion of a modest community center providing sundries, sanitary facilities, and preferably some type of commercial food service for neighbors, visitors to the public swimming pool, the project's residents, and the nearby Kapa'a Middle School campus.

Creating attractive multimodal transportation connections—not only within the project, but most importantly to the surrounding multimodal infrastructure as well—will help create a community where families can live, work, and play with less dependence on automobiles and enhanced opportunities for improved health.

Respectfully,

Sally Jo Manea

Sally Jo Manea, President Board of Directors,
Kauai Path Inc.

Tommy A Noyes

Tommy A Noyes
Member of Board of Directors
Kauai Path Inc.

Dear Land Use Commission, 10/14/11

This letter is to show my support for the Kapa'a Highlands subdivision. It has been many years since the Kapa'a Ahupua'a has had a new planned subdivision. Planned communities are superior to random growth because they integrate community parks, green spaces, commercial areas and housing in an organized, smart layout that benefits everyone. The Kapa'a Highlands subdivision will be a planned community. It promises a healthy and livable community that will provide some work force housing which is sorely needed.
I ask that you give the Three Stooges LLC and Kapa'a Highlands your approval.

Thank you,

David Vickers

David Vickers

Island Truss

October 14, 2011

Land Use Commission
Department of Business, Economic Development, and Tourism
State of Hawai'i
P.O. Box 2359
Honolulu Hawai'i 96804-2359

Re: Petition to amend the Land Use Boundary of certain lands situated at Kapa'a, Island of Kaua'i, State of Hawai'i, consisting of 97 acres from the Agriculture and Rural District to the Urban District, Tax Map Key No. (4)4-3-03:001. Kapa'a Highlands, Three Stooges, LLC.

Dear Land Use Commissioners,

I am writing in support of the Kapaa Highlands project. As a person who has a degree in Urban Planning I believe this project has many of the features of a true smart growth community and will be a welcomed and vital addition to the Kapaa community. The project is close to town center making it a walkable community. It is also near a public transportation site. The plans are also asking for some limited mixed use within the community which could provide shopping and jobs within walking distance for residents. The project will allow the middle school to in effect expand into the park area and provide them with use of a pool (a needed addition since the nearby Kapaa pool is in need of repair.

The community will have a good density with single family homes duplexes and apartments. The plan is to make this community affordable for the average person which is most needed. The so called "gap housing" is often neglected on Kauai. They are incorporating parks and green space and the community is across the street from the Kapaa Park which will be a great addition for the kids of the community. The community will be walkable and bike able and they are looking to extend a spoke of the eastside bike path to the community. All streets are planned to be complete and therefore safe for all modes of transportation. The developers will be dedicating the bypass road to the state which is necessary for the development of Kapaa. The current circle at the bypass is a very safe feature for pedestrians and bicycles.

There are so many good and thoughtful smart growth considerations in this community that it should be approved and built. In addition this is one of the best uses for this land that is so near to central Kapaa.

Thank you for your consideration of this project, which I feel should be approved overwhelming.

Sincerely,

Neil J Clendeninn, MD, PhD, MS-arch
PO Box 1005, Hanalei, HI 96714
cybermad@msn.com
808-294-0660

KURT R. BOSSHARD
ATTORNEY AT LAW
3144 ELUA STREET
LIHUE, HAWAII 96766

TELEPHONE 808-245-5302
FAX 808-245-8929

October 6, 2011

Re: TMK 4-3-03-001

To Whom It May Concern:

I am the President of Kapaa Solar LLC. In 2010, Kapaa Solar LLC entered into with its owners who are the applicants herein, a lease/purchase and option to purchase portions of TMK 4-3-03-001. Construction of Kapaa Solar LLC's approximately 1.2 megawatt facility which will feed the Kauai Island Utility Cooperative's grid was successfully completed in December 2010. Construction was completed without placing any encumbrances upon the real property. And, in fact should the owner/applicant successfully complete the subdivision of the property, Kapaa Solar hopes to purchase several of the agriculturally zoned condominium units where the solar farm is located. The Kurt Bosshard Trust, of which I am the Trustee, has been the first mortgage holder as to the property since 2001.

I presently engage in other agricultural pursuits on approximately 30 additional acres of this property. Presently, the property is used for pasturage but my intention is to engage in more intensive farming activities should I be able to obtain subdivided lots/units where I am now farming. These activities would include aquaculture and fish farming, as I own an adjacent kuleana which has access to water. In these regards, I have had the Kauai Community College Chancellor and faculty members at the site who have shown interest in working with me to move such a project forward. KCC has a "sustainability" curriculum and it would like to place its graduates into such projects.

I have been a resident of Kauai's east side since 1976 and believe I have significant knowledge of this property, development in this area, and the communities' needs and concerns. Kapaa Solar LLC and the Bosshard Trust believe that the development of the property as proposed by the owners is in the communities' best interests as outlined in the application presently pending your approval. It is unfortunate that this land was not available in the year 2000 and thereafter when growth in the Kapaa area was forced to spread out away from the Kapaa urban area. It would be a shame should the same pressures for growth again emerge and the land not be available for reasonable urban expansion to meet the needs of Kauai's east and north sides. Timely approval of the

To Whom It May Concern
October 6, 2011

owners' application would be a significant step towards proper planning for the area and the communities' benefit.

I am available to respond to any questions you may have as to any of the foregoing and appreciate your attention to these matters.

Sincerely,

KURT BOSSHARD
President, Kapaa Solar LLC
Trustee, Kurt Bosshard Trust

KB:tes

Records

COUNTY COUNCIL
JAY FURFARO, CHAIR
JOANN A. YUKIMURA, VICE CHAIR
TIM BYNUM
DICKIE CHANG
KIPUKAI KUALI'I
NADINE K. NAKAMURA
MEL RAPOZO

4396 RICE STREET, SUITE 209
LĪHU'E, KAUA'I, HAWAI'I 96766
E-mail: cokcouncil@kauai.gov

OFFICE OF THE COUNTY CLERK
Council Services Division
Elections Division

PETER A. NAKAMURA, County Clerk
EDUARDO TOPENIO, JR., Deputy County Clerk

Telephone: (808) 241-4188
Facsimile: (808) 241-6349

October 5, 2011

Normand R. Lezy, Chairperson
Land Use Commission
State of Hawaii
Department of Business, Economic Development, and Tourism
P.O. Box 2359
Honolulu, Hawai'i 96804-2359

Dear Chairperson Lezy:

RE: Petition To Amend The Land Use Boundary Of Certain Lands Situated At Kapa'a. Island of Kaua'i, State of Hawai'i, Consisting Of 97 Acres From The Agriculture And Rural District To The Urban District, Tax Map Key No. (4)4-3-03:001. Kapa'a Highlands, Three Stooges, LLC.

Thank you for the opportunity to offer my support in my individual capacity as a member of the Kaua'i County Council for the amendment of 97 acres in the Urban State Land Use District.

I have been assured that the Petitioners, Three Stooges, LLC, continues to work directly with various County departments in order to follow all County ordinance requirements.

The proposed amendment is expected to provide 231 affordable housing units, both single family and multi-family types of structures.

The Petitioners are dedicated to creating a multi-use development that serves the best interest of its surrounding community and is consistent with smart, responsible growth.

Thank you for allowing me this opportunity to provide my support as an individual member of the Kaua'i County Council.

U:2011 memos & letters/CMBynumSupportLTRtoLUCChairperson/JT:impw

Test lug

Norman R. Lezy, Chairperson
October 5, 2011
Page 2

Should you have any questions, please feel free to contact me at (808) 241-4188.

Sincerely,

TIM BYNUM
Councilmember
Kaua'i County Council

U:2011 memos & letters/CMBynumSupportLTRtoLUCChairperson/JT:lmpw

NEIL ABERCROMBIE
GOVERNOR OF HAWAI'I

GARY L. HOOSER
DIRECTOR

STATE OF HAWAI'I
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET, SUITE 702
HONOLULU, HAWAI'I 96813

In reply, please refer to:
File:

October 3, 2011

Patrick J. Childs
Suite 104
4365 Kukui Grove Street
Lihue, Hawaii 96766

Dear Mr. Childs:

Subject: Kapaa Highlands Phase II, Petition for District Boundary Amendment, TMK: 4-4-02-01 por. Kauai

Am in receipt of your letter requesting the Office of Environmental Quality Control (OEQC) to "...confirm through your office that there is no specific requirement for an EA at this time."

Based on the information presented in your letter, it appears that this action involves an application before the Land Use Commission requesting the redistricting of 97 acres of agricultural land into urban. In this case, the determination as to whether or not this application triggers HRS Chapter 343 would be made by the LUC. It is my understanding that changing the land use designation as described does not by itself trigger HRS Chapter 343, however depending on the extent and nature of the planned development, a permitting agency may determine otherwise. Furthermore, depending on the developments ultimate impact on adjacent State highways, the Department of Transportation should also be consulted. I would be pleased to meet and discuss this project or any issues of concern or questions that you might have, should you believe that would be helpful.

NOTE: The OEQC is not authorized to determine or enforce compliance with HRS Chapter 343, nor does it have legal authority to approve or disapprove exemptions, EA's or EIS documents. The OEQC policy on such requests is to consult and offer general guidance based on our understanding of HRS Chapter 343 and past practice with regards to its implementation, but to refrain from issuing specific opinions on specific projects, except that the OEQC may make a recommendation as to the acceptability of a final statement upon request. Not only does the OEQC not have the legal authority to direct compliance or make determinations, the office also lacks the resources to effectively analyze specific projects, conduct site visits and in general conduct the due diligence needed to properly evaluate a projects impacts and potential Chapter 343 compliance issues. The responsibility for such analysis and determinations rests solely on the permitting and approving or accepting agency.

Sincerely,

Gary Hooser, Director
Office of Environmental Quality Control

Bernard P. Carvalho, Jr.
Mayor

Gary K. Heu
Managing Director

Michael A. Dahilig
Interim Director of Planning

Dee M. Crowell
Deputy Director of Planning

PLANNING DEPARTMENT
County of Kaua'i, State of Hawai'i
4444 Rice Street, Suite A-473, Līhu'e, Hawai'i 96766
TEL (808) 241-4050 FAX (808) 241-6699

August 31, 2011

RECEIVED
SEP -6 2011
BELLES GRAHAM PROUDFOOT WILSON & CHUN, LLP

Max W. J. Graham, Jr.
BELLES GRAHAM PROUDFOOT WILSON & CHUN, LLP.
Watumull Plaza
4334 Rice Street, Suite 202
Līhu'e, Hawai'i 96766-1388

Subject: KAPA'A HIGHLANDS SUBDIVISION – Subdivision of Parcel 1, Being a Portion of Grant 5266 to Rufus P. Spalding Into Lots 1 to 13, Inclusive, Kapa'a and Waipōuli, Kaua'i, Hawai'i. (**S-99-45**, Allen Family LLC/Moloa'a Bay Ventures, LLC/Three Stooges, LLC)

An extension until **AUGUST 31, 2012** to file final subdivision maps has been approved by the Planning Commission at their meeting held on August 30, 2011. The Applicant shall submit an updated status report on the subdivision that includes a detailed time chronology on the progress of the tentative approval requirements and it shall be submitted to the Planning Department no later than six (6) months from that date of the extension approval.

MICHAEL A. DAHILIG
Interim Director of Planning

xc: CoK – Public Works Dept.
CoK – Water Dept.
CoK – Real Property Div. – Assessment
State Health Dept.

Department of Water
County of Kaua'i

Water has no substitute.......Conserve it

August 22, 2011

Mr. Gregg Allen
161 Wailua Road
Kapaa, HI 96746

Dear Mr. Allen:

Subject: Water Master Plan for the Kapa'a Highlands Project on TMK: 4-3-03:001

At the Department of Water, Water Board July 28th 2011 meeting, via Managers Report 12-10, in response to your letters of April 22, 2011 and May 11, 2011, accepted the proposed exchange of source for storage on a dollar for dollar basis. This acceptance is based on your commitment to proceed with zoning changes in your development to match the county zoning. That zoning change requires affordable housing in certain portions of your proposed development.

This acceptance is based on building permits and County water meter service not being issued if the source and storage requirements have not been completed as of the date of requested building permit approval. We ask that you submit a proposed draft of an agreement to memorialize this action. We would expect that this agreement runs with the land.

If you have any questions, please contact Mr. Gregg Fujikawa at (808) 245-5416.

Sincerely,

David R. Craddick, P.E.
Manager and Chief Engineer

GF/WE:bdm
Bill/Gregg Allen Response Letter/July Board Mtg.

4398 Pua Loke St., P.O. Box 1706, Lihue, HI 96766 Phone: 808-245-5400
Engineering and Fiscal Fax: 808-245-5813, Operations Fax: 808-245-5402, Administration Fax: 808-246-8628

Bernard P. Carvalho, Jr.
Mayor

Gary K. Heu
Managing Director

Michael A. Dahilig
Director of Planning

Dee M. Crowell
Deputy Director of Planning

PLANNING DEPARTMENT
County of Kaua'i, State of Hawai'i
4444 Rice Street, Suite A-473, Līhu'e, Hawai'i 96766
TEL (808) 241-4050 FAX (808) 241-6699

4 March 2011

Agor Architecture, LLC
424 Ena Road, Suite 206A
Honolulu, HI 96815

Re: **Kapa'a Highlands Phase II**
Petition for District Boundary Amendment
TMK: 4-4-03: 01 Por.

Dear Mr. Agor:

Mahalo, for providing information to us on your proposed project. In reviewing your Draft EA and Petition, we note that you propose to apply to the State Land Use Commission to redesignate approximately 97 acres of land, from the Agriculture State Land Use District to the Urban State Land Use District. The proposed area is located adjacent to, and south and east of the existing Kapa'a Middle School.

The area is located in the Agriculture Zoning District. From a map and text review of the 2000 General Plan, we note that the area was redesignated from Agricultural to Urban Center and Residential Community. It appears that the 97 acres is located totally within the General Plan Urban Center area. Because of the conceptual nature of your submittal, we cannot locate the exact area of your project on our General Plan Map. However, General Plan designations do allow for some flexibility in interpretation and we may be able to make minor adjustments. Be aware that the Land Use Commission will require a metes and bounds description of the area you propose to redesignate.

Therefore, because your proposed project appears to be in conformance with the General Plan of the County of Kaua'i, and HRS Ch. 343 is not triggered by any requirements of the Planning Department. We have no comments to offer on the particulars of your project at this time.

Also, please be advised that recent court decisions and legislation have had an impact on HRS Ch. 343 triggers. You may want to consult other state and county agencies that deal with land development to discuss any change in their particular requirements.

If you have any questions, please feel free to call me, or Deputy Director Dee Crowell at (808)241-4050, or email dcrowell@kauai.gov.

MICHAEL A. DAHILIG
Planning Director

Bernard P. Carvalho, Jr.
Mayor

Gary K. Heu
Managing Director

OFFICE OF THE MAYOR
County of Kaua'i, State of Hawai'i
4444 Rice Street, Suite 235, Līhu'e, Hawai'i 96766
TEL (808) 241-4900 FAX (808) 241-6877

March 1, 2011

Mr. Greg Allen
161 Wailua Road
Kapa'a, Hawai'i 96746

Dear Greg:

Allow me to extend my deepest Mahalo and congratulations for the recent dedication of the Kapa'a solar project. This is such a huge accomplishment and will benefit Kaua'i for many years to come. I know you played a significant role in its development and hope that you know we are very grateful for your efforts.

I'm also hopeful your plans for additional housing for Kapa'a will move forward expeditiously, as this project could also provide many benefits such as affordable housing and community facility assets – especially for the nearby schools.

Best wishes, Greg, for continued success and Mahalo again for your contribution to Kaua'i's renewable energy future!

Sincerely,

Bernard P. Carvalho, Jr.
Mayor

Bernard P. Carvalho, Jr.
Mayor

Gary K. Heu
Managing Director

OFFICE OF THE MAYOR
County of Kaua'i, State of Hawai'i
4444 Rice Street, Suite 235, Līhu'e, Hawai'i 96766
TEL (808) 241-4900 FAX (808) 241-6877

December 9, 2010

Vladimir P. Devens, Chairperson
Land Use Commission
Department of Business, Economic Development, and Tourism
State of Hawai'i
P.O. Box 2359
Honolulu, Hawai'i 96804-2359

Re: Petition to amend the Land Use Boundary of certain lands situated at Kapa'a, Island of Kaua'i, State of Hawai'i, consisting of 97 acres from the Agriculture and Rural District to the Urban District, Tax Map Key No. (4) 4-3-03: 001. Kapa'a Highlands, Three Stooges, LLC.

Dear Chairperson Devens:

Thank you for the opportunity to offer my support for the amendment of 97 acres in the Urban State Land Use District.

The Petitioners, Three Stooges, LLC, have continued to work directly with various County departments to ensure this development project follows all County ordinance requirements and mitigates any adverse impacts during construction.

The proposed amendment will provide 231 affordable housing units in a manner consistent with the County of Kaua'i's General Plan. The development will provide single and multi-family housing as well as various public facilities to support its close proximity to Kapa'a Middle School and the urban areas of Kapa'a town.

Furthermore, Petitioners are dedicated to creating a multi-use development that serves the best interest of its surrounding community. This is consistent with the smart, responsible growth that I envision for the island of Kaua'i, to create communities where families can live, work and play.

For these aforementioned reasons, I support the petition to amend the land of 97 acres to the Urban District.

Mahalo nui loa,

BERNARD P. CARVALHO, JR.
Mayor, County of Kauai

LINDA LINGLE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
KAUAI DISTRICT
1720 HALEUKANA STREET
LIHUE, HAWAII 96766

MICHAEL D. FORMBY
INTERIM DIRECTOR

Deputy Directors
FRANCIS PAUL KEENO
JIRO A. SUMADA

IN REPLY REFER TO:

HWY-K 4.100528

November 3, 2010

Vladimir P. Devens, Chairperson
Land Use Commission
Department of Business, Economic Development, and Tourism
State of Hawaii
P.O. Box 2359
Honolulu, Hawaii 96804-2359

Dear Chairperson Devens:

Subject: Petition to amend the Land Use Boundary of certain lands situated at Kapaa, Island of Kauai, State of Hawaii, consisting of 97 acres from the Agriculture and Rural District, to the Urban District, Tax Map Key No. (4) 4-3-03: 001
Kapaa Highlands
Three Stooges, LLC

We are writing in general support of the Kapaa Highlands petition to amend 97 acres in Kapaa to the Urban District. The proposed amendment is for the development of 231 affordable housing units. The Department of Transportation is generally supportive of petitions that will provide affordable housing units in a manner consistent with the Kauai County General Plan.

We have met with the Petitioners, Three Stooges LLC, and we will work with them to ensure that any traffic impacts from the project are analyzed and effectively mitigated

If you have any questions, please call me at 241-3006.

Sincerely,

for RAYMOND J. MC CORMICK, P.E.
District Engineer

SMI:JI
cc: Ron Agor

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

June 28, 2010

LOG NO: 2010.2441
DOC NO: 1006MV50

Greg Allen, Kapaa Highlands Inc.
161 Wailua Road
Kapaa, HI 96746

SUBJECT: **Historic Preservation Review-**
Consultation Letter on TMK [4]-4-3-003:001, Kapa`a Kauai

Thank you for the opportunity to provide a current determination letter on the property with TMK# [4]-4-3-003:001. According to our records, there has not been an Archaeological Inventory Survey (AIS) of this property. In addition, Archaeological Inventory Surveys of nearby properties (TMK [4]-4-3-003:004 and TMK [4]-4-3-003:005) recorded multiple historic properties (SHPD Log No. 2008.1916). However, aerial photos indicate that this property was previously cultivated with sugar cane, which may have destructive implications for pre and post-contact Native Hawaiian sites within the project area. However, current aerial photos indicate the presence of potentially historic irrigation features as well as terrain that may not have been subject to intensive cultivation.

The historic preservation requirements for any proposed action within this project area would vary depending on the extent of the action's impact on the parcel. If the action were to take place on previously cultivated land the only historic preservation requirement would be to document the irrigation features. However, if the action takes place in a part of the property that was not cultivated an Archaeological Inventory of that area may be required. It would be highly beneficial for all proposed actions to have an Archeological Inventory Survey for the entire property in order to document the presence or absence of historic sites in this parcel.

Please call Mike Vitousek at (808) 692-8024 if you have any questions or concerns regarding this letter.

Aloha,

Nancy A. McMahon

Nancy McMahon, Deputy SHPO/State Archaeologist
and Historic Preservation Manager

Bernard P. Carvalho, Jr.
Mayor

Gary K. Heu
Administrative Assistant

KAUAI COUNTY HOUSING AGENCY
Pi'ikoi Building 4444 Rice Street Suite 330
Lihue Hawaii 96766

Eugene K. Jimenez
Housing Director

COPY

March 2, 2010

Mr. Greg Allen
161 Wailua Road
Kapa'a, HI 96746

SUBJECT: In the Matter of the Petition of KAPA'A HIGHLANDS, THREE STOOGES, LLC, to Amend the Land Use District Boundary of Certain Lands Situated at Kapa'a, Island of Kaua'i, State of Hawai'i, Consisting of 97 Acres from the Agriculture and Rural District, To the Urban District, TAX MAP KEY NO. (4) 4-3-03: 01 (por.)

Dear Mr. Allen,

Thank you for the opportunity to review your preliminary Petition for District Boundary Amendment of 97 acres into the Urban State Land Use District. We are aware that a portion of TMK (4) 4-3-03:01 has been designated Urban Center by the Kaua'i County General Plan since the 1980's. The property is contiguous to and in close proximity to the coastal urban areas of Kapa'a Town, yet sits at a higher elevation and abuts the Kapa'a Middle School. The Petitioner proposes to develop single and multi-family housing as well as public facilities on the redistricted land. For the foregoing reasons, we support the petition to amend the land into the Urban District.

Please be advised that under current law, at the time of zoning amendment, the project area will be subject to Ordinance No. 860, the Housing Policy for the County of Kaua'i. The Ordinance requires the development of workforce housing targeted to Kaua'i residents earning from up to 80% to 140% of the Kaua'i Median Household Income. Ordinance No. 860 requires the fee-simple sale of workforce housing equivalent to thirty (30%) of the market units, which may be reduced to a minimum of fifteen percent (15%) through the use of incentives. We anticipate that the subject project would comply with all County ordinance requirements, and that our comments will be sought in the Land Use Commission's formal petition review.

Sincerely,

Eugene K. Jimenez

EUGENE K. JIMENEZ
Housing Director

cc: Ron Agor, AIA; Imai Aiu, Planning

Development Section (808) 241 4444 FAX (808) 241 5118
TDD (808) 241 4411

Section 8 (HUD) (808) 241 4440 FAX (808) 241 5119

COPY

BERNARD P. CARVALHO JR.
MAYOR

GARY K. HEU
ADMINISTRATIVE ASSISTANT

IAN K. COSTA
DIRECTOR OF PLANNING

IMAIKALANI P. AIU
DEPUTY DIRECTOR OF PLANNING

COUNTY OF KAUA'I
PLANNING DEPARTMENT
4444 RICE STREET
KAPULE BUILDING, SUITE A473
LIHU'E, KAUA'I, HAWAI'I 96766-1326

TELEPHONE: (808) 241-4050 FAX: (808) 241-6699

January 5, 2010

To: Ransom A.K. Piltz, Chairperson
Department of Business, Economic Development & Tourism
State of Hawaii
P.O. Box 2359
Honolulu, Hawaii 96804-2359

Subject: Petition to amend the Land Use District boundary of certain lands situated at Kapa'a, Island of Kaua'i, State of Hawai'i, consisting of 97 acres from the Agriculture and Rural District, to the Urban District, Tax Map Key no. (4)4-3-03:01. Kapa'a Highlands, Three Stooges LLC

Aloha Chair Piltz,

We are writing in general support of Three stooges LLC's petition to amend 97 acres in Kapa'a to the Urban district. The proposed amendment is in conformance with the County of Kaua'i's General Plan and will provide 231 units of affordable housing. Affordable housing remains an acute need on Kaua'i, even with a falling real estate market and as such the County is generally supportive of any petition that proposes additional affordable housing, particularly when contiguous to developed urban areas, infrastructure and consistent with our General Plan.

Sincerely,

IAN K. COSTA
Planning Director, County of Kaua'i

CC: Ron Agor

BERNARD P. CARVALHO, JR.
MAYOR

GARY K. HEU
ADMINISTRATIVE ASSISTANT

DONALD M. FUJIMOTO
COUNTY ENGINEER
TELEPHONE 241-4992

EDMOND P.K. RENAUD
DEPUTY COUNTY ENGINEER
TELEPHONE 241-4992

AN EQUAL OPPORTUNITY EMPLOYER
COUNTY OF KAUA'I
DEPARTMENT OF PUBLIC WORKS
4444 RICE STREET
MO'IKEHA BUILDING, SUITE 275
LIHU'E, KAUA'I, HAWAI'I 96766-1340

December 22, 2009

Mr. Greg Allen
161 Wailua Road
Kapa'a, Hawai'i 96746

SUBJECT: PROPOSED KAPA'A HIGHLANDS RESIDENTIAL DEVELOPMENT

Dear Mr. Allen:

We acknowledge receipt of your email dated September 24, 2009 for the proposed project and offer the following comments:

1. The proposed project will be connected to the Wailua Wastewater Treatment Plant (WWTP) via a connection to the County's Wailua-Kapa'a sewer system in the vicinity of Olohena Road. The on-site and any necessary off-site extension of a sewer collection system will need to be designed and constructed as part of the development, and may either be a privately owned and operated collection system, or may be designed and constructed with the intent to convey the new collection system to the County. In either case, the system should be designed and constructed pursuant to County standards.

2. The concept plan map submitted does not show proposed sewer utility lines. All appurtenant sewer collection system improvements necessary to serve the development will be designed and installed by the developer. As such, sewer connection charges (SCC) will be waived as provided by the County's sewer ordinance.

3. Based on the proposed 769 single-family and multi-family residential units to be developed, at the current rate of \$3,900.00 per unit, the Wastewater Treatment Capacity Assessment (WTCA) is in the amount of \$2,999,100.00. The WTCA shall be paid prior to any final subdivision or building permit approvals.

4. Please note that a preliminary engineering report (PER) is required to evaluate the adequacy of the existing and proposed sewer collection system and treatment plant capacity. The PER shall be submitted for our review and approval. The PER should include sufficient detail to allow the County to verify that the proposed sewer system will comply with County Standards, identify the anticipated flow to the County's

Mr. Greg Allen
December 22, 2009
Page No. 2

sewer system, and to evaluate whether improvements to the existing County sewer system will be needed to serve the development. In the event the project will be developed in phases, please indicate the approximate schedule for phasing of the project, to allow the County to identify impacts from the project on the County's wastewater system, including the flow projections for the Wailua WWTP.

5. Prior to start of any sewer system construction, plans need to be submitted for our review for compliance with sewer design standards.

6. Depending on the extent of necessary improvements to the County's wastewater system, applications for sewer service by others, and project phasing and build-out flows to the Wailua WWTP, there may need to be improvements at the WWTP prior to the County having adequate capacity for the full build-out of the project.

Should you have questions, please contact Valentino Reyna at (808) 241-4083.

Very truly yours,

EDWARD TSCHUPP
Chief, Wastewater Management Division

CONCUR:

DONALD M. FUJIMOTO
County Engineer

VR

cc: Engineering Division
Planning Department

GAllen

From: Tadani, Curtis [ctadani@kiuc.coop]
Sent: Thursday, September 06, 2007 9:44 AM
To: gallen@harbormall.net
Cc: Pascual, Ferdinand
Subject: Kapaa Highlands

Hi Greg,

I got your message and the plans that you brought in were already approved and signed off by us on June 27, 2005 so as far as we're concerned, it should be okay. But if you need to do anything different that will affect the electrical plans, than you should revise them and resubmit them to us for further review. Let me know if anything happens after your Planning Commission meeting next week that will affect the design of the subdivision and more so the electrical portion.

Thanks,

Curt K. Tadani
Eastside Distribution Planner
Kauai Island Utility Cooperative
Ph: 246-4356
Fax: 246-4332
Email: ctadani@kiuc.coop

Elec plans ok

BRYAN J. BAPTISTE
MAYOR

IAN K. COSTA
DIRECTOR OF PLANNING

GARY K. HEU
ADMINISTRATIVE ASSISTANT

IMAIKALANI P. AIU
DEPUTY DIRECTOR OF PLANNING

COUNTY OF KAUA'I
PLANNING DEPARTMENT
4444 RICE STREET
KAPULE BUILDING, SUITE A473
LIHU'E, KAUA'I, HAWAI'I 96766-1326
TEL (808) 241-6677 FAX (808) 241-6699

May 29, 2007

Max Graham, Jr.
Belles Graham
Proudfoot & Wilson
4334 Rice Street, Suite 202
Lihue, Kauai HI 96766

JUN 12 2007

SUBJECT: TMK: 4-3-003:001
Kapa'a and Waipouli, Kauai

In response to your letter dated April 16, 2007 concerning the Kapa'a and Waipouli property Tax Map Key (TMK) 4-3-003:001, the subject property is approximately 163.125 acres in size. The State Land Use Commission (SLUC) designates the entire 163.125 acres of the subject property as Agriculture. The County General Plan designates approximately 97.654 acres Urban-Center, 33.685 acres Open, and 31.787 Agriculture. The Comprehensive Zoning Ordinance has the property zoned approximately 127.305 acres Agriculture (A) and 35.820 acres Open (O).

Please understand that the contents of this letter reflect the regulations and/or requirements that are currently in effect and being administered by this Department. These regulations are subject to change. Additionally, we recommend that you also check with other governmental agencies which may administer regulations and requirements that relate to development on this property and/or the proposed use

Attached is a copy of a map showing the SLUC District boundaries on the subject property.

Should you have any questions, please contact Ka'aina Hull of my staff at 241-6677.

Sincerely,

IAN K. COSTA
Director of Planning

Attached.

AN EQUAL OPPORTUNITY EMPLOYER

2-16-2010 8:54AM FROM BOSSHARD/BRONSTEIN 808 245 8929 P. 2

Dec-19-99 12:40P GREG KAMM 1 808 7421751 P.02

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

TIMOTHY E. JOHNS, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DEPUTIES
JANET E. KAWELO
LINNEL NISHIOKA

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
HISTORIC PRESERVATION DIVISION
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS
WATER RESOURCE MANAGEMENT

December 14, 1999

Mr. Greg Kamm
P.O. Box 1200
Koloa, HI 96756

LOG NO: 24572
DOC NO: 9912NM02

Dear Mr. Kamm:

SUBJECT: **Chapter 6E-42, Historic Preservation Review -- Subdivision Permit Application S-99-45 (Silagi Family Trust and Hillside Corp. Center L.L.C.)**
TMK: 4-3-03: 01 por
Kapaa, Kawaihau, Kaua'i

Thank you for submitting the 1975 air photo of the above subject parcels. We agree that the land has been extensively altered by cane cultivation and filling. Therefore, we now believe that this project will have "no effect" on significant historic sites.

If you have any questions, please call Nancy McMahon at 742-7033.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

NM:lm

c: D. Crowell, Planning Department County of Kauai

From: Heidi_Meeker/FacilDev/HIDOE@notes.k12.hi.us
[mailto:Heidi_Meeker/FacilDev/HIDOE@notes.k12.hi.us]
Sent: Wednesday, April 25, 2012 11:24 AM
To: PeterYoung@Hookuleana.com
Subject: Kapaa Highlands II - Draft Language in EA

Heidi Meeker/FacilDev/HIDOE

04/25/2012 10:40 AM

To Jeremy Kwock/FacilDev/HIDOE@HIDOE,
cc
Subject Kapaa Highlands II - Draft Language in EA Link

Hello Peter,

I appreciate the opportunity to review the education section of the DEA for Kapaa Highlands.

1. Publication of our worksheet
We didn't have a problem with responding to your specific request for a hypothetical impact worksheet, but the sheet itself was marked for discussion purposes only. We have a real problem with the publication of an impact fee work sheet for an impact fee district that doesn't exist, with no current plans to proposed one. The sheet doesn't serve any real purpose for Kapaa Highlands and could be grossly misinterpreted if it was applied to other proposed projects.

2. There's no impact district
Your narrative never states in plain language that there is no school impact fee district in Kapaa, or any where else on the island. The conclusion seems to be buried: we will not be asking the Kapaa Highlands project for any contributions or fees at this point in time. We do not have any current plans to propose an impact district in Kapaa. However, it is possible that a future impact district may cover Kapaa. In that event, Kapaa Highlands may be required to pay impact fees, based on the fee schedule established for the district.

3. Capacity figure
We would prefer that the capacity figures you use be labeled "Classroom Utilization Report 2007-2008" and "CUR 07-08". The annual Classroom Utilization Report was not strictly an inventory of classroom space, it relied on other data such as faculty and staff counts.

We don't have a problem with your estimated student count, but would like the Student Generation Rate to be identified as an estimated Kapaa-area-only SGR.

We don't have a problem with your general assessment that there is sufficient capacity in the Kapaa schools at this point in time to accommodate the students who will reside in the Highlands project.

Please get back to me if you have questions.

Heidi Meeker - heidi_meeker@notes.k12.hi.us
Planning Section
Department of Education/Facilities Development Branch
Kalani High School TB1B
4680 Kalanianaole Highway
Honolulu, 96821
Ph.808-377-8301

Exhibit O

Kauaʻi County Planning Commission
Tentative Subdivision Approval for HoKua Farm Lots
June 19, 2014

PLANNING COMMISSION
County of Kaua'i, State of Hawai'i
4444 Rice Street
Kapule Building, Suite A-473
Līhu'e, Hawai'i 96766-1326
TEL (808) 241-4050 FAX (808) 241-6699

Michael A. Dahilig
Clerk of the Commission

JUN 19 2014

Mr. Brian M. Hennessy
HONUA ENGINEERING, INC.
Ching Young Center, Suite C7
P.O. Box 851
Hanalei, Hawai'i 96714

Subject: Hokua Farm Lots, being the Subdivision of Parcel 1 into Lots 1 to 6 inclusive and designating Easements "AU-1", "AU-2", "D-1", and "W-1", being a portion of Grant 5226 to Rufus P. Spalding at Kapa'a, Kaua'i, Hawai'i.
(**S-2014-02**, HG Kauai Joint Ventures LLC)

Dear Mr. Hennessy,

This letter memorializes the action taken by the Kaua'i Planning Commission effective JUNE 10, 2014 concerning **TENTATIVE APPROVAL** of the above subject application. Final subdivision map approval, per your consent, is subject to the following conditions:

1. Requirements of the Planning Department:

    a. An updated preliminary title report for the existing lot shall be submitted to the Planning Department for review.

    b. All existing and proposed easements shall be identified in the deed descriptions of affected lots and shown on the final subdivision map. Draft copies of the deed descriptions shall be submitted to the Planning Department for review and approval.

    c. Pursuant to section 9-3.8(b) of the Subdivision Ordinance, Kaua'i County Code (1987), the applicant shall submit to the Planning Department an electronic record (digitized format) of the final subdivision map(s) on disk for record keeping purposes prior to final subdivision approval.

rcd 6/21/1
Jnb#5117

d. The following fees shall be paid to the County of Kaua'i:

1) Park Dedication fee: $900.00

2) Environmental Impact Assessment fee: $1,250.00

e. A future road widening reserve shall be established along the frontage of Olohena Road and Kapa'a By-Pass Road which shall be subject to the specifications of the Public Works Department for a major street. There shall be no new structures permitted within the reserve, and any new structures should be setback from the reserve. The reserve along with its restrictions shall be incorporated into the deed descriptions of the affected lots, draft copies of which shall be submitted to the Planning Department for review and approval.

f. Prior to final subdivision approval, the subdivider shall delineate the Class "B" classified lands on the final subdivision map. In addition and pursuant to Act 199, Session Laws of Hawai'i, 1976, the applicant shall enter into an agreement with the County to incorporate agricultural restrictions into the instruments of conveyance for those lots which contain the Class "A" and/or "B" soils.

g. The Applicant is advised that uses on the newly-created lots shall be limited to those listed as permissible uses within the "A" Agricultural District in the State Land Use Commission Rules and Regulations. Dwellings on the lot shall mean a single-family dwelling located on and used in connection with a farm where agriculture activity provides income to the family occupying the dwelling. These restrictions shall be included in the covenants for the proposed lots, draft copies of which shall be submitted to the Planning Department for review and approval.

h. Prior to final subdivision approval, the Applicant shall submit to the Planning Department a density breakdown for each lot which will be subject to review and approval by the Department. These restrictions shall be included in the covenants and deed descriptions of the proposed lots, draft copies of which shall be submitted to the Planning Department for review and approval. The Planning Department reserves the right to impose additional conditions relating to this matter while in the process of resolving this condition.

i. The pole sections of the double flag lots shall be designated as common access/utility easements in favor of each other and shall be incorporated into the deed descriptions of the affected lots (Lot 4 and Lot 5), draft copies of which shall be submitted to the Planning Department for review and approval.

j. The subdivider shall resolve with the Planning and Public Works Departments the following:

1) Participation in the upgrading of the intersection of 'Olohena Road, Ka'apuni and Kaehulua Roads by providing necessary lands to accommodate the future improvements.

2) Limiting vehicular access points onto 'Olohena Road.

3) Establishing a road reserve within the project area in order to accommodate future construction of interior roadway system that would allow a connection for 'Olohena Road to the Kapa'a By-Pass Road and relieve traffic off 'Olohena Road.

The Planning Department reserves the right to impose additional conditions relating to this matter while in the process of resolving this condition.

k. The Applicant shall prepare and obtain construction plan approvals for necessary road, water, drainage, electrical and telephone utilities and facilities, and either construct the same or post a surety bond for completion.

l. In order to ensure that the subdivision and development of property complies with the land use requirements contained in Chapter 205 of the Hawai'i Revised Statutes ("HRS"), the following matter shall be resolved prior to final subdivision approval:

(1) The Applicant shall provide the following documents to the Subdivision Committee of the Planning Commission ("Subdivision Committee") for its review and approval:

(A) An Agriculture Master Plan shall describe the proposed agricultural uses of the property, the marketing and business plans associated with such activities, and the manner in which the agricultural and related uses on the property will comply with HRS Chapter 205.

(B) A map of the property showing the proposed location of: Agricultural Activities; Building Areas; and Agricultural Easements.

(C) A Declaration of Conditions, Covenants and Restrictions ("Restrictive Covenants") which will be recorded in the Bureau of Conveyances of the State of Hawai'i ("Bureau"), which will encumber and run with the property, and which will provide and require: that the owners of the lots in the subdivision ("Subdivision Lots") shall comply with the Agricultural Plan and the provisions of HRS Chapter 205; that the owners of all of the Subdivision Lots shall be members in an association ("Association") which will have the power and duty to enforce the Restrictive Covenants; that the Association shall file periodic reports (as determined by the Planning Department) with the Planning Department verifying compliance with the Agricultural Master Plan; and that the Agricultural Master Plan shall not be amended without prior approval of the Planning Department.

(D) An Agricultural Subdivision Agreement which will be recorded in the Bureau, run with and encumber the property, and which will provide and require: that each Subdivision Lot owner shall indemnify, defend and hold the County harmless from any claims arising out of the failure of the Subdivision Lot owner to comply with the Agricultural Master Plan and/or HRS Chapter 205; and that in the event of a Subdivision Lot owner's noncompliance with the Agricultural Master Plan and/or HRS Chapter 205 as determined by the Planning Department, the County and the State of Hawai'i shall have the right to refuse to grant any permits or approvals for uses or development on any Subdivision Lot affected by such noncompliance unless and until the noncompliance is cured, as determined by the Planning Department.

m. The subdivider shall resolve with the Planning Department the provision of public access within the subdivision. The applicant shall propose an access plan for the review and approval of the Planning and Public Works Departments. Additionally, due to the farming activities, the subdivider shall work with the Planning Department on establishing a public access control system.

Proper documents shall be prepared and ready for execution prior to final subdivision approval. The Planning Department reserves the right to impose additional conditions relating to this matter while in the process of resolving this condition.

2. Requirements of the Department of Public Works:

DRAINAGE

a. The subject subdivision abuts a natural unnamed drainage way on the West for which a detailed flood study has not been incorporated with the Flood Insurance Rate Maps (FIRM). Several natural drainage valleys or drainage swales traverses through and along the property. The natural drainage water courses will collect and concentrate storm flows through the site. A drainage study and provisions need to be established to prevent structures from being built in flood prone areas and to preserve the function and capacity of the natural water courses.

The subdivision and subsequent development of residences and other impermeable surfacing will increase storm water flowage. A drainage study needs to be made to evaluate the impacts of the increased storm runoffs. Measures to keep flow rates to predevelopment conditions is required.

b. Flood studies need to include the existing bridge at the Kapa'a By Pass Road whether the bridge is adequate to convey storm flows without overtopping the Kapaa By Pass Road.

c. The flood zoning, FIRM panel no. 204F and the date of the FIRM November 26, 2010 needs to be labeled on the final maps as well as the determined flood prone areas with base flood elevations. The applicant and future owners shall be advised that construction of new structures in flood prone areas presents flood risks and associated flood problems.

ROAD

d. The street name labeling for *Opala Road* needs to be amended to **"Malu Road"**. The Kapa'a By Pass Road traverses through the proposed Lot 6. We recommend that the Kapa'a By Pass Road be named to facilitate house addressing assignment.

e. The subject subdivision abuts the Olohena Road on the North. Olohena Road has a right of way width of 40 feet and an average pavement width of 20 feet. The pavement width is adequate for two way passenger vehicular type traffic. The right of way width is inadequate for a major collector street classification (60 feet right of way). We recommend a road reserve be established along Olohena Road or lands be dedicated to the County as well as improvements to Olohena Road to facilitate Safe Route to School and Complete Streets facilities.

f. Access along Olohena Road **must** be restricted. Access for Lots 1, 2 and 3 **shall** be restricted to the pole section for Lots 4 and 5. Easement "AU-1" for roadway and utility purposes shall be restricted to the pole section for Lots 4 and 5. Comments should be solicited from the State Department of Transportation whether access would be allowed for Lot 6 from the Kapa'a By Pass Road.

OTHERS

g. Complete Streets and Safe Route to School design principles needs to be incorporated with the subdivision improvements to Olohena Road. Complete Streets and Safe Route to School features include interconnected sustainable transportation networks providing opportunities for all modes of travel to and from neighborhood destination points for users of all ages and abilities. Comments should be solicited from the County's Transportation Planner.

3. Requirements of the Department of Water:

a. The subdivider shall pay the Department of Water, a Facilities Reserve Charge of $23,000 (5 lots at $4,600 per lot). The subdivider shall pay any rate increase and/or applicable charges in effect at the time of receipt.

b. The subdivider shall prepare and get Department of Water's approval on construction drawings for necessary water system facilities and either construct said facilities or post a performance bond for construction. These facilities shall also include:

   1) Additional source facilities. The Applicant may wait until others (including the Department of Water) to construct additional source for this area.

   2) The domestic service connection.

c. Locate and show all existing water meter/s (with appropriate water meter number) on the tentative subdivision map for the Department of Water's review and approval. Also identify the proposed subdivision lot that the existing water meter/s will be assigned to. The DOW comments may change depending on the approved tentative map.

4. Requirements of the State Health Department:

   a. The existing individual wastewater system can continue to serve the existing building. However, wastewater generated from any additional dwelling units and other buildings shall be disposed of in wastewater systems that meet the wastewater rules in effect at the time of building permit application.

   b. Noise will be generated when construction occurs after Lots 1 through 6 are subdivided, shall not exceed the applicable maximum permissible sound levels as stated in Title 11, Hawaii Administrative Rules (HAR), Chapter 11-46, entitled "Community Noise Control" unless a noise permit is obtained from the State Department of Health (DOH).

   c. Temporary fugitive dust emissions could be emitted when/if construction activities occur after Lots 1 through 6 are subdivided. At that time, in accordance with Title 11, HAR, Chapter 11-60.1, entitled "Air Pollution Control", effective measures for air pollution control shall be provided to minimize or prevent any fugitive dust emissions caused by the construction work from impacting the surrounding areas. This includes the off-site roadways used to enter / exit the project. The control measures include but are not limited the use of water wagons, sprinkler systems, dust fences, etc.

   d. In accordance with Title 11, HAR, Chapter 11-58.1, entitled "Solid Waste Management Control", the construction waste that is generated when/if the subdivided lots are developed shall be either recycled or disposed of at a solid waste disposal facility that complies with the DOH. The open burning of any of these wastes on or off site is prohibited.

   e. Any project and its potential impacts to State waters must meet the following criteria:

      1) Anti-degradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

      2) Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

      3) Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

   f. Please call the Army Corps of Engineers at (808) 438-9258 to see if this project requires a Department of the Army (DA) permit. Permits may be required for work performed in, over, and under navigable waters of the United States. Projects requiring a DA permit also require a Section 401 Water Quality Certification (WQC) from our office.

   g. You are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters

(HAR, Chapter 11-55). For the following types of discharges into Class A or Class 2 State waters, you may apply for NPDES general permit coverage by submitting a Notice of Intent (NOI) form:

1) Storm water associated with industrial activities, as defined in Title 40, Code of Federal Regulations, Sections 122.26(b)(14)(i) through 122.26(b)(14)(ix) and 122.26(b)(14)(xi).

2) Storm water associated with construction activities, including clearing, grading, and excavation, that result in the disturbance of equal to or greater than one (1) acre of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. **An NPDES permit is required before the start of the construction activities.**

3) Treated effluent from leaking underground storage tank remedial activities.

4) Once through cooling water less than one (1) million gallons per day.

5) Hydro-testing water.

6) Construction dewatering effluent.

7) Treated effluent from petroleum bulk stations and terminals.

8) Treated effluent from well drilling activities.

9) Treated effluent from recycled water distribution systems.

10) Storm water from a small municipal separate storm sewer system.

11) Circulation water from decorative ponds or tanks.

   h. You must submit a separate NOI form for each type of discharge at least 30 days prior to the start of the discharge activity, except when applying for coverage for discharges of storm water associated with construction activity. For this type of discharge, the NOI must be submitted 30 before to the start of construction activities.

   i. For types of wastewater not listed in Item 3 above or wastewater discharging into Class 1 or Class AA waters, you must obtain an NPDES individual permit. An application for an NPDES individual permit must be submitted at least 180 days before the commencement of the discharge.

   j. You must also submit a copy of the NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or demonstrate to the satisfaction of the CWB that SHPD has or is in the process of evaluating your project. Please submit a copy of your request for review by SHPD or SHPD's determination letter for the project along with your NOI or NPDES permit application, as applicable.

k. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with the water quality requirements contained in HAR, Chapter 11-54 and/or permitting requirements, specified in HAR Chapter 11-55 may be subject to penalties of $25,000 per day per violation.

5. Requirements of the Housing Agency:

   a. Chapter 7A of the Kaua'i County Code, 1987, as amended, is applicable to the proposed subdivision, pursuant to Section 7A-1.4(c)(1).

   Prior to final subdivision approval, the Applicant shall resolve the workforce housing assessment and shall execute a Workforce Housing Agreement with the Kaua'i County Housing Agency, as to the method of meeting the workforce housing requirement pursuant to Chapter 7A. The executed agreement shall be recorded on the deed of the project properties concurrent with final subdivision approval.

   The Kaua'i County Housing Agency reserves the right to change this determination if the petition or application changes from the above, or if the project incorporates or becomes part of a larger residential or resort project, such that provisions of Kaua'i County Code, Section 7A-1.4 become applicable.

6. Requirements of the Department of Wastewater:

   a. The proposed subdivision is near the County's sewer service area. If sewer service is needed, the Applicant shall apply for County sewer service and shall be responsible for design and construction of all infrastructure necessary to connect to the County sewer and shall be responsible for payment of all applicable fees.

7. Requirements of the State Historic Preservation Division (SHPD):

   a. Pursuant to Hawaii Administrative Rules §13-284 we request an **archaeological inventory survey** be conducted by a qualified archaeologist in order to adequately determine the potential impacts of this subdivision on both surface and subsurface historic properties. We look forward to the opportunity to review the archaeological report prior to commencing further on the subdivision application. We recommend the final subdivision approval be deferred until the archaeological inventory survey report has been completed and appropriate mitigation measures/plans are in place.

   b. As recommended by the State Historic Preservation Division (SHPD) of the Department of Land and Natural Resources (DLNR), in the event that historic resources, including human skeletal remains are identified during routine construction activities, all work needs to cease in the immediate vicinity of the find, and the finds need to be protected from additional disturbance, and the State Historic Preservation Division, Kaua'i section, needs to be contacted immediately at (808)692-8015.

8. The Applicant is advised that prior to and/or during construction and use additional conditions may be imposed by government agencies. Should this occur, the Applicant shall resolve these conditions with the respective agency(ies).

Sincerely Yours,

MICHAEL A. DAHILIG
Clerk, Kaua'i Planning Commission

xc: COK Public Works Dept.
COK Water Dept.
COK Real Property – Assessment Div.
State Dept. of Health
State Historic Preservation Dept.